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THE

JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JANUARY 5, 1892.

The Question of Photometry.

IN another part of the JOURNAL will be found some further communications on the (literally) burning question of light standards and the photometry of gas. As Mr. Charles Hunt, who has again written upon the subject, said in the letter which appeared among our last week's correspondence, this is a matter of widespread interest; and it is not to be supposed for an instant that the special need for action which the Board of Trade have just discovered in the arrangements for testing London gas, excludes the consideration of helpful suggestions from any quarter. It is to be hoped that everybody who has ideas relating to the subject generally, and is desirous of directing the attention of the Investigation Committee to any point of principle or of detail, whether connected

with light standards, photometer design, standard gas-burners, or any other division of the questions to be submitted to the Committee, will forthwith take this opportunity of making his views known. We offer the publicity of the JOURNAL to all who may have fair reason to join in the discussion of the proposed work of the Committee which has been so well started by Mr. Leicester Greville and others. Whatever may be the nature of the commission given to the Board of Trade Committee, its members will see everything that appears in our columns with regard to their proceedings; and it will be idle for cavillers to complain at a future time that the case has not been fully laid before that body, if they now neglect this agency for publicity.

It may be as well to remark that, if anything in our own comments upon the present state of the standards question is read as limiting the range of the inquiry to be undertaken by the Committee, such an interpretation is quite foreign to our meaning. So far as the statutory regulation of gas-testing methods and apparatus goes, we may take it as certain that the Metropolitan gas engineers on the Committee will be careful to secure due observance of the principle that the *status quo ante* shall be the datum for all legislation upon the subject. That is to say, that when 16-candle gas is specified in any Act of Parliament or administrative notification applying to the gas supply of London (and inferentially of other places), it means gas as shown to be of this illuminating power by the apparatus and the photometrical practice in vogue at the period when this definition was legalized. Some authorities have gone so far as to assert that to lay down this principle is tantamount to claiming that defective apparatus and methods in photometry shall be perpetuated; but it is not so. The only purpose served by adhering to this principle is that improvements in photometry shall not be made at the expense of the gas. For example, supposing a gas examiner to have discovered a way of treating the candles which he uses as the standard of light, by which he can obtain more light from the sperm consumed, and this without breach of the letter of the regulations for the employment of such standard. We maintain that this method of enhancing the value of the standard, and consequently of depreciating the gas being compared with it, would be contrary to the meaning of the statutes applying to the matter. So also with the design of the photometer. The instruments in use at the period when the law of the matter was settled may have been imperfect. We are not prepared to say that they were or were not defective. But we argue that any so-called improved pattern of instrument cannot justly be used against gas without proper allowance being made for the instrumental variation. If, for instance, the brewing of beer had been so regulated by law—say, in 1840—that no liquor of the kind should be sent out of a higher specific gravity than a figure then stated, under penalty; and if, by 1890, a very much more accurate and sensitive form of hydrometer had been adopted by the supervising authority, would it be fair to use the latter as though it were interchangeable indifferently with the former? But the case in point is far stronger than this, because the specific gravity of a fluid with reference to an invariable datum, like the weight of pure water, is something that can be determined with a degree of certainty only depending upon the reliability of the instruments employed and the carefulness of the observer; whereas in the photometry of gas everything is indeterminate, and the standard is as liable to variation as the article of which it is supposed to be a measure.

With regard to the legalization of pentane, again, some of our readers, who doubtless have reasons of their own for their opinions, may think that our expressions unduly anticipate the decision of the Committee. If anybody takes a different view, now is his time for saying what is in his mind. We purposely laid great stress upon the prospects for the legalization of the pentane standard, in order to bring to a head, if possible, any lurking distrust of it which may exist with practical photometrists. If there are any such, who entertain, upon what appear to them to be sufficient grounds, dislike of the pentane standard, they had better make their protest now, "or hereafter for ever hold their peace." We believe the pentane standard has the best chance of adoption by the Committee; for the general reason that it has been reported favourably upon by every technical body which has been

charged with a similar inquiry to that now in contemplation. It is impossible to deny this fact. And now, when some of the most serious objections to the pentane standard as originally introduced have been overcome, it appears to be idle to blink the exceedingly strong probability that the new Committee will regard it with particular favour. There is something to be said for the view that the pentane standard is only the best of a poor show of substitutes for the candle, itself a discredited representation of the standard. But what can we have? A perfect standard of light may be still to seek; but it is not wisdom to despise what is good because it is not better. From all the evidence before us at present, we conclude that pentane holds the best place in the list of candle substitutes; but we are quite ready to listen to anyone who can reasonably maintain a different conclusion.

The Gas Supply of London and the Fog.

THE great fog which descended upon London and a goodly area of the South of England during the early part of Christmas week had very many striking consequences, not the least important of which were those relating to the supply of gas in the Metropolitan area during this period of continuous darkness and exceptional cold. The circumstances are worth putting on record, if only as illustrating the nature of the emergency with which the London gas engineers have to grapple without an hour's premonition. The weather during the whole of the week ending Dec. 19 was very clear and open; so that when, in the afternoon of this day, the various station managers left their posts in the north, south, east, and west of the great province of houses which they serve with gas, they had the satisfaction of perceiving that their stocks of this necessary of town life were in a healthy state for bearing the extra strain which the following week would be certain to bring. The weather was growing colder—a sharp frost having set in on the Friday night; and the barometer was steadily climbing up into "anticyclonic" readings. But Sunday came, and in some works the day gang lay off just as though it had been summer time. With Monday, however, the anticyclone became firmly established; and it was no longer doubtful what the weather in town was going to be for as long as the meteorological conditions remained unaltered. Next day was the worst that London has experienced for years. Blackness that could not only be felt, but also insisted upon being tasted, swallowed, inhaled, and otherwise fully realized, settled down upon the Capital, and lasted until the morning of Christmas Day. The demand for gas was unprecedented, for the weather was bitterly cold as well as hopelessly befogged; and the three London Gas Companies alone—to say nothing of the Suburban ones, which were all equally busy in their degree—sent out on Christmas Eve something like 170 million cubic feet of gas.

This is the bare statement of the facts; whereupon it seems natural to cry, "Good for the Gas Companies!" as many people did during those memorable four days. But what is the truth of the matter? It is that this remarkable fog, with its attendant frost, did the Gas Companies anything but good. Not only were their manufacturing resources and their distributing plant strained to the uttermost; but, since not a ship nor a barge moved on the river during all that time, they were unable to get in their customary supplies of coal, and were compelled to use from the store, which means additional expense. Then, although the "free" stokers of the South Metropolitan Company worked with hearty good will, giving the retorts all the coal they would take in, the same conditions were by no means universal; for, of course, Union principles cannot yield before such an ordinary trouble as a fog, and the "Union stroke" must be adhered to, fog or no fog. Moreover, every frozen public lamp or private service advertises itself by an irritating extinction or by a sadly insufficient supply, which proclaims to all observers that the circumstances are much too severe even for the Gas Company. And there is no use in denying the fact that, heavy as was the gas consumption in London during this Christmas week, it would have been heavier still if the public could have had as much gas as they wanted. In some districts at the beginning of the week, in others nearer to the end, gas-engines, gas-fires, gas cooking-stoves, and at last the lighting-burners, had to go short; and anything like this does infinitely more harm to the Companies than the sale of some extra gas can, under any circum-

stances, do good. So that, taking the matter all round, Gas Companies have quite as good reason as other interests and organizations—from railway company to pantomime managers—for wishing that the always congested business of Christmas week might never more be hampered as it was this time by a coincident anticyclonic frost and fog.

Mr. J. Orwell Phillips, the Secretary and General Manager of The Gaslight and Coke Company, was "interviewed" last week upon the subject of the fog, by a reporter of the *Daily News*, which journal printed a strange farrago of small-talk as the result of the conversation of its representative with the great man at the Horseferry Road. We were prepared to reproduce the substance of Mr. Phillips's story; but there is really nothing in it beyond the statement that the Company's output of gas on "Black Thursday" was 128 million cubic feet, and that three more holders are urgently needed. The reporter was evidently much impressed by Mr. Phillips's *bonhomie*; and his "copy" is sprinkled with repetitions of the "Ha! ha!" of this "humorous philosopher," as he calls his entertainer. And Mr. Phillips might well have laughed, behind the innocent reporter's back as well as in his face; for he managed to "rush" the inquisitive pressman for a column advertisement, without making the slightest allusion to the increase in price for which all London is abusing the Horseferry Road Administration. Most of the other London newspapers have noticed the advance, some of them in the most opprobrious terms; but not a sound of this seems to have penetrated into the *Daily News* offices. It is becoming more and more apparent, however, that Mr. Phillips will need all the humour and all the philosophy of which he may be master, to render this Christmas gift of his Company palatable to his customers. Moreover, it is only too likely that the increase in the price of gas to 3s. 1d. per 1000 cubic feet over the greater part of London will do more to discourage the use in the same district of gas-engines, gas-stoves, &c., than anything the worst enemy of the industry could have devised. In many cases, a rise of 7d. per 1000 cubic feet within eighteen months means completely turning the scale in favour of the steam-engine; while both electricians and oil sellers will take heart from the gas consumers' discomfiture. It is well for Mr. Phillips that he can laugh in the face of a newspaper reporter who happened to be unaware of these considerations; but there are others who do not regard the present position of The Gaslight and Coke Company as at all a laughing matter.

Dr. Bunte's Experiments upon Coal.

THE high reputation as a scientific gas maker already enjoyed by Dr. Bunte in this country, as well as in his own, will be enhanced by the recent publication in our columns, for the benefit of English-speaking gas engineers, of our translation of the Doctor's own account of his experiments upon coal, which originally appeared in the *Journal für Gasbeleuchtung*. It is too frequently seen that men of science hold aloof from those practical considerations which the men who have to do the work of the world are compelled to observe; so that there is a wide and deep gulf between the two classes of workers. How wide and deep the separation is, can hardly be realized by casual perusers of the philosophical journals and the Transactions of learned societies in which the former class of seekers after Truth are accustomed to enshrine their records of work done. They pursue Truth, with infinite pains, into the secret places where she lies withdrawn from careless eyes; but one is often struck by the reflection that the results of their labours often appear sadly disproportionate to the toil and care spent upon them. The *Comptes Rendus* of such a large and influential philosophical institution as the Académie des Sciences, for example, form two bulky volumes every year; but, upon the most liberal valuation, it would be difficult to say much for the net value of most of these records. This waste of learned labour is mainly due, in the estimation of outsiders, to the perversity of so many truly scientific men in electing to study subjects which are a long way removed from the concerns of common life. Far be it from us to defend a shallow Utilitarianism in technical research, which, when it is too "practical," is apt to be as fruitless as when its objects are wholly transcendental. There is a "golden mean" in this matter, as in all things. It is possible to admire the refined exactitude of method and the unselfish devotion to Truth shown by the man of pure

science, while at the same time wishing him to remember that he too lives on the earth with the rest of his kind. Dr. Bunte, as we understand him, is a man of science in its best sense. He keeps in touch with what the professors and the doctors in philosophy are doing in their laboratories; but he practises in matters which are of immediate concern to work-a-day humanity. He evidently holds that a boiler may be, in its way, as "scientific" an apparatus as a Berthelot calorimeter; and he tells, in the article now under notice, how he worked with a boiler and certain accessories with a view to making it reveal some previously unknown or misunderstood truths. It is impossible not to respect a man of science who tells us that "in practice, in many cases, the question is not so much how to select any special kind of fuel, as how to make the most of that which is to be had abundantly in a particular district." Why, this is talk that goes right home to the understanding and appreciation of the most "practical" man who ever stoked a furnace. And it is as truly scientific as any disquisition upon the combustion-heat of a radicle of which not a pound exists in the world, that ever padded out the reports of the most high-and-dry Society for the Cultivation of Useless Knowledge. We hope that Dr. Bunte will give the world many more such specimens of sterling, thorough work, the usefulness of which consists not only in what they tell us, but also, and in an even higher degree, in the example they supply of how work of the kind should be conceived and carried out.

The Course of the Sulphate Market.

IN another column will be found an abstract of Messrs. Bradbury and Hirsch's "Annual Review" of the course of the market for sulphate of ammonia. We must leave to the skilled authors of this valuable statement the difficult task of individualizing sulphate; only remarking that they do this so successfully as to impart a considerable degree of interest to the dry record of fluctuations in the market price of this useful article. It is with Messrs. Bradbury and Hirsch as with some other "reporters" on particular commodities—they seem to regard their selected market as something really possessed of objective existence. This creature of their imagination is, to their absorbed vision, endowed with a sentient personality; and its movements are only to be properly described in their chronicles in the terms proper to living beings. The market operator lays his finger, so to speak, upon the pulse of his subject; and his reports read like a physician's clinical notes on an interesting "case." We cannot aspire to such a flow of fancy. It is deplorable; but the truth remains that, as Peter Bell's "primrose by the river's brim, a yellow primrose was to him, and it was nothing more," so in our clouded minds sulphate is something which gas manufacturers have to sell, and ought to turn into money at the earliest possible opportunity, without dwelling over much upon whether the market seems to be "flat," "active," "dull," or in any other condition describable in commercial, medical, or poetic language. We know, from repeated experience, how difficult it is to get at the truth respecting the sulphate market from time to time. It has been our endeavour to obtain, for the guidance of readers engaged in the business, reliable quotations of the current value of the principal bye-products of gas manufacture; but only those who have tried can realize how practically impossible it is to read the market at all times in a way that shall be satisfactory to buyers and sellers. Reporters are, of course, human; and critics usually find it easy to be wiser after the event than those who have a hand in the actual making of history. Until all the sulphate produced in England is sent to one market, and sold under the hammer every week, those who speak of its current value from time to time will continue to be flouted on both sides—by those who would like it to be dear, and by such as have an interest in seeing it cheap. Meanwhile, we take refuge in the simple faith that the best way for makers to treat their sulphate is to sell it off for what it will fetch. How futile it is for them to scheme for favourable market prices is clear from the reminder of Messrs. Bradbury and Hirsch that "the producing power of the combined nitrate companies per month is equal to that of Great Britain's production of sulphate per annum." How far, and in what way, the price of nitrate governs the value of sulphate, our reporters profess inability to say. This is a study for "operators" in sulphate, not for the makers of it, who cannot shape their proceedings

in accordance with market conditions, but must produce at the bidding of the consumers of gas.

It is to be noticed that Messrs. Bradbury and Hirsch put the price of sulphate low in comparison with that of other fertilizers; saying, indeed, that it is "unprecedentedly cheap." This being so, more money may be reasonably expected to be obtained for the spring deliveries; but to those makers who are wisely content to take matters as they come, this is not a very exciting prophecy. The prudent gas manager, even when he makes sulphate (which most prudent gas managers do), has enough else to think of without troubling himself with vain imaginings for the discomfiture of the "bears" of the sulphate market. He lets the "bulls" and the "bears" tear one another, which they will do cheerfully, whether or not he assists at the performance, just as the Laureate tells us that the "dragons of the Prime" amused themselves in this style, when there were no human spectators of their tournament. The most profitable study which the gas manager can give to his sulphate, particularly when he is in a small way of producing it, is in the direction of creating and fostering its local consumption. The difficulty here is the question of payment, when anything like a trade is attempted. A country gas manager finds an awkwardness in the contemplation of an annual sulphate paying day, which is customary with the manure agencies and the lime burners. But this difficulty must be overcome; and it is not insuperable when approached with the determination to succeed in dealing with it. Unfortunately, the wet and unseasonable autumn did not favour experiments with artificial manures in the United Kingdom; and it remains to be seen whether the farmers' circumstances will improve with the spring. By-the-by how striking an illustration of the saying that the worth of anything is "just as much as it will bring" is afforded by the record of the average prices of sulphate of ammonia from 1882 to 1891. The product is precisely the same, and the cost of producing it from the raw material is practically constant; what was worth £20 8s. 6d. per ton eleven years ago, now sells for less than £11. There is a good lesson in economics to be extracted from these figures.

Mr. Elliot Smith, J.P., D.L., one of the founders of the Cambridge University Water-Works Company, and a Director until a short time since, died on the 23rd ult. The deceased, who was in his 81st year, had of late been suffering from bronchitis and influenza.

Institution of Civil Engineers.—Last Saturday was the 74th anniversary of the establishment of this Institution. Founded by six young men then beginning their engineering life, it has grown to be one of the largest bodies in the kingdom, numbering 6139 of all classes. In the Royal Charter of Incorporation, granted to the society in 1828, its object was stated to be for the general advancement of mechanical science, more particularly in its application to civil engineering; and some of the principal objects of the art were set out. It was, however, pointed out that "its scope and utility will be increased with every discovery in philosophy, and its resources with every invention in mechanical or chemical art." The range of practice has accordingly, during the last 50 or 60 years, become much enlarged.

Methods of Collecting Water for Supply.—At the fifth ordinary meeting for the present session of the Liverpool Engineering Society, held on the 23rd ult.—Mr. G. Farren, Assoc. M. Inst. C.E., in the chair—Mr. A. W. Brightmore, M. Sc., Assoc. M. Inst. C.E., read a paper, entitled "Methods of Collecting Water for Supply." The author commenced by dividing his subject into three parts: (1) Interception of rain water before reaching the earth, by collecting it directly in tanks or from the roofs of buildings. (2) Taking the water from streams or rivers, directly if the flow is sufficiently constant, or equalizing the supply by constructing a reservoir if the flow varies below the supply required. (3) Obtaining the water from the earth's crust by means of springs, shallow wells, intercepting tunnels or drains, or deep-seated wells. The author proceeded to discuss the probable state of purity of the water derived by each of these means, and gave examples of towns and cities, either in Europe or America, supplied on each system. It was pointed out that the supply obtained by direct interception could only be very limited. With respect to the supply procured from streams or rivers, it was shown to be freer from contaminating influences if obtained near to the source of the streams; hence the advantages of a water supply from an equalizing reservoir. Referring to the third method, water collected from shallow depths by means of wells or intercepting drains was shown to be useful for supply when it was derived from sparsely-populated districts. Water from deep-seated springs or wells, owing to its infiltration through the overlying strata, was often of great purity, and valuable for supply. An interesting discussion terminated the meeting.

WATER AND SANITARY AFFAIRS.

THE precise text of "the agreed Bill" of the Corporation of the City and the London County Council, by which the great question of the Metropolitan Water Supply is to be brought before Parliament in the coming session, is now available for criticism. The present title is that of the London Water Bill, and the main purport is twofold—namely, the establishment of a Water Committee representative of the County Council and the Corporation, and the giving of power to the Council to promote Bills in Parliament relative to the water supply. The constitution proposed for the Water Committee is the same as that with which our readers are already familiar. One-eighth of the members will be appointed by the Corporation, and the remaining seven-eighths by the County Council. Starting with a total of forty-eight, the number may be altered from time to time; but the foregoing proportion is to be preserved. The body so formed is to be "a Committee of the London County Council." The Bill in the next place specifies the nature of the measures which the Council shall have power to introduce. By these Bills the Council may be authorized "to acquire, construct, and maintain water-works, aqueducts, wells, reservoirs, and other works, and do any necessary acts in connection therewith, to afford a new or a supplemental water supply." Or the Council may seek to acquire or take on lease any existing or future water-works, or the undertaking of any Water Company, "or any part thereof." No provision is made for the representation on the Water Committee of any of the authorities of the outer area; but the Council desire power to introduce such a Bill as would enable them to supply water in bulk to such authorities. The way being thus opened for the Council to bring their schemes before Parliament, the present Bill goes on to invest the Water Committee with power to make and enforce regulations respecting fittings and appliances to be used for preventing the waste, misuse, and contamination of water. This reads as if intended to take effect immediately; but we can hardly suppose such to be the case. The Committee are to have full power of inquiry as to the existing supply of water throughout the area supplied by the Companies; such inquiry to include the charges made for the supply, and an investigation into any "possible sources." They will have authority to negotiate for the acquisition of water-works, subject to ratification by the County Council. The proposed powers of investigation respecting the works, plant, books, documents, and accounts of the London Water Companies are not to be exercised, except in pursuance of an order of a Magistrate, unless the Company agree to the proceeding. There will be delegated to the Committee, "absolutely and without reference to the London County Council," all the administrative and executive functions of carrying on the supply of water from any works acquired, taken on lease, or constructed by the Council. But the Committee will not have power to purchase, sell, or let on lease any such works. They may not incur capital expenditure or raise capital, neither may they fix or alter the rates leviable for water, or the principle of charging or levying rates in respect of water supplied. All this, therefore, is reserved for the Council; and no provision is made by which the Corporation will have any voice in such grand transactions. The appointment of the Committee is to take place within six months from the passing of the Act. There is power to maintain offices, and form a regular staff; all expenses to be defrayed as for general county purposes. Such a Committee, we may venture to say, London never saw before. Perhaps, indeed, it will never see this. But while the proposal for the establishment of a Water Committee agrees with one of the recommendations of the Select Committee presided over by Sir Matthew White Ridley, the Bill contains a grave departure from a vital principle laid down by that Committee, which was that the County Council, if constituted the Water Authority, should be required to purchase the undertakings of the eight Metropolitan Water Companies, by agreement or by arbitration, "within a fixed period." The Bill contains no provision of this kind, but leaves the County Council free to purchase or not as they please; and, if they purchase, simply to take what they choose to bargain for, if anybody will sell to them. At the same time, there is the power to introduce "a new or a supplemental

"water supply," which, as a matter of course, may take a competitive form. It will probably be remembered that the Corporation contemplated having a clause fixing a period within which the existing works should be purchased. But to this the County Council would not consent; and the Corporation thought fit to yield. We have no doubt that on this point the whole policy of the Council may be said to turn; and the Bill is framed to create machinery by which the Council may coerce the Companies. Although the measure is mainly a preliminary one, it serves to raise the main question; and it must be fought on that ground. Concerning the scope of the Bill, we may observe that it extends to the entire area over which the Metropolitan Water Companies "have power of supply," although there is no provision for the representation of the outer area on the Committee. Perhaps we should add that Sir M. W. Ridley's Committee advised a parliamentary inquiry, if the existing undertakings were not purchased. The recommendation is one which may not be overlooked.

Mr. Archibald Dobbs has a characteristic article on "The London Water Companies" in the *Contemporary Review* for the present month. Having read all the Acts of Parliament connected with the Metropolitan Water Supply, and dived into all the Blue-books on the subject, Mr. Dobbs emerges with a conviction that what he has found is little else than chaos. He is distracted by the "highly irregular" nature of the rates of charge for the domestic supply; but when he comes to the non-domestic portion, he speaks of "confusion worse confounded." Having inquired, so far as might be possible, into these latter rates, he says: "I do not like to say what I know of them." Mr. Dobbs has accordingly learned something, though his knowledge is simply vexation and sorrow. In every Act there is a list of purposes which may "not" be included in a domestic supply. But the list is said to be "drawn up with abominable vagueness;" and by way of a general conclusion we are told: "The whole of the sections, and every London Special Water Act, are a monumental scandal." These Acts, Mr. Dobbs asserts, "are so loosely drafted that they contain every fault a draftsman can commit;" and nobody knows "the true meaning and construction" of sundry important sections. All this sounds very dramatic; but we question whether even the genius of Mr. Dobbs could frame a satisfactory definition in each particular case. Not "every garden" is made the subject of an extra charge by a Water Company; and it is notorious that in a very large number of cases the Companies take no notice either of a garden or a bath. But amid all the confusion which fills the mental vision of Mr. Dobbs when surveying the Metropolitan Water Question, there is one point concerning which he announces a clear and unmistakeable discovery. He states that when the Metropolis Water Act of 1852 was before the Select Committee, the Counsel for the Chelsea Company pledged that Company and five others that if certain rates were granted to them, with power to levy up to the maximum, they would only exact the customary rates, and would regard the maximum as never to be reached or approached, "except in cases of extraordinary and exceptional use of water." Mr. Dobbs says it was on the faith of that promise and undertaking, again and again declared, that the Committee "recommended the adoption of the new scale and basis of rates." He admits that such a compact could not be taken account of in a Court of Law; but he describes it as "one conspicuous mark of the incapacity and ineptitude of the Corporation of the City in dealing with this subject," that, although distinctly informed of such a compact, they failed to recognize its existence. Mr. Dobbs says the promise made was observed for some time. It seems it must have been kept for about thirty years. Perhaps it would have been maintained by the Companies until now, had not the "basis" of the agreement been disturbed by the substitution of "rateable" for "annual" value—a change in which Mr. Dobbs took an active part. Possibly the Corporation were not so inept as to be unmindful of this. The compact has been clearly broken on one side, leaving room for a contention that it was no longer obligatory on the other. The legislative tinkering which has gone on with respect to the London Water Companies, coupled with one or two rather erratic decisions in the Law Courts, has not tended to diminish the confusion of which Mr. Dobbs so vehemently complains.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 35.)

THE closing week of 1891 was a satisfactory one in the Stock Markets, despite the usual interruption to business caused by the holidays; and with the opening of a new year on Saturday a disposition to take a brighter view of things in general manifested itself, which it is hoped may be a happy omen of the future. The sudden hardening of the Money Market in the earlier part of the week, had a somewhat deterrent effect upon the upward tendency of prices; but this being subsequently relieved, a general improvement took place. The Gas Market had its fair share of the rising tide; and though business was very quiet until after the settlement, many quotations closed at a moderate advance upon the previous week's figures. Gaslight "A" started at 221, and touched 225; the final quotation showing an advance of 2. Some of the debenture and preference issues changed hands at good prices; but the "H" 7 per cent. limited receded 2. In South Metropolitan, the "B" recovered 1. Commercial did not move at all. Several debenture stocks were quoted *ex div.* at fractionally better figures. Among the Suburban and Provincial Companies, the only feature was a relapse of 2 in Bristol. The Continental undertakings continued very firm; and Imperial advanced 1½. Of the Orientals, Bombay showed a tendency to advance. The South Americans were no better; and Buenos Ayres fell ½. The Water Companies have shown more activity and recuperative power; almost all quotations having risen considerably.

The daily operations were too slight to call for notice; but the following movements may be noted: On Monday, South Metropolitan "B" rose 1; and Bristol fell 2. In Water, East London and Grand Junction rose 1 each. On Tuesday, Continental Union advanced 5. In Water, New River rose 5; Kent, 2½; West Middlesex, 2½; and East London, 1. On Wednesday, Imperial Continental went up 1½; East London Water, 2; and Southwark, 1½. The only move on Thursday was a rise of 5 in Kent. On Saturday, Gaslight "A" rose 2; but the "H" fell 2. In Water, Chelsea rose 5; and East London, 1.

In accordance with our usual practice, we append a comparative table of the quotations of Gas and Water Securities at the close of 1891, and as they were twelve months before; showing their respective gains and losses. It will be seen that, with rare exceptions, quotations of Gas issues have fallen. The Metropolitan Companies are considerable losers. A great deal of this is attributable to the high price of coal; for although coal was cheaper in the latter part of 1891 than it was a year previously, yet the stock quotations at the close of 1890 had not felt the full effect of the high price, and the Companies' accounts issued in 1891 showed then for the first time the actual position. Another group that has receded largely is the South American, the cause of which is sufficiently notorious. But the largest shrinkage in value is to be found in the Water Companies, owing in a great degree to the fear of measures being introduced for the acquisition of the Companies' undertakings by a public body upon terms savouring of spoliation. At the moment of writing, however, a more reassured feeling is discernible in the market.

NAME.	Prices on Dec. 31, 1890.	Prices on Dec. 31, 1891.	Gain or Loss.
GAS COMPANIES.			
Alliance and Dublin Company, 10 per cent. maximum.	16-17	15½-16½	-½
Do. 7 per cent.	12-13	11-12	-1
Australian (Sydney) 5 per cent. Debentures	107-109	107-109	-
Bahia, Limited.	17-19	12-14	-5
Bombay, Limited.	6½-7½	6½-6¾	-½
Do. New	5-5½	4½-5	-½
Brentford, Consolidated.	212-217	210-220	+½
Do. New	155-160	157-162	+2
Brighton and Hove, Original	40-42	40-42	-
Bristol	-	98-103	*
British	43-45	42-44	-1
Bromley, ordinary 10 per cent.	18-20	18-20	-
Do. 7 per cent.	13-14	13-15	+½
Buenos Ayres (New), Limited	11-12	6-7	-5
Do. 6 per cent. Debenture	103-105	92-96	-10½
Cagliari, Limited	26-28	24-26	-2
Commercial, Old Stock	250-254	240-250	-7
Do. New do.	193-203	185-195	-10½
Do. 4½ per cent. Debenture Stock	117-122	117-122	-
Continental Union, Limited	47-49	215-225	*
Do. 7 per cent. Preference	37-39	185-195	*
Crystal Palace District	195-205	190-200	-5
European, Limited	19-20	19-20	-
Do. Partly paid	13½-14½	14-15	+½
Gaslight and Coke, A, Ordinary	240-245	219-224	-21
Do. B, 4 per cent. maximum	98-101	94-97	-4
Do. C, D, and E, 10 per cent. Preference	249-254	248-253	-1
Do. F, 5 per cent. Preference	119-123	118-123	-½
Do. G, 7½ per cent. Preference	177-182	172-177	-5
Do. H, 7 per cent. maximum	164-168	155-160	-8½
Do. J, 10 per cent. Preference	247-252	245-250	-2
Do. K, 6 per cent. Preference	147-152	145-150	-2
Do. 4 per cent. Debenture Stock	111-116	110-114	-1½
Do. 4½ per cent. Debenture Stock	121-125	118-123	-2½
Do. 6 per cent. Debenture Stock	158-162	160-165	+2½
Imperial Continental.	220-225	220-224	-½
Malta and Mediterranean, Limited	5-5½	4-4½	-1

NAME.	Prices on Dec. 31, 1890.	Prices on Dec. 31, 1891.	Gain or Loss.
GAS COMPANIES.			
Metropolitan of Melbourne 5 per cent. Debenture Stock	109-111	109-111	-
Monte Video, Limited	184-19½	15-16	-3½
Oriental, Limited	8½-9½	8½-9	-½
Ottoman, Limited.	5-5½	4-5	-1½
Pará, Limited	3-4	2½-3½	-½
People's Gas of Chicago, 1st Mtg. Bds.	95-100	94-99	-1
Do. 2nd do.	93-98	93-98	-
San Paulo, Limited	15-17	11-12	-4½
South Metropolitan, A Stock	280-285	265-275	-12½
Do. B do.	228-233	220-225	-8
Do. C do.	235-245	225-235	-10
Do. 5 per cent. Deb. Stk.	140-145	138-143	-2
Tottenham and Edmonton, Original.	11-13	11-13	-

NAME.	Prices on Dec. 31, 1890.	Prices on Dec. 31, 1891.	Gain or Loss.
WATER COMPANIES.			
Chelsea, Ordinary.	267-272	250-260	-14½
East London, Ordinary	213-218	202-207	-11
Do. 4½ per cent. Debenture Stock	140-145	136-140	-4½
Grand Junction	117-122	98-103	-19
Kent	273-278	265-275	-5½
Lambeth, 10 per cent. maximum.	245-250	220-230	-22½
Do. 7½ per cent. maximum.	195-200	189-194	-6
Do. 4 per cent. Debenture Stock	120-124	120-123	-½
New River, New Shares	360-365	335-345	-22½
Do. 4 per cent. Debenture Stock	125-128	125-127	-½
Southwark and Vauxhall, 10 per cent. max.	175-180	147-152	-28
Do. 7½ per cent. maximum	167-172	138-143	-29
West Middlesex	260-265	245-255	-12½

* Capital remodelled.

ELECTRIC LIGHTING MEMORANDA.

The Prospects of Electric Light Companies—Two Views of the Cost of Electric Lighting—Electrical Construction Companies—Electric Railways in Parliament.

THE electric light companies begin the New Year under peculiar conditions. Up to the present time these undertakings have subsisted very largely upon hope and fair expectation; but this state of existence cannot last for ever. The accounts which some of the oldest of the Metropolitan Companies must publish during the year upon which we have now entered, will show what amount of justification there is for the promises by virtue of which these concerns obtained their capital. It is impossible to postpone the day of reckoning indefinitely, albeit there is small doubt that the Directors of more than one company of this description would like to follow the custom of insurance companies, and refrain from saying anything about profits or dividends until the expiration of the fifth year from commencing business. The law being as it is, however, and the circumstances what they are, we candidly confess that we look forward to the revelations of the current year as likely to clear up a good deal of prevalent uncertainty with regard to the commercial side of electric lighting. The people who have speculated in these companies' shares naturally hope that their ventures will, sooner or later, come safely into port. But, notwithstanding the persistent advertisement that partizans of electric lighting seem always able to command, this class of shares still fails to take a good position in the investment market, and the financial newspapers are repeatedly moved to explain the reason for this deplorable state of things. The last effort of this kind that has come under our notice is the production of that "trustworthy" print, the *Financial News*, which says of the electric light business for 1891 that "this interesting enterprise, freed from stupid and harassing legal restrictions, has been able both to demonstrate its possibilities as an illuminant, and to reinstate itself in the opinion of the investor." Yet in the very next sentence the writer goes on to observe that, "partly owing to imperfect scientific knowledge, but still more to unscrupulous financing, the early history of the electric light in England was a history of disaster." How can such confused and contradictory explanations be reconciled? It will occur to most impartial readers of these remarks that if it was the "unscrupulous financing" that ruined the electric light business from its start, it is a pity that the so-called "stupid and harassing legal restrictions" were not a great deal more stringent than seems to have been the case.

In the course of the *Financial News* article referred to above, this statement occurs: "It seems certain that for a long time, to come, always excepting the possibilities of discovery, the sheer cost of producing the electric light must be greater than that of producing gas." This remark brought up a reply from Messrs. Crompton and Co., Limited, who seized upon the phrase about the cost of *producing* the electric light as an excuse for asserting that the statement is wrong, and that the "sheer cost" of generating electricity for the purpose of lighting has actually been reduced to the low figure of 2d. per Board of Trade unit. Messrs. Crompton admit that there is, for various reasons, a great discrepancy between this figure and the cost at which supply companies can afford to sell the unit of electricity; but they declare that the disproportionate expenses which at present account for this discrepancy will be reduced as the scale of production increases; so that, "when the scale of production is as great as that on which gas is now produced, the cost will be the same, or even lower." Touchstone pointed out the great virtue that resides in an "if;" and there is the same quality in Messrs. Crompton's "when,"

which must be taken to cover such a long-dated draft on the future that the drawers are never likely to be called upon to redeem it. Meanwhile, a matter-of-fact person, writing from the City, has the effrontery to say that, whatever the actual cost of production may be, he knows by experience that "the cost to the consumer of the electric light within the limits of the House-to-House Company is certainly not less than three times that of gas." And the same inconsiderate individual goes on to assert, in direct opposition to a cherished idea of the electricians, that "three Edison-Swan 8-candle incandescent lamps do not give a light for reading and working purposes equal to three 5-foot Peebles gas-burners." If there are many subscribers to electrical supply companies of the same mind as this outspoken gentleman, it can hardly be regarded as good for those undertakings.

Two electrical construction companies held their statutory meetings near the close of the year—the Company that was formed to take over the Elwell-Parker business, and that which is exploiting the Immisch system. Both undertakings claim to be doing fairly well; the former particularly so, inasmuch as they have paid for the second time a dividend after the rate of 6 per cent. It is difficult, however, to form a trustworthy opinion respecting the true position of enterprises of this order, especially in the early days, when there is money at the bankers', and several heavy cross entries appear in the accounts. They are all more or less fighting concerns—the privateersmen of industry, so to speak—and deal in patents, concessionary companies, and uncertain property of other kinds, mostly partaking of the general character of appearing like a valuable asset so long as it is not subjected to the test of realization. As with the various lighting companies which they help to start on their way, so these construction companies have not yet lived long enough to test the real value of their founders' prospects. In the case of the Elwell-Parker concern, moreover, it may, of course, be perfectly right and proper for a manufacturing firm to spend £11,400 odd for the expenses of the head office, and another amount of £13,000 for advertising their debentures, law charges, "&c.;" but we take leave to doubt whether a mere workshop connection in the electrical way can bear such impositions. So long as the merry game of subsidiary company promotion can be kept up, this sort of thing may be endured; but the game in question is one that does not, generally speaking, last longer than a year or two.

Mention of the doings of electrical construction companies leads to the consideration of the electric railway projects that will engage the attention of Parliamentary Committees next session. The number of these schemes is eloquent testimony to the avidity with which speculators will take hold of any description of electrical enterprise that offers even the faintest prospect of earning a dividend. It is true that the City and South London Railway does not pay as yet; but this failure is ascribed rather to general causes than to any radical defect in the system of locomotion adopted. At any rate, several other underground electrical railways are being projected for London, besides two or three in the country; and if we are not to dismiss the whole of these as "contractor's jobs," they must be regarded as good evidence of the existence of people who honestly believe that there is something in the electric railway business. Suggestions are made for solving by electrical locomotion that long-standing puzzle of the Metropolitan railway system—the provision of a direct connection between the Waterloo Terminus of the London and South-Western Railway and the heart of the City. The direct connection by the same means of the northern and southern trunk-line systems is also engaging the attention of the electro-locomotive engineers. We sincerely hope that good work may be done in this field. There is plenty of room in London for several more rapid-transit devices; and it would be satisfactory to see the graduates in Electrical Engineering of the City and Guilds of London Institute better employed, if only as guards or switchmen upon electrical tram lines buried safely out of the way in the subsoil of London, than they are likely to be while lighting is their chief study.

Mr. Benjamin Payne, one of the founders of the Tunbridge Water-Works, has just passed away at the advanced age of 89.

Sir W. Thomson, D.C.L., President of the Royal Society, has had the dignity of a peerage of the United Kingdom conferred upon him by Her Majesty, as a New Year's Honour.

The Price of Gas in Brussels.—After much consideration and discussion, the Brussels Municipal Council have come to a decision on the question of the price of gas. It will probably be remembered that M. Richald brought forward a proposition to make the rate 12c. per cubic metre all round, instead of having a lower price for the gas used for cooking and motive power. To this a counter-proposition was submitted by M. Allard, to make the charge for gas used for domestic purposes, whether in the daytime or otherwise, 10c., and retain the existing price of 14c. for lighting gas. After a debate which was not remarkable for wisdom, this suggestion was adopted by 21 votes to 7. The result is that those who require a supply of gas at the lower rate will have to take it through separate service-pipes and meters—an arrangement which assuredly will not commend itself to intending consumers.

THE DECAY OF THE CONTRACT SYSTEM.

SOMETHING was said in the Retrospect of the past year, which was given in the last number of the JOURNAL, respecting the difficulty of noting at the time the beginnings of fresh industrial movements which afterwards develop sufficient importance to render memorable the era of their birth. One always seems to be living in an age of small things. Everything must have a beginning; and this beginning is usually so small and obscure that it is next to impossible to predict its future increase until this has become manifest, when prediction has to be changed for history. So many of the tendencies of the age in which one lives die out before coming to anything; so many promising beginnings never get any farther; so many revolutionary principles, in industry as well as in politics and social affairs, wilt under our eyes, even while their propounders are busily occupied in explaining their nature and object—that wise observers of the signs of their own times are careful how they form the opinion of any particular movement that it contains within itself the guarantees of growth and endurance. It is therefore with some diffidence that we invite the attention of our technical readers to the consideration whether, and to what extent, it can be said of the last year or two that they have witnessed the commencement of the decay of that once potent personage, the general engineering contractor. The question is both interesting and important, and has, moreover, so many bearings, that, unless its application is strictly limited to a particular order of cases, it will be extremely difficult to arrive at a definite conclusion in the matter. It may therefore be admitted at once that, for some purposes, we are likely to have the building and engineering contractor among us for many years longer. So long as non-technical bodies and private individuals continue to require, as they do, all kinds of building and engineering work, so long will they prefer, in the majority of instances, to contract with skilled persons for the execution of such work for a lump sum, in order that they may know what they will have to pay, and be relieved of all responsibility for the due performance of the constructor's task, whatever it may be. It is obvious, however, that contractors for the construction of building and engineering works have hitherto found employment under a very much more numerous and influential order of patrons than such as come into this category. It has been, and still is, customary for industrial and commercial concerns of all magnitudes to "put out" their constructional work, as well as many other services, under contract; and it is in connection with this class of contractor's patrons that we desire to discuss the question which constitutes the text of this article.

The term "contractor" is almost as elastic as that of "commission agent" in trade and industrial vocabularies. Of very many so-called contractors it may be said that they are nothing else than middlemen; and the latter term has not a pleasant savour in the nostrils of the present generation. Contractors have had a great deal to do with the business of gas supply, from the earliest times to the present day. It was once a common thing for contractors to occupy the middle place between a gas company and the consumers. The gas company was merely the financial organization for bringing gas lighting into a particular district; the works were built by contract, and managed by contract. It was nothing less than a revolution in the gas supply of whole provinces of the United Kingdom when gas companies were prevented from delegating their responsibilities, and gas-works lessees were consequently disestablished. We have no intention of bringing a general accusation against lessees of gas undertakings. There were black sheep among them, of course, and the temptations of the position were such as to handicap honourable dealers. But there were many able and honest men in this line of business, whose example spurred the statutory companies to conduct their affairs upon commercial principles. Moreover, the age of the gas-works lessees was the hey-day of middlemen. Vast undertakings of every kind now administered at first hand, were farmed out to shrewd business men, who, for guaranteeing the capitalist his dividend or interest, were allowed the fullest opportunity of scraping an additional profit for themselves. There have been few industrial movements of greater moment in this century than the general suppression of the order of "lessees"—that is to say, of middlemen contractors.

When the lessees disappeared, however, gas companies, like railroad and steamship companies, and many other well-established interests, still found themselves committed to a system of business of which contractors held the keys. Everything that was purchased was contracted for; and it was the same with all services that demanded anything like commercial aptitude or organizing ability in the performance. Either gas company directors entertained a profound distrust of the capacity of their officials, or the latter aimed at making things comfortable for themselves at any cost. But, whatever the motive, it is certain that many gas companies continued the practice of paying dearly for the convenience of relying upon middlemen for performing services which the company's own officers ought to have undertaken. Would we could describe the custom as obsolete. Unfortunately, it is too well known that it is still rooted in the policy of many gas administrations; and the fact that these are the undertakings which are unable

to sell gas cheaply, does not appear to enlighten those who are responsible for maintaining such practices. It is only when fossilized directors and managers are removed in the ordinary course of nature, that radical alterations of policy can usually be effected.

Yet there cannot be any mistaking of the right course in this regard, by those who keep their eyes open to what is going on around them. One after another the gas companies, water companies, and railway companies of the United Kingdom are doing more and more of their own work, and emancipating themselves in the same measure from the burden of maintaining contractors in the position of middlemen. The contracting system is crumbling on all sides, and dying out altogether wherever it can be spared. Some undertakings are more advanced than others in this respect; but if we confine our observations to the gas industry alone, it would be easy to find striking examples of companies and local authorities doing for themselves, with the greatest ease and comfort, things which more backward administrations still continue to "put out" to contract. Some gas companies do not seem able to set a retort, build a shed, lay a main or a service pipe, discharge a cargo of coal, get in a barge-load of bricks, repair a stove, or paint a gasholder without employing contractors. Why is this? There may be two reasons for putting out the work of a gas factory to contract: It may be very casual or infrequent work; or the management may be weak, and unwilling to incur responsibility. The former, so far as it goes, is a good excuse. Nobody would expect a gas company to keep up gasholder-making plant for use only every six or seven years, or to provide an iron foundry for the casual repair of castings not in sufficient demand to keep a moulder occupied. But when work is contracted for outside merely because of incompetency at home, it simply means that the cost of management is indirectly increased accordingly.

It is a difficult and often a thankless task for a gas manager who has been trained in a modern undertaking, where everything possible is done on the premises and at first hand, to break through the contrary system when he finds himself in independent control of a works whereon contractors have battenened from time immemorial. He feels constrained by his sense of duty to stop the multitudinous issues which he sees to be draining the life-blood of the concern; but where is he to begin? Next to his Board, the first people he comes in contact with are the contractors for coal, cartage, lighterage, building, repairs, mainlaying, and all the rest of it; and, it is necessary to say that, from the manner in which some of these gentry are recommended to his kind consideration by old stagers on the Board or in the undertaking, the new manager is often able to form a shrewd opinion as to where lies the greatest interest in the contracts. Even where there is no apparent ground for suspecting the existence of those "wheels within wheels" which make of some gas undertakings such marvellously intricate pieces of mechanism, the manager or the director who comes fresh into an old-fashioned concern of the kind, will do well to keep his reforming zeal out of sight for awhile, until he has the run of the "ins and outs" of the whole affair. The contractors are such capital good fellows, as a rule, and do their work so well—when things are going straight—that it seems a thousand pities not to leave well alone. An opportunity for making a change is certain to present itself sooner or later, however; and then is the time for the reformer to show whether he has the tact by which reforms are carried out without giving offence, as well as the knowledge of what ought to be done. The best aid to the disestablishment of the contract system is command of the history of contracts; and in this record, the back volumes of the JOURNAL are rich.

For it is of the essence of the contract system that it shall be profitable to the contractor. So long as this condition prevails, everything will work well. When the circumstances change, however, the trouble begins; and those who patronized the contractor in order to save themselves trouble, discover that he expects to be paid for doing their work at a higher rate than they could do it for themselves. Moreover, there is something very unpleasant in the spectacle of a local authority, or a gas company protected by statute in the enjoyment of good dividends, wringing the last sovereign out of a poor wretch of a contractor who has put himself between the rich corporation and an adverse market. We have published so much upon this aspect of the question on former occasions, that it is unnecessary to say much about it now. Contracts when made must be upheld, of course, or the fabric of the industrial world will fall in pieces. It is worth pointing out, however, that the unrighteousness of Shylock consisted, not so much in insisting upon his bond (in which he was justified by the law) as in proposing the terms of that remarkable contract, which the other party was constrained to accept. So that one's sense of justice is offended when a municipal corporation or a statutory gas company, neither of whom can lose money by the influence of adverse markets, enters into engagements with unprotected contractors which may result in the ruin of the latter from this same cause. If the form of a contract must be adhered to in the matter of purchasing gas-works supplies, the only sound policy is to shorten the term during which the engagement is binding.

When a contract has been made, it is as a rule highly undesirable to vary its terms in any important respect. We too frequently hear of gas coal contracts which, on account of an alteration of views on the part of the buyers, or for some

other plausible reason, are tinkered out of all shape before they run out. It is notoriously the policy of some coal contractors never to allow a contract to run its natural course, if they can help it, without making it the subject of some "arrangement," or "understanding" having reference to future business. This is a peculiar vice of the system of long coal contracts; and is only to be avoided by restricting the duration of such engagements to periods which fall within the range of ordinary commercial providence.

It may be remarked by some professional readers that, while the evils of the contract system can be avoided or mitigated in regard to gas-works supplies, repairs, &c., it is not so easy to do without the engineering and building contractor in carrying out constructional work. We believe, however, that the usefulness of the contractor is usually overrated, even for this class of work. Structural iron and steel work must, of course, be contracted for, except under extraordinary conditions which need not be discussed here; but speaking generally, most works of construction required by industrial organizations, such as gas companies, need not be "put out" in this way. When the engineer is a capable designer, and the contracts are properly prepared for competition, it will frequently be found that the contractor's profit, and the incidental expenses of having work done in this way, far exceed any possible advantages derivable under the system. The contractor has to protect himself against loss, of course; and this can only be effectually done at exorbitant cost to the client. Why not, then, dispense with the contractor in his conventional capacity as the middleman who is to make the greatest profit, or bear the loss, if any, on the job? This is what many well-managed industrial concerns are doing; and the movement constitutes, unless we are greatly mistaken, a noteworthy sign of the times. Engineers and managers of gas-works who have not yet felt this movement, may regard the idea with some apprehension, as implying an addition to their responsibilities without necessarily improving their position. This fear is groundless. An engineer who is worthy of the name, who not only knows how to design a structure to meet his own requirements, but is competent to see that it is properly made or built, as the case may be, not seldom experiences many qualms at the thought that all his plans must be committed to the tender mercies of a tradesman, whose interest lies in fulfilling his obligations in the cheapest style permitted by the terms of his specification. How much more comfortable would such a designer be if he knew that the responsible builder, the head of the executive work, would be an agent of his own, with the same interest as himself in having good work done? The idea is not that the designer or the engineer shall always necessarily also be the working head of the executive staff. On the contrary, it is usually preferable that the supervizing and the executive staff should be distinct, although the Engineer would naturally be supreme over both departments. The great point is the avoidance of the creation of the separate interest of the contractor, which may usually be secured more easily than some engineers inured to the ordinary system are apt to believe. This, as we take it, is one of the salient features of later engineering practice; and it is certainly a feature that able and conscientious engineers have no reason to find fault with.

COMMUNICATED ARTICLES.

THE PHOTOMETRIC VALUE OF THE STANDARD SPERM CANDLE.

By W. C. Young, F.I.C., F.C.S., &c.,

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Before the present standard of light can be replaced by a substitute, it will be absolutely necessary to decide what is the exact photometric value of the parliamentary standard sperm candle. With this object in view, I made a large number of experiments in the early part of 1891, the results of which may be acceptable at the present time.

When the sperm candle was legalized as the standard of light, the old form of Bunsen photometer was in use; and in this one candle only was employed. This was burnt as in the ordinary way for domestic lighting purposes. The experiment commenced as soon as the ends of the wicks glowed, and were slightly bent; and the candle was extinguished at the end of ten minutes. Some time later, the Letheby modification of the Bunsen photometer was very generally adopted, and continues in use to the present day. In this instrument two candles are employed; and, for a long time (in many places it is so now), the whole candles were used, one burnt from the thin end and the other from the thick end. The practice of burning the candles in this way most probably arose from Bowditch's experiments, which appeared to show that the thickness of the candle influenced the light it gave. The Gas-Works Clauses Act, 1871, is in force in most places outside the Metropolis. This Act enforces the use of an open photometer (the Letheby-Bunsen being the one generally furnished); and it provides that the candles should be extinguished at the end of ten minutes, and the consumption of sperm ascertained by the loss of weight. In most places, however, the more exact method of ascertaining the consumption of sperm by the time taken to burn 40 grains, is now adopted.

Taking all these facts into consideration, I came to the conclusion that the most impartial method of using the candle for the purposes of these experiments would be to use two; burn each from the thin end; commence each testing when the wicks glowed and were slightly bent; ascertain the consumption of sperm by the time method; and extinguish them immediately on the completion of the test. Strict cleanliness was observed throughout; but the candle wicks were never touched, or influenced in any way. As many tests as possible were taken with each pair of candles, with an interval of at least 30 minutes between each; and the candles were fixed so that the flames were on the level of the centre of the disc in each testing.

CANDLES A.		CANDLES B.		CANDLES C.	
Result.	Sperm Burnt in 10 min. Grains.	Result.	Sperm Burnt in 10 min. Grains.	Result.	Sperm Burnt in 10 min. Grains.
14'93	39	14'80	39	15'17	41
14'61	37'9	14'55	40'1	14'31	38'7
14'04	39	15'14	40'6	14'64	40'3
14'95	44	15'08	40'7	14'91	42
15'12	40	15'15	40'9	14'65	42
15'26	39'3	14'65	41'4	15'23	41'3
14'73	40'3	14'89	40'2	14'78	40'7
14'44	38'3	14'50	39'5	14'86	40'4
14'63	38'2	14'84	40'0	14'74	40'9
14'10	38'4	14'79	41'9	14'39	40'2
14'64	38'5	15'37	41'0	14'73	39'2
14'94	39'9	15'06	41'1	14'72	39'1
15'51	40'7	15'19	40'2	14'51	40'5
15'72	40'8	15'25	40'3	14'58	40'3
16'12	40'2	14'56	40'2	14'72	40'4
15'35	39'9	14'32	40	15'02	41
14'94	40'1	13'98	38'9	15'03	41'6
15'15	40'7	14'11	38'3	14'43	40'6
15'95	40'1	14'16	39'4	14'52	40'4
15'14	41'2	14'00	40'4	14'62	40'8
16'03	40'9	14'00	38'6	14'66	39'8
14'85	41'2			14'90	40'9
14'77	41'4			14'72	41'3
Highest . .	16'12	Highest . .	15'37	Highest . .	15'23
Lowest . .	14'04	Lowest . .	13'98	Lowest . .	14'31
Mean. . .	15'04	Mean. . .	14'68	Mean . .	14'73
Check tests after the first, fourth, tenth, and fifteenth experiments gave 14'2, 14'18, 14'1, and 14'16 candles respectively.		Check tests after the sixth and tenth experiments gave 14'06 and 14'4 candles respectively.		Check tests after the first, seventh, fourteenth, nineteenth, and twenty-first experiments gave 14'24, 14'3, 14'18, 14'24, and 14'3 candles respectively.	

CANDLES D.		CANDLES E.		CANDLES F.	
Result.	Sperm Burnt in 10 min. Grains.	Result.	Sperm Burnt in 10 min. Grains.	Result.	Sperm Burnt in 10 min. Grains.
15'36	38'4	14'80	40	15'04	39'8
14'92	39'9	14'42	39	14'15	40'6
14'92	41'4	14'26	38'6	14'62	41'2
15'11	40'3	14'49	40'2	14'06	41'9
15'09	39'4	14'53	40'9	14'13	41
15'50	38'9	14'55	40'1	14'23	39
14'77	41'1	14'21	40'2	14'04	40
15'36	39'1	14'73	41'7	14'10	40'8
14'78	38'5	14'40	41'2	14'17	41'2
15'18	39'3	14'73	41'0	14'31	42'3
15'33	39'2	14'76	40'4	14'37	39'6
14'86	38'3	14'45	41'3	14'11	40'5
15'44	37'8	14'79	40'7	14'15	39'0
14'62	39'2	14'56	39'1	14'25	40'2
14'89	39'3	14'35	39'7	14'36	40'8
14'96	41	14'46	40	14'55	40'2
14'38	40'3	14'00	40'9	14'13	39'6
14'69	39'7	14'09	39'8	14'18	38'6
14'62	40'9	14'31	39'4	14'21	39
14'42	40'7	14'34	41'1	14'10	39'6
14'93	38'6	14'32	41	14'04	40'4
15'05	38'6	13'95	39'4	14'14	41'4
		14'01	39'1	14'62	38'9
Highest . .	15'50	Highest . .	14'80	Highest . .	15'04
Lowest . .	14'38	Lowest . .	13'95	Lowest . .	14'04
Mean. . .	14'91	Mean. . .	14'41	Mean . .	14'26
Check tests after the fifth and sixteenth experiments gave 14'21 and 14'15 candles respectively.					

Mean of all the experiments = 14'67 candles.

The light used for comparison was a 2½-inch flame in the standard "London" Argand used in the Metropolis for 16-candle gas. I showed in my paper on candles read before the Society of Chemical Industry in February, 1891,* that such a flame accurately measured, with the same burner and glass chimney—the latter being placed always in the same position—gave, with

common coal gas unmixed with carburetted water gas, a practically uniform light, which, tested with candles having clean, smooth, and well-bent wicks, was equal to 14'2 candles, burning 120 grains of sperm per hour. Check testings of the flame were occasionally made with candles having smooth and well-bent wicks (as described in the paper above referred to), during the progress of the experiments. The photometer employed was the last modification of the "Evans," such as is in use now at each of the City of London testing-stations, which is practically a 60-inch "Letheby," with the candles and burner protected from draughts.

The six sets of candles were all obtained from different sources, and fairly represent the candles in use at the present time; and the results show that the photometric value of the average standard sperm candle, when used as at the time of its official adoption, is equal to a little more than one-fifteenth of the light produced by an accurately measured 2½-inch flame of ordinary coal gas in a "London" Argand burner with a thin glass chimney.

It has been suggested that the sperm candles used for gas testing have much improved of late years, and give more light; and, on the other hand, that they are not so good as they used to be, and give less light. My own opinion, after using them daily for 25 years, is that they are the same now as they ever were; and I am confirmed in this by the fact that a 3-inch flame in the "London" Argand was, years ago, always considered (and spoken of) as of 16-candle power, and that an average of a large number of experiments upon carefully-measured 3-inch flames gives a value of 16'25 candles at the present time.

LIGHTING.

By W. H. Y. Webber.

(Continued from Vol. LVIII., p. 1085.)

PART III.—A CRITICAL EXAMINATION OF MODERN PRACTICE.

From what has already been stated, it will be perceived how the practice of gas-lighting has been gradually developed and improved of late years with more or less direct reference to theoretical requirements. It is the principal object of the writer to show that yet greater exactitude in dealing rationally with problems of lighting may be attained, and lighting effects reduced systematically to precise quantitative expressions, so that the lighting of one locality may be exactly compared with that of another when the same system is applied in both cases, or the useful effects of different systems may be contrasted, by a simple and indisputable mathematical method. To this end it is necessary to briefly recapitulate so much of the theory of illumination as bears immediately upon the problems that occur in practice. Having done this, it will be easy to place practice upon a sound scientific footing. Clearly, the starting-point of such an attempt to rationalize lighting is a thorough grasp of all the relations of the Law of Distance. These relations will appear by the following graphic illustration.

Diagrammatic Proof of the Law of Distance.—Let Q = the quantity of illuminating power of any source of light. Draw a circle C round the source at any distance d , and draw another circle C_1 from the same centre at double this distance d_1 . Mark off any part l of the inner circle, say 1 foot in length. Draw radii from the centre to each end of the length l , and produce them until they meet the outer circle C_1 . The length l_1 will be double that of l . Since light radiates from a source in straight lines in all directions, the circle C may be considered further as

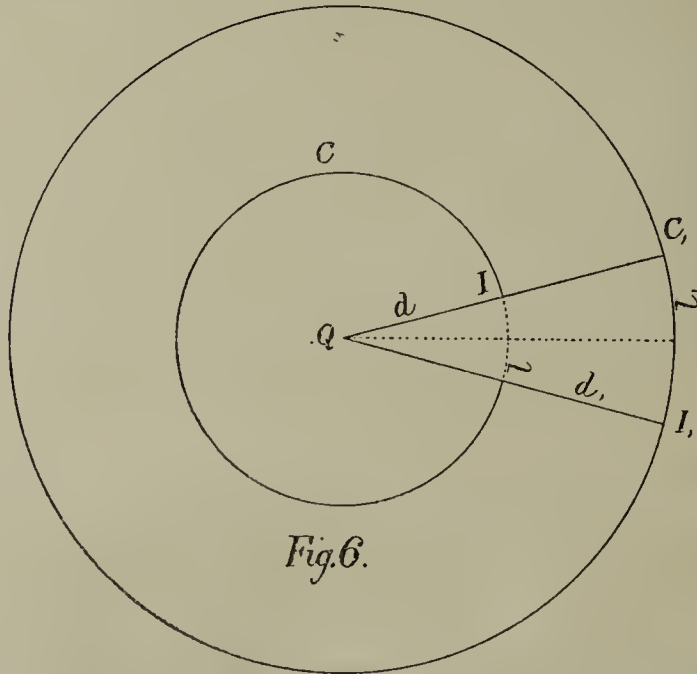


Fig.6.

the section of a sphere with centre Q . Every part of the inner surface of this sphere with radius d will receive the same illumination from the central source. Consider further this sphere as an opaque shell, in which an opening 1 foot square is cut at l . The shell C is surrounded by a concentric shell C_1 of twice its radius; wherefore the light radiating through the opening l will mark on the inner surface of the latter an illuminated square patch, the sides of which will be double the length of the sides of the opening l , and therefore it will be four times its area. If the area of l is 1 foot, the area of l_1 will be 4 feet; and as the

* See JOURNAL, Vol. LVII., p. 249.

light-intensity at I has to spread at I_1 over this quadrupled area, it can only be one-fourth as bright at any point of the extended surface.

The following are the formulæ for the Law of Distances:—

$$\begin{aligned} (1) \quad I &= \frac{Q}{d^2} \\ (2) \quad Q &= I \times d^2 \\ (3) \quad d &= \sqrt{\frac{Q}{I}} \end{aligned}$$

Let $Q = 64$ candles; $d = 2$ feet; $d_1 = 4$ feet. Here we have for the intensity I at the distance d

$$I = \frac{64}{2^2} = \frac{64}{4} = 16 \text{ candles.}$$

Also, the intensity I_1 at the distance d_1 will be—

$$I_1 = \frac{64}{4^2} = \frac{64}{16} = 4 \text{ candles.}$$

In the second form of the equation, we are supposed to know that $I = 16$ candles, and that $d = 2$ feet. Whence, to find the power of the central source, or Q , we have—

$$Q = (16 \times 2^2) = (16 \times 4) = 64 \text{ candles.}$$

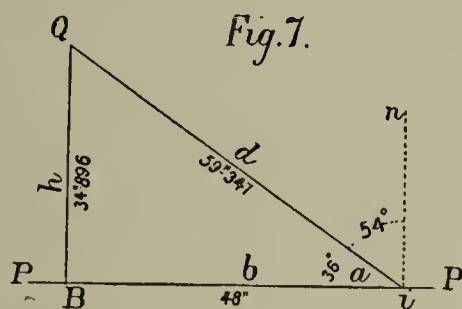
Again, knowing the value of Q and of I as being 64 candles and 16 candles respectively, we wish to find d . To put the problem in the simplest language, we may ask: At what distance must a surface be from a light-source of 64-candle power in order to receive an illumination equal to 16 candles? Here—

$$d = \sqrt{\frac{64}{16}} = \frac{8}{4} = 2 \text{ feet.}$$

In order to logically complete the explanation of the method of computing the diminution of the lighting effect of any source whatever, from the square of the distance from the source at which the effect is produced, it is necessary to remark that the illuminating power of the source is taken also to mean the lighting effect which it is capable of exerting at a distance *unity* from itself. Thus, if the distance is expressed in feet or inches, the initial luminous effect is supposed to be exerted at 1 foot, or 1 inch, as the case may be. (See Parkinson, Vol. LVIII., p. 664.) Unity, in short, is the understood third term of the proportional expression used in these calculations.

Thus, when we say that, according to the formula $I = \frac{Q}{d^2}$, the intensity of a light-source of 64 candles at a distance of 2 feet is equal to that of another of 16 candles, we may either mean that this is the comparative power of the lights themselves, or that a light of 64 candles at 2 feet or 2 inches distance will give the same luminous intensity upon a screen normal to its radiation as another light of 16-candle power at a distance of 1 foot or 1 inch, according to the unit of measurement employed. The former definition is the language of *photometry*; the latter, that of *lighting*.

When, going beyond computing the *intensity* of light at a point of a sphere surrounding the source, we proceed to consider the question of the *quantity* of light distributed from a source over a plane surface, which is the necessary condition of all artificial lighting, we must take into account the Law of the Cosinus as well as the Law of Distance; because, with the exception of the point in the plane situated vertically under the light, and consequently, in optical language, in the normal of the plane, all such light must fall on the plane at an angle.



Hence the two laws are combined in one expression (see Vol. LVIII., p. 664), whereby the intensity i of the lighting effect upon a point i in the plane PP (fig. 7) is—

$$i = \frac{Q}{d^2} \cos. Q i n.$$

But since the cosine of the angle $Q i n$ is equal to the sine of the angle a , which is its complement, and $\sin. a$, by the trigonometrical definition, is the ratio $\frac{h}{d}$, we have—

$$i = \frac{Q}{d^2} \times \frac{h}{d} \text{ hence } i = \frac{Qh}{d^3}$$

Expressing this in words, we find the rule that the intensity of the light that falls upon a point in a horizontal plane from a source above it, is determined by multiplying the illuminating power of the source by its vertical height above the plane, and dividing the product by the cube of the slant distance. It will be noticed that this is not quite identical with Professor Robinson's rule (Vol. LVIII., p. 753), which takes the horizontal distance from the foot of a lamp-post to the spot of which the illumination is to be determined, instead of the slant distance;

that is to say, it makes the intensity vary with the tangent instead of with the sine of the angle. The difference is not great in the case of lighting at a very acute angle, such as that from a street lamp at a considerable distance, because the tangents of acute angles do not greatly differ from their sines. The error increases, however, with the angle; and, in any case, it is preferable to work by a correct rule.

Since in the foregoing rule we have the lighting effect diminishing *inversely* with the square of the distance, and *directly* with the sine of the angle which the rays proceeding from the source make with the horizontal plane beneath them, there must be some common measure for both, where the maximum combined effect is exerted. In other words, if there is a small plane of unit area i (Fig. 7) situated at a certain distance b horizontally from the perpendicular passing through a light-source Q , there will be a height h at which the light-source must be fixed if the effect of the Law of Distance is to be exactly balanced by that of the Law of the Cosinus, so that the light shall be as near to the illuminated plane as is compatible with its falling upon its surface at the greatest angle.

Heath gives it as a proposition for students of Geometrical Optics to prove that this maximum effect is produced when $h = \frac{b}{\sqrt{2}}$. The mathematical proof of this statement may be

attempted by any reader of these articles who thinks it necessary. It is a somewhat laborious exercise, involving the calculus, and not worth filling the space of the JOURNAL with. Let it suffice for present purposes to admit that the theorem is correct. To give the expression its value, it may be stated that when in a right-angled triangle the perpendicular = $\frac{\text{the base}}{\sqrt{2}}$, the angle a is nearly 36° .

In fig. 7 let the base $b = 48$ inches; the angle a being 36° as before. The height of the perpendicular $h = \tan. a \times b$. In this case $\tan. a = 0.727$, and $b = 48$ inches; wherefore $h = 0.727 \times 48 = 34.896$ inches. And since the sides of triangles are proportional to the sines of the opposite angles, as $\sin. a : \sin. B :: h : d$. $\sin. a = 36^\circ = 0.588$. $\sin. B = \sin. 90^\circ = 1.00$. Whence, as $0.588 : 1.00 :: 34.896 \text{ inches} : d = 59.347 \text{ inches}$.

(To be continued.)

TECHNICAL RECORD.

GAS v. STEAM ENGINES FOR MOTIVE POWER.

From time to time we have recorded the results of working with the cheap fuel gas made in the apparatus devised by Mr. J. Emerson Dowson. This gas has long been used for a great variety of industrial purposes; the largest plant being at the well-known cocoa factory of Messrs. Van Houten and Son, in Holland, where about a million cubic feet can be produced per day of ten working hours. This gas is also suitable for cooking and heating; and at the Gloucester County Asylum all the kitchen work for the staff and inmates has for a considerable time been done with it. About 300 quartern loaves are baked with it daily, at a cost of about 1s. only for fuel; and, in addition, it serves two 12-horse power engines used for pumping water, and driving a dynamo for electric lighting. At Gloucester, the cost of the gas, including fuel, wages, repairs, and all incidental expenses, is under $1\frac{1}{2}$ d. per 1000 cubic feet. But when made on a small scale, the average cost is from 2d. to 3d. per 1000 cubic feet; and as four volumes of this gas are required to give the same heat as one volume of ordinary lighting gas, it follows that the cost of the equivalent of 1000 feet of the latter varies from 6d. to 1s. At Messrs. Van Houten and Son's works, the equivalent cost is $6\frac{1}{2}$ d., with anthracite coal costing 16s. a ton.

These remarks will serve to show that, in a quiet way, the Dowson system has steadily established itself for a variety of heating purposes; but, besides this, we believe we are right in saying that about half the installations of this plant are for motive power. It is, in fact, with this branch of the subject that we now propose to deal chiefly. Messrs. Crossley Bros., Limited, frankly state in their catalogue that, when town gas costs more than 3s. per 1000 cubic feet, the working cost of a gas-engine of upwards of 14-horse power nominal exceeds that of a steam-engine under the usual conditions of working. The fuel in the form of town gas is, in fact, too dear compared with the steam coal used for a boiler. On the other hand, it has been found that the ratio of heat converted into work is higher in a gas-engine than in a steam-engine. From a practical point of view, we are thus faced with the fact that, although the gas-engine is more efficient as a heat-engine than its rival, it cannot be economically used in large sizes, unless some cheaper form of fuel than ordinary illuminating gas is available.

Mr. Dowson was, however, ready with his plant; and the results obtained with it in many places were so satisfactory, that makers of gas-engines were encouraged to design motors of much higher power than could be driven economically with ordinary gas. Messrs. Crossley, for instance, now make a double-cylinder engine which actually develops more than 160 indicated horse power when worked with Dowson gas; and there are three of these engines now in operation regularly—

GAS POWER AT THE CAMBRIAN MILLS, NEWTOWN, MONTGOMERYSHIRE.

TABLE showing the Result of Two Trials, each of Six Days (56 Hours) with Dowson Gas, made from [A] Welsh Anthracite and [B] Ordinary Gas Coke from the Wellington Gas-Works; the Data being Furnished by the Severn Tweed Company, Limited.

Number of Section.	Nominal Horse Power of Crossley Engine.	Approximate Maximum Brake Horse Power of Engine.	Approximate Brake Horse Power used for Machines and Shafting during Trial.	Brake Horse Power Hours during Trial.	FUEL CONSUMED.			COST OF FUEL.			Remarks.
					For Generator.	Slack for Boiler.	Total per Brake Horse Power per Hour.	Anthracite per Ton.	Slack per Ton.	Total per Brake Horse Power per Hour.	
A { 1 and 4 2 3 Hoists	60	128	96'03	5377'75	13,416	336	1'23	19 10	9 6	0'130	The boiler was partly fired with anthracite cinders, &c., which fell through the generator grate bars.
	40	73	72'39	4054'00							
	40	73	27'00	1515'25							
	4	5½	3'57	200'00							
	144	279½	198'99	11147'00							
B { 1 and 4 2 3 Hoists	60	128	89'46	5010'00	16,615	1568	1'73	Coke. 15 0	9 6	0'135	The coke was not of good quality. There was no residue from the coke in the generator, which could be used in the boiler.
	40	73	66'12	3702'72							
	40	73	28'49	1595'44							
	4	5½	3'57	200'00							
	144	279½	187'64	10508'16							

Machines used in, and Horse Power Required for each Section.

SECTION NO. 1.		SECTION NO. 2.		SECTION NO. 3.		SECTION NO. 4.	
Description of Machine.	Approximate Brake Horse Power Required.	Description of Machine.	Approximate Brake Horse Power Required.	Description of Machine.	Approximate Brake Horse Power Required.	Description of Machine.	Approximate Brake Horse Power Required.
Blackman fan . . .	2'50	6 twisting machines .	18'00	40 fast looms . . .	19'00	5 fulling-machines .	15'00
Wool-drying machine .	3'25	12 mules	24'00	47 slow „	8'00	3 washing „	3'00
Shaker	0'50	Warp hank-machine.	1'00	4 Sowden looms . .	0'50	2 hydros.	1'00
Burring-machine . .	3'50	Reel „ „	1'00	6 Bradford „ . . .	0'50	Wool-scourer	3'00
New Willey	2'00	5 sets of carding-machines	30'00	4 winding-machines	4'00	Stocks	0'50
Old „	2'00	Shafting, &c.	6'00	Shafting	8'00	Shearing-machine, &c.	5'00
Garnet-machine . . .	1'25					Tenter „	6'00
8 sets carding-engines.	48'00					Shafting, &c.	4'00
2 „ waste „	4'00						
6 mules	12'00						
Shafting, &c.	6'00						

one at the engineering works of the Projectile Company, Limited, at Wandsworth; one at the flour-mills of Messrs. Mead and Son, of Chelsea; and one at the cloth-mill of the Severn Tweed Company, Limited, Newtown, Montgomeryshire. At Wandsworth, there are also two other Crossley engines, each of 80 indicated horse power; and at Newtown there are three additional large engines. It will thus be seen that a new departure has been made in gas power, and that large engines driven by it are now fairly in competition with steam-engines.

It remains to be seen what is the economical result. Fortunately, we have the means of gauging this, as the Severn Tweed Company have lately made independent trials to ascertain the weight and cost of fuel consumed. The details of these trials are given in the tables, with a list of machines in each department. In experiments marked A, the gas-generator was fed with anthracite; in those grouped under B, ordinary gas coke was employed. At the time the trials were made, the mill was not in full work; and the aggregate brake or effective power used was about 190-horse power, while the engines are capable of developing a total of about 280-horse power effective. The friction of the engines was, therefore, greater in proportion to the work done than would have been the case if they had been fully loaded; but we do not look upon this as an exceptional condition in average mill work. Attention is drawn to it merely to show that in the trials referred to the engines were not at all favoured.

The general outcome of the trials is that, when anthracite was used in the generator, the total fuel consumed was only 1'23 lbs. per brake horse power per hour; and allowing 20 per cent. for the average friction of the engines, the consumption was barely 1 lb. per indicated horse power per hour. The price of anthracite is now high; but, even at 20s. per ton, the total fuel works out to only 0'13d. per brake horse power per hour. In the trial with gas coke, it is stated that the latter was rather inferior in quality, and produced much clinker and ash. Even with this, the total consumption was at the rate of only 1'73 lbs. per brake horse power, or about 1'4 lbs. per indicated horse power per hour. The coke cost 15s. per ton delivered at Newtown; and at this rate the cost per brake horse power per hour was 0'135d. It will thus be seen that even coke at 15s. a ton can compete with the best anthracite. But at 10s. a ton the cost would be 0'09d., and at 5s. per ton, only 0'045d. per brake horse power per hour.

These are, no doubt, remarkable results; and, seeing that the trials referred to were made under thoroughly practical conditions of working, one may hope that, as the use of gas power under the new system extends, a new demand for coke will be created. Mr. Dowson has, however, drawn attention to some practical points connected with the use of this residual, which gas companies will do well to consider. In the first place, the coke used in the gas-generator must be of fairly good quality, as

much clinker interferes with the proper working of the plant. If there is much sulphur, it nearly all assumes the form of sulphuretted hydrogen; and this is not only injurious to metals, but the smell from it, when gas escapes during the feeding of the generator, &c., causes a nuisance. On the other hand, the coke for the generator should not be large—pieces about ¾ inch to 1 inch cube being best. If, therefore, the consumer is obliged to buy large coke, he must break it to the size required. A further important point is that the consumer should be able to buy suitable coke at something like the local price of the slack used for steam-boilers; otherwise the saving in weight of fuel in the gas system will be all, or nearly all, lost in the increased cost of fuel. To meet all these points, Mr. Dowson suggests that the small coke of the gas-works yard should be washed to remove dirt, small coal, and other impurities; and he is of opinion that when so treated, it could be sold with a good profit at about the price of local steam coal. In London and other important centres there are already, we believe, several users of anthracite who would gladly adopt coke if it could be obtained of suitable size and quality, and if the price were reasonable. It may be said that there is not yet a sufficient demand for this class of coke; but if the gas-engine makers hold back because of the cost of anthracite and coke, and if the gas companies do not display some endeavour to meet the difficulty, the extension of gas power will necessarily be much slower than it should be, now that a good practical start has been made. A new field of enterprise is opening up; and to a great extent it seems to depend on the gas companies whether or not it shall be cultivated with energy.

Sugg's "Gas Engineer's Pocket Almanac and Lighting Table" for the present year contains, in addition to full particulars of the gas-testing apparatus and other gas appliances with which the name is associated, a number of tables to which a gas manager will find it instructive to refer. Provision is made for recording monthly working results, and general memoranda.

New Companies and Issues in the Past Year.—Although the number of new companies registered last year, and the amount of new capital offered for subscription, were less than in 1890, there were 2436 additional joint-stock undertakings promoted; the aggregate capital of which reached £124,231,000. In the previous year the number was 2478; the total capital being £216,554,000. The largest number of companies registered in 1891 was in April; the amount of capital concerned being £16,931,000, of which a sum of £2,000,000 was contributed by the Water and Gas Works Securities Corporation. To show the extent of joint-stock enterprise, it may be added that since the adoption of the limited liability principle in 1862, nearly 39,000 companies, with capitals amounting to £4,040,000,000, have been registered.

THE DESSAU CENTRAL ELECTRIC LIGHTING STATION OF THE GERMAN CONTINENTAL GAS COMPANY.

Progress of the Undertaking from 1886 to 1891.

In the JOURNAL for Nov. 10 last, we noticed, among the "Electric Lighting Memoranda," a volume of reports in connection with electric lighting matters presented at a conference of German Municipal Administrators held during the continuance of the Frankfort Electrical Exhibition. Special attention was called to the report on the central lighting station of the German Continental Gas Company at Dessau, by the General Director of the Company (Herr W. von Oechelhäuser). This report has been printed separately; and, in view of the interest attaching to the question dealt with—the supply of electric light on a large scale by a Gas Company—we had the appended translation of the document prepared. We are indebted to Herr Oechelhäuser for the use of the original blocks illustrating his report; and, for the assistance of those of our readers who are not acquainted with the German language, we give the English equivalents for the descriptive particulars which appear thereon.

In accordance with a supplementary regulation of March 12, 1879, the German Continental Gas Company extended their sphere of operations to the business of electric lighting; and the first central electric station of the Company was opened in Dessau on Sept. 13, 1886. With the exception of the Berlin central stations, this was the oldest in Germany. The project arose in the first place from the idea that the application of gas-engines as a motive force in electrical central stations of moderate magnitude, was the natural link connecting gas and electricity, inasmuch as, under such conditions, the electric light appears merely as a transmuted force or as a mechanical transformation of the heat of combustion of the gas; and, secondly, from the consideration that a very important future was in store for gaseous fuel, and especially coal gas, as a producer of power, even in engines of larger size—this being the inference to be drawn from all researches on the theory of heat and from practical experience during the last decade.

DESCRIPTION OF THE INSTALLATION.

The Allgemeinen Elektrizitäts-Gesellschaft (General Electric Company) and Messrs. Siemens and Halske, of Berlin, executed the electro-technical portion; the Berlin-Anhaltischen Maschinenbau-Actien-Gesellschaft (Berlin and Anhalt Machine Construction Company) put up the engines and carried out the arrangements for transmission. Since the opening, the works have been under the direction of Herr H. Roscher, the Engineer. The motive-power plant, which at the present time has undergone considerable alteration, formerly consisted of two double-cylinder "Otto" gas-engines, each of 60-horse power, one similar engine of 30-horse power, and one single-cylinder engine of 8-horse power; making a total of 158, or (say) 160 effective horse power. The gas-engines were connected by belting and throw-off couplings with the four dynamos of suitable size. The 8-horse power engine, ordinarily assumed as of 10-horse-power effective, was employed for lighting requirements during the daytime, and to start the larger engines.

For cooling purposes, the gas-engines were all connected with three intercommunicating wrought-iron air-cooling chambers, having a total surface of 100 square metres (119·6 square yards); an injector, actuated by the town water supply, being interposed between the cooling chambers and the gas-engines, to overcome the considerable frictional resistance in the cooling channels, and to regulate, as desired, the circulation and the temperature. A small pump with a 1-horse power electro-motor serves as a reserve for the water supply. The average annual consumption of water by the engines was diminished to from 23 to 24 litres (5 to 5½ gallons) per horse power per hour by the air-cooler; while with new and improved cooling arrangements further economies in working can, no doubt, be effected. Besides, we wish to point out here that the quantity of water stated above includes the by no means inconsiderable consumption in the dynamo department.

By means of a simple arrangement, the result of numerous experiments, the explosion of the gas-engines has been rendered completely noiseless; so that anyone standing outside the engine-house can scarcely distinguish by the sound whether or not the engines are in action; a white, odourless cloud of steam being the only indication of the working of the engines.

The Dynamo Machines.—At the opening of the station there were: Two of Edison's dynamos, each of 35,000 watts, one of 23,000 watts, and one of 5,000 watts—total, 98,000 watts. The dynamos work at a tension of 110 volts. After establishing a more powerful battery of accumulators in 1889, the two larger dynamo machines had to be exchanged for one with higher tension (140 volts). The increase in efficiency with this new dynamo of 45,000 watts, as compared with the 35,000 watts of its predecessors, represents approximately the loss in the accumulators. At the present time, therefore, the efficiency of all the dynamos amounts to 108,000 watts.

Distribution of the Electricity.—The scheme of the Allgemeinen Elektrizitäts-Gesellschaft in vogue at the time was introduced,

and was arranged for a double system of conductors; but a third system can also be added subsequently. There are at present 3451 metres (about 3774 yards) of double conductors—in fact, Messrs. Siemens and Halske's lead cables protected with iron banding.

The Accumulator Installation.—In 1887 a small battery for 100 lamps came into use, and was charged by means of the small 8-horse power gas-engine; and, notwithstanding its small duty (amounting to only about 50 per cent.), and its rapid deterioration, it demonstrated so decisively the advantage of accumulators in various directions, that in the summer of 1889 the old and small battery was replaced by a larger Tudor accumulator battery (by Messrs. Müller and Einbeck, of Hagen, in Westphalia) of a capacity of 1700 ampères per hour. The new battery is arranged parallel to the dynamo machines, requires the full power of two 60-horse power engines to charge it, and can supply 600 lamps for five or six hours. The introduction of this battery of accumulators increased the total amount of capital expended on the station by 15 per cent., and its producing capacity by about 38 per cent.; and it is only since this introduction that the working of the station can be regarded as normal, economical, and certain. The economical duty of the battery (carefully recorded by two Aron watt-meters) during the year 1890 was as follows: January, 75 per cent.; February, 86 per cent.; March, 70 per cent.; April, 80 per cent.; May, 74 per cent.; June, 79 per cent.; July, 76 per cent.; August, 70 per cent.; September, 77·5 per cent.; October, 92·8 per cent. (probably an error in reading); November, 72·2 per cent.; December, 77 per cent.—averaging for the year, 78·9 per cent.

The progress in the duty of the preceding and present installations is as follows: The small battery of accumulators gave a duty of 40 per cent. in 1887 and 52 per cent. in 1888; the larger one, 78·8 per cent. in 1889 and 78·9 per cent. in 1890. In making use of these numbers, however, the error is ordinarily committed of debiting the total annual production of such a central station with the 20 to 25 per cent. loss of energy of the accumulators. This is by no means just, inasmuch as the percentage of loss for the year is also far more dependent on the proportion that the magnitude of the accumulator battery bears to the total engine capacity. In Dessau, for example the accumulators use up 52 per cent. of the twelve months' consumption; therefore the loss of 21 per cent. can only be considered on this percentage, so that the loss by the accumulators only amounts to 10 or 11 per cent. of the whole year's consumption. The new battery has been in continuous operation for nearly two years without any interruption; and it has been at various times surcharged to the extent of 20 or 25 per cent. without suffering any damage.

The acknowledged advantages of accumulator installations have been confirmed to the following extent in the Dessau works:—

1. Sudden variation in light and pressure, due to changes in consumption and to the pulsations of the engine, are avoided. These drawbacks are comparatively more violent and more sudden in small and medium-sized installations than in larger central stations, owing to the total number of lights in use being smaller in the former cases.

2. In case the driving-engines break down suddenly, a portion of the consumption (for example, in the theatre, &c.) can be sustained for a long time from the accumulators.

3. The working of the engines having been more efficient, the following savings have been effected per horse-power-hour: (a) The gas consumption in the engines was reduced from an annual average of 920 litres in 1888 to 750 litres in 1890; (b) the consumption of water for cooling, from 62·6 to 23·7 litres; (c) the consumption of oil, from 19·9 to 9·8 grammes.

4. Large gas-engines can be set going by the dynamos by means of the current taken from the accumulators; consequently, the erection and working of special machinery and transmission appliances for starting can be dispensed with.

5. The supply of electric current can be continuously sustained at all times, day and night; and night labour can be saved.

WORKING RESULTS.

The people at present employed at the central electric station are the engineer-in-chief, an assistant, two mechanics, one fitter, and one labourer. The capital expenditure has increased from 219,952 marks on Dec. 31, 1886, to 240,660 marks on Dec. 31, 1890. So that at the close of 1890, with 3689 lamps installed, the cost per lamp was about 65 marks. Of the 3689 incandescent lamps installed, only quite an exceptionally small proportion (about 60 per cent.) have been burning at the same time. The capital expenditure in future will, however, be very considerably diminished, on account of the cost of gas-engines of 100-horse power which are now to be obtained, and also by a more advantageous arrangement of the machinery. The expenses of first establishment comprise: Buildings, 10 per cent.; engines and dynamos, 12·5 per cent.; accumulators, 10 per cent.; boxes, cables, gas and water conduits, 3 per cent.

Up to the present time the most economical application of the gas-engines has been charging the accumulators for one hour's burning of the 16-candle incandescent lamps with a consumption of 68 litres of gas; while, according to the above table, a consumption of 100·52 litres was the annual average required for one hour's burning of the lamps when the loss in the accumulators and in the distribution was included. Nevertheless,

THE DESSAU CENTRAL ELECTRIC LIGHTING STATION.

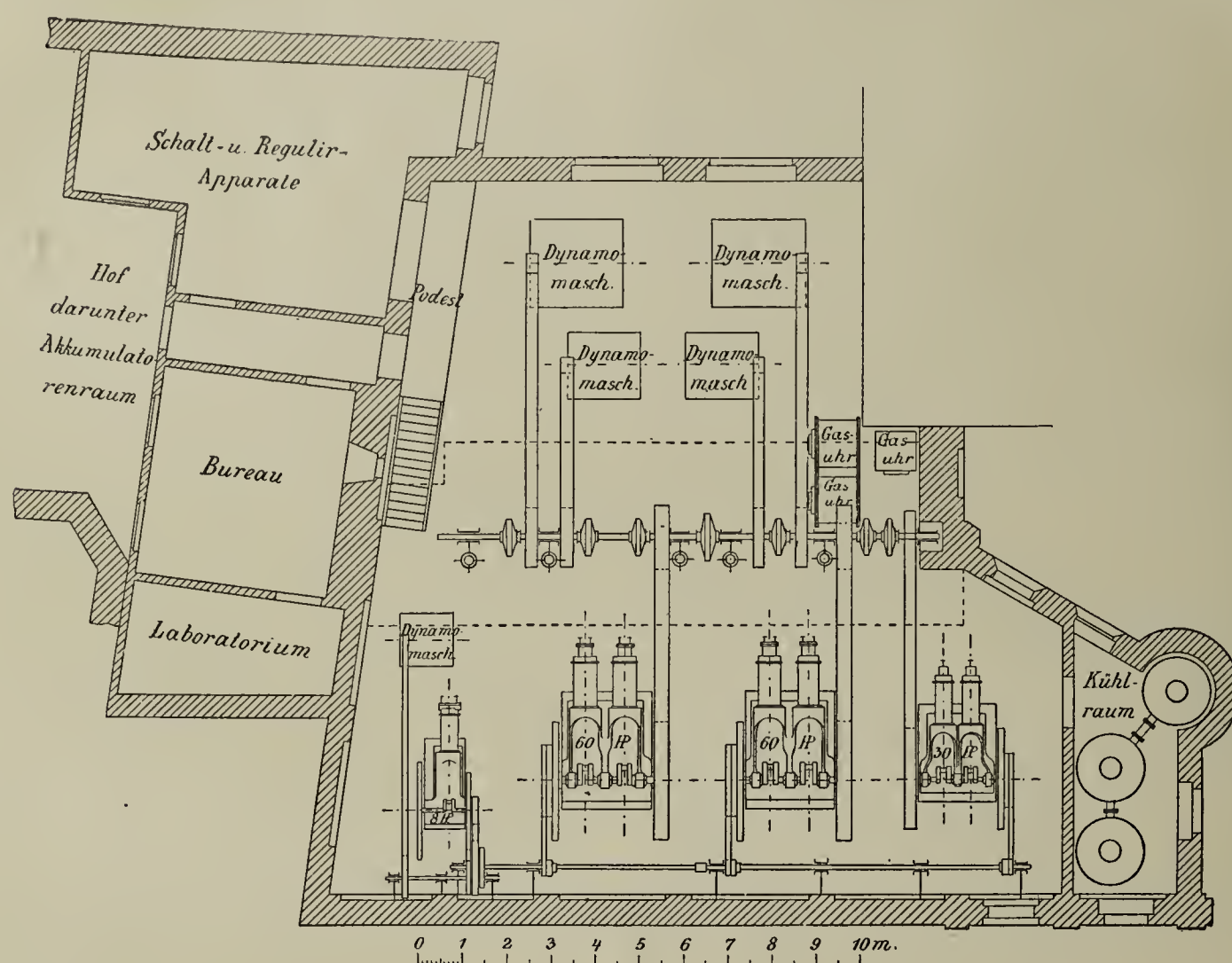


FIG. 1.—PLAN OF THE STATION AS IN 1886.

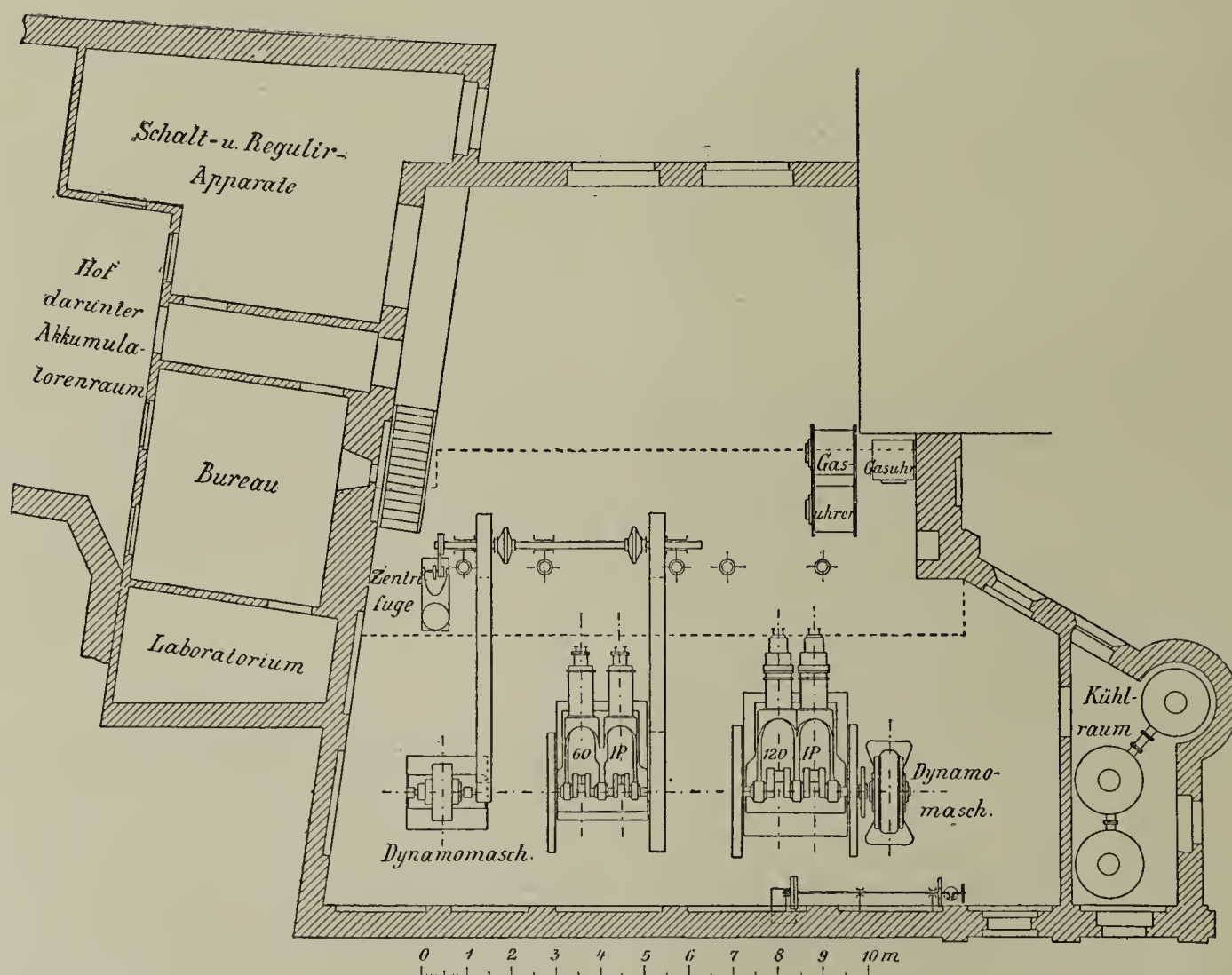


FIG. 2.—PLAN OF THE STATION AS IN 1891.

Schalt und Regulir Apparat—Switch and Regulator Plant. Hof darunter Akkumulatorenraum—Yard with Accumulator Room below. Bureau—Office. Laboratorium—Laboratory. Podest—Supervisor's Platform. Dynamomasch—Dynamometers. Gasuhr—Gas-Meters. Kühlraum—Condensers. Zentrifuge—Centrifugal.

the two sets of numbers do not admit of direct comparison, because the first are not yearly averages, whereas the latter are.

Resumé of Some Working Factors.

	1886. (3 mos.)	1887.	1888.	1889.	1890.
1. Number of lamps installed—					
(a). Incandescent lamps of various sizes	1,014	2,027	2,064	3,094	3,194
(b). Arc lamps	4	27	48	56	59
a and b reduced to terms of 16 candle power	1,076	2,400	2,544	3,565	3,689
2. Ampère-hours of current sold	62,827	195,547	243,670	333,380	367,135
3. Annual consumption of gas	27,754	54,189	60,020	68,733	67,099
4. Average annual requirements per horse power—					
Gas litres	..	953	920.60	800	750
Water (including cooling in the dynamo department) litres	..	..	62.60	33.70	23.70
Lubricating material grammes	..	43.60	19.90	13.50	9.80
5. Gas consumed per hour's burning of the glow lamps of 16-candle power, at 55 watts (including the total loss of production and electrical distribution) . . . . .	..	152.40	131.37	113.39	100.52

The average number of hours' burning of the whole of the lamps installed is only 181, on account of the comparatively large quantity of lamps which are very seldom used (those in the Ducal Castle at Dessau); but for private lighting the number is 264 hours per annum. These figures are obtained by dividing the hourly consumption of the total lamps or of the private lamps into the total annual supply in ampère-hours. The hours of burning for gas-lights, calculated in a similar manner, reckoning 180 litres per 16-candle power, amounts in Dessau to 437 hours; or, reckoning 156 litres per 16-candle power, to 534 hours. The smaller number of hours of the electric as compared with the gas lights is accounted for by the fact that the majority of the private consumers use both kinds of lights; that in small towns, even the best consumers (shop-keepers and *restaurateurs*) do not burn lights as long as in large towns; and that a specially good class of utilizers of electricity—viz., banks and large mercantile houses—only exist to a very limited extent in many smaller places. Finally, the facility with which the electric light is turned on and extinguished, coupled in winter with the want of heating power in it, contributes to diminishing the number of hours' burning. This small annual average burning of the lights, which, as regards electric light, cannot be raised much higher in a considerable number of small and medium-sized towns, is the chief source of the hitherto bad financial result obtained at Dessau. The number of hours' burning constitutes one of the chief factors for making things pay; and therefore, with additional hours, increased dividends will accrue.*

ALTERATION OF THE CENTRAL STATION.

When the introduction of accumulators had been proved to be a success, a change became necessary in the mode of working the central station, and also certain alterations in the arrangement of the machinery, which would not otherwise have been contemplated. Formerly, without accumulators, it was thought necessary to adjust the size of the engine to the supply—small engines for a small supply, large ones for a large supply—so that they should always be worked to their full extent; for running a large engine for a small amount of work, as might be expected, was *a priori* anything but economical in gas consumption, &c. Therefore, whereas the original Dessau installation had 10, 30, and 60 horse power engines and dynamos with the accumulators, the need for small and medium-sized engines disappeared, inasmuch as a limited supply can more advantageously be furnished entirely by accumulators without any engine working, or the lack of load required to work the engines fully is compensated for by using it for charging the accumulators. For in spite of the loss of about 21 per cent. in the accumulators, large motors act more beneficially arranged parallel with them, than the smaller engines without any accumulators working directly on to the distributing cables, because, in the first place, large engines require 25 to 30 per cent. less gas per effective horse power than small ones; and, secondly, on account of the parallel arrangement with the accumulators, they always run with a full load, while smaller engines, notwithstanding their adaptability in size, are only seldom fully utilized in direct working. The large motors and their full load, therefore, not only compensate for the loss in the accumulators, but lead, as is shown by the statistics given above, even to an increased working economy in various directions, and also offer many other advantages.

The importance of working engines with a full load, which is equally true of steam as of gas engines, should be demonstrated more strikingly in operating central electric stations than in other works. In the latter, one is very seldom in a position, on account of incidental charges, to compare the actual load with the simultaneous consumption of fuel; whereas, in central stations, accurate electrical measuring implements

can at all times give a record of the behaviour of the engines while at work. In this direction, and for the reason that such observations must attract more attention in future, the English have, at the suggestion of Mr. Crompton, gone so far as to introduce a special expression for this purpose—namely, "load factor." It therefore follows quite naturally, with the Dessau central station in actual working, that, after the installation of the accumulators, the 8 and 30 horse power engines were seldom worked, and, in fact, not as formerly during periods of slackness, but when at certain hours the maximum output of the 60-horse power engine and the accumulators combined was insufficient to meet the demand. Then four engines and the accumulators had to be worked simultaneously. While, in the year 1886, gas-engines of only 60-horse power efficiency were generally known, at the present time twin engines are built of 120 to 140 effective horse power. Therefore it is possible to replace three engines of 60, 30, and 10-horse power by a single one of 120-horse power, which not only yields 20-horse power more, but occupies considerably less space, and needs (per horse power) less gas, lubricating material, as well as attention. Moreover, besides the increase in size, gas-engines are now constructed of such form as to permit of even single-cylinder ones being coupled directly with the dynamo; hence apart from the gain in space, transmission by belts, ropes, complicated couplings, and incidental loss of power, will be done away with in the future. Finally, it has to be remembered that, with the use of accumulators, a starting-engine is no longer required by the large gas-engines, inasmuch as the latter can be turned in the right direction by the dynamos with the aid of the current from the accumulator. The Superintendent of the central station (Herr Roscher) has since 1890 planned an arrangement of this kind in a very simple manner; and has succeeded in abolishing not merely the starting-engines, but also the starting transmission arrangements for the large engines.

In accordance with these considerations, the alterations of the central station were carried out during the current year as shown in fig. 2. The 3 and 30 horse, and one of the 60-horse power engines were replaced by a new Deutz engine of 120-horse power, coupled directly with a dynamo having a maximum duty of 80,000 watts. The dynamo put up in 1889 to charge the accumulators, was placed near the remaining 60-horse power engine, and is driven by some of the old transmission fittings. A comparison of figs. 1 and 2 will show distinctly, among other things, the saving of room, and the great simplification of the whole plan. It is scarcely necessary to point out that the irregularity of the ground plan is occasioned by local circumstances.

When the installation of accumulators becomes enlarged in sympathy with the demand, so that the entire power of the new 120-horse power engine will be needed for the complete charging, the 60-horse engine will, as heretofore, be set to work to help the operation; while during the evening the new engine will run simultaneously for the accumulators and direct on the distributing cables. Consequently, instead of three, only one fully-loaded engine, and only two instead of four engines have to be worked. It has, moreover, been demonstrated that the loading capacity of the present battery is considerably greater than 60-horse power; so that even the 120-horse power engine can transfer about 75-horse power to the accumulators. The saving of gas shown by charging the accumulators from the 120-horse power motor with a load of about 75-horse power, compared with the fully-loaded 60-horse power, will ultimately be utilized during the day for charging the accumulators by the 120-horse power engine alone.

This complete re-organization, which will be carried out with gas-engines in other large central stations of the Company permits not only of a considerable saving of space, but also furnishes the possibility of a further important enlargement on the same piece of ground, which is very favourably situated, being in the midst of the town, and in the immediate vicinity of the Ducal Court and Theatre, which is illuminated by the electric light. It likewise encourages the anticipation of still more important working results for the future.

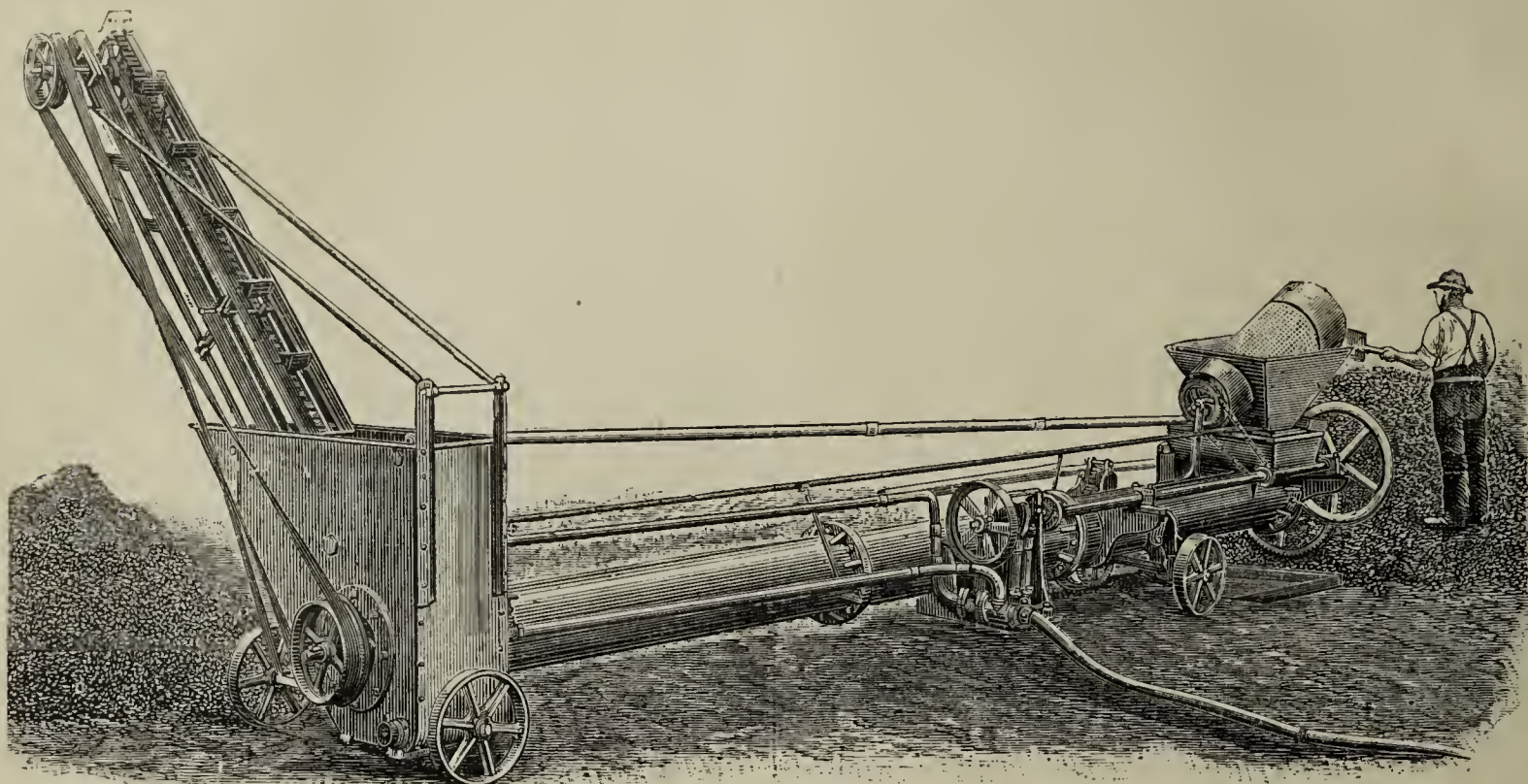
(To be continued.)

GREENWAY'S SAND WASHING AND ELEVATING MACHINE.

In the course of the letter by "Inspector," in last week's number of the JOURNAL, dealing with the storage and mechanical filtration of water, reference was made, in connection with the latter subject, to the necessity for some means of promptly and efficiently cleansing the sand or other medium employed in the filter, upon which, as then pointed out, the whole secret of the success of the process depends. It may therefore be opportune to direct attention to the sand washing and elevating machine shown in the accompanying illustration, which has been constructed in accordance with Mr. Greenway's patent, the licensees for which are Messrs. James Gibb and Co., of 99, Fenchurch Street.

In the illustration on next page, the machine is shown attached to a water motor, by which it may be driven where sufficient pressure is available; but it can, of course, be fitted with a small steam-engine. When the former power is used, the water

* Taking the annual average of the twelve gas stations of the German Continental Gas Company, the average hours' burning is 506; the minimum one town being 341, and the maximum 580.



is conveyed from the main to the motor by hose pipe; and the exhaust water, after passing through the motor, is carried into the discharge-tank of the machine. Thence it flows by gravitation along the large pipe at the bottom, meeting the sand, which is being forced along this pipe, by a series of paddle blades on a shaft, from the feeding end of the machine. These blades thoroughly churn up the sand; and by the time it reaches the tank, it is perfectly clean, and is lifted out by an elevator, consisting of a series of steel buckets having perforated bottoms (to allow of the water draining away), and dropped in a heap alongside the machine—the dirty water overflowing into a catch-tank, and being carried away by hose pipes or into a catch-pit. With one passage through the machine, the sand is delivered thoroughly and uniformly clean, which, as is well known, is not generally the case with hand-washing. Large stones or other refuse that may be with the sand are screened out; and thus the blades are preserved from damage. The screw-shaft bearings are kept perfectly free from grit by small jets of water, under pressure, admitted into them—effectually preventing them from wearing away. Being mounted upon wheels, the machine can be run up to the sand, which it will deal with and discharge either to the right or to the left, until the heap is 8 or 9 feet high, when it can be moved. With the assistance of this appliance, one man is able to wash from $1\frac{1}{2}$ to 2 yards of sand per hour at a cost for labour very considerably less than with the old system of hand-washing. Where a water motor is attached, the power is supplied at practically no cost, seeing that the exhaust water is utilized in the washing of the sand.

A New Lead Paint.—*Le Génie Civil* describes a method of making a lead paint. About 5 litres of cotton-seed oil are placed in a suitable metal vessel, and into this is poured about 10 kilos. of molten lead at a temperature of 335°C . The lead is poured in slowly, a little at a time, and the mixture is kept constantly stirred. When the operation is complete, and the oil has cooled down, it will be found that about $1\frac{1}{2}$ kilos. will have been taken up and held in solution by the oil. The operation is then repeated as often as required; it being found that 5 litres of oil will take up about 5 kilos. of lead after five repetitions of the treatment. The result is a liquid about as thick as varnish, which will adhere very strongly to any materials, more especially to metals, and is a valuable vehicle for protecting iron or steel against rust in sea water.

Liberty and Property Defence League.—This League, which was established about nine years ago, with the object of maintaining freedom of contract, upholding proprietary rights, and resisting Socialistic legislation, has issued its report for the past year. The need of such an organization is shown by the increased number of applications made to its Parliamentary Committee by the Defence Societies of various interests, and by owners of property of all kinds, for co-operation in resisting the legislation by which they are in turn severally assailed. In addition to the delivery of lectures and the holding of public meetings, the League do a great deal of good work by the distribution of pamphlets and leaflets, for which there is a growing demand. In the past twelve months, no less than 105,533 publications were printed and issued. With regard to the League's work in the coming session, the report states that a Bill has been drafted which will have for its object to restore to ratepayers the control over expenditure by municipal corporations in promoting or opposing Bills in Parliament, which was taken from them by section 15 of the Local Government Act of 1888, by which their sanction to such expenditure is dispensed with. The Council of the League is composed of gentlemen well known in political, scientific, and financial circles; and they have the Earl of Wemyss for their Chairman. The Secretary is Mr. W. C. Crofts; and the offices are at 7, Victoria Street, Westminster, S.W.

REGISTER OF PATENTS.

Production of Coke.—Jones, F. J., of Bradford. No. 19,501; Nov. 29, 1890. [8d.]

This invention relates to improvements in the process of making coke described in patent No. 11,920 of 1889. In the process then explained, the coking of the coal is effected by the passage transversely, through a thin vertical stratum of coal, of the hot gases resulting from the combustion of producer gas generated in a separate gas-producer furnace. The coke so produced is, however, liable to be contaminated by the volatilizable impurities—particularly the sulphur—contained in the fuel consumed in the furnace, while the gases resulting from the coking operation are virtually wasted.

The present improvement, therefore, is designed both to avoid this contamination with sulphur and to utilize the gases resulting from the coking operation. With this object the gases given off are first purified, and then reheated; and in this condition are used for the purpose of continuing the coking operation, either on the same or a different charge, and simultaneously sweeping out the impurities contained in the charge. By purifying the gases and using them in this way, it is claimed that a much purer coke will be produced than when crude gases from the producer furnace are employed, and the ammonia, sulphur, and other valuable bye-products may be recovered. As the gases given off in the operation of coking a charge are more than sufficient to enable the operation to be repeated on another charge, the producer gases need only be used for coking at starting—that is to say, for the purpose of coking the charge in the first oven (or first pair of ovens) of a series. The coking of the charges in the succeeding ovens of the series is effected by the gases (purified and reheated) coming from the ovens already at work, and so on; the timing of the heats and of the intermediate operations being so arranged as to make the cycle of operations continuous through the whole series of ovens. The principal use of the producer in all the coking operations after the first is, therefore, to reheat the gases after purification and prior to their re-use for repeating the coking operation; the gases used being theoretically everlasting, and simply alternating in composition from carbon dioxide to a rich gas consisting largely of carbonic oxide, and back again to a gas consisting of carbon dioxide, and so on. In each complete cycle, the carbon dioxide made in the combustion chamber becomes changed in passing through the hot coking mass; the gases becoming highly charged with tarry vapours, ammonia, and other gaseous constituents. The reheating of the gases might, therefore, be effected without admixture with the producer gases, which would in that case only be passed through the first charge of coal. But in practice it is preferred that the gases after purification should be reheated by being mixed with the gases from the gas-producer; and to avoid contamination of the gases with impurities contained in the fuel, the producer is fed with the breeze resulting from a previous charge, which, having been coked by this process, will be pure.

The apparatus for this process consists of any number of pairs of ovens; each pair being situated between a combustion chamber on the one side and a gas-collecting chamber on the other. The chambers are common to the two ovens of a pair, which communicate with them by orifices in the division-walls. Each combustion chamber is preferably placed between two pairs of ovens, and is common to both pairs. Each oven is a long narrow upright chamber of approximately equal length and height, but of a breadth of only about one-tenth the height; the roof and floor being inclined at a pitch of (say) about 35° . The most important dimension is the breadth, which is governed by the permeability of the mass by the gases of combustion; this being in turn dependent on the kind of coal and size of the pieces. The inventor finds that 14 inches is a good working dimension for the average breadth of the oven for coking "smudge" or "duff," or 18 inches for coking rough slack. The sides of the oven should not, however, be quite parallel, but slightly wider apart at the front of the oven, to facilitate drawing the charge. The orifices in the walls are of such size that they will not be choked by the coal, and may be made either by using perforated fire-clay lumps, or by leaving open (to the extent of about $\frac{1}{4}$ inch) all the vertical joints of the brickwork of the side-walls from the floor up to the shoulder, above which the brickwork is solid; these perforated walls being prevented from bulging by headers or cross-ties of fire-brick crossing the chambers, and binding their opposite

walls together. The opposite side-walls of the ovens being thus perforated over practically the whole area of the charge, the products of combustion in passing to the gas-collecting chamber will cross the ovens, and be uniformly distributed through the whole mass of coal contained therein, and be caused to traverse in the direction of its least thickness.

The ovens of each pair are set back to back, or with their higher and narrower ends together; and each pair has a charging-mouth, closed by a cover, and common to the two ovens. The cross-division wall between the inner ends of the ovens is only high enough to separate the masses of coke, without interfering with the free charging of both ovens from the one mouth. In order to enable the coke to be discharged *en bloc*, and with little waste of labour, each oven floor is inclined downwards towards the front end, where is situated the discharging aperture, extending the full width and height of the oven, and closed by sand-luted doors. The downward inclination of the floor is continued outside the oven, to enable the mass of coke to be slid out with little or no breakage. The perforated side-walls of the ovens (especially when a shrinking coal is intended to be used) have each a ledge or shoulder about 2 inches in width, inclined at a slightly greater pitch than the floor, and situated at such a height that a sufficiency of the charge (which fills the oven nearly to the roof) will rest on the shoulders, and seal the passage left by the contraction in bulk of the coal in coking. This prevents the gases of combustion from passing round, instead of through, the charge towards the end of the coking operation. In order to ensure adequate heating of the lower part of the charge, the space beneath the floor (which is of fire-brick) may communicate with the lower part of the combustion chamber by orifices. The gas-producer furnace communicates with the several combustion chambers by a flue (provided with valves) of fire-brick, for controlling the passage of the furnace gases to the combustion chambers. The furnace also has air-heating flues, through which the air supplied to the combustion chambers passes.

Igniting and Starting Arrangements of Gas-Engines.—Lanchester, F. W., of Bedford Row, Holborn, London. No. 19,513; Dec. 1, 1890. [8d.]

This invention, relating to the igniting and starting arrangements of gas-engines, is applicable to incandescent tube or incandescent metallic surface igniters; and one object is to dispense with continuous external heating for such igniters, and to cause the temperature of the ports and passages leading to the tubes to be more uniform under variation of load. Another part of the invention refers to an arrangement for igniting the charge and starting gas-engines such as are described in patent No. 19,868 of 1889.

In carrying the first part of the invention into effect, communication is made between the explosion space and a small chamber by a tube controlled by any suitable valve; and opposite the end of the tube which passes into, or projects into, this chamber is arranged a plate of platinum, or other suitable material, to be first heated to incandescence by a flame. When the engine is at work, a portion of combustible mixture is allowed to pass through the tube at every compression stroke; and the current entering the chamber impinges against the incandescent metal, and becomes ignited. The flame so produced further heats the already incandescent metal, and keeps it at a temperature suitable for ignition, without requiring any application of an external flame. The bore of the tube (or a portion of it) is so proportioned that, when the chamber is being filled with gases from the cylinder, the velocity of flow is sufficient to prevent the flame passing back to the cylinder; but when the chamber fills sufficiently to reduce this velocity to a certain rate, the flame at once passes back to the engine cylinder, and explodes the mixture contained therein.

In order to keep up a supply of sufficient combustible mixture or flame to maintain the metal or other surface incandescent, the engine is governed by preventing the flame passing back to the cylinder, and alternately expanding and compressing the mixture in the cylinder without exploding it—allowing, however, a sufficient portion of inflammable mixture to impinge against the hot surface to keep it incandescent. With this object, the governor acts on a valve, which so closes or reduces the passage between the cylinder and the chamber that, although the mixture fires in the small chamber and so heats the surfaces, yet the flame which is the result of the ignition cannot pass into the cylinder.

In starting a compression gas-engine with positively actuated valves, or with an automatic or other gas and air inlet-valve, in accordance with the second part of this invention, a passage is provided between the compression space near the inlet-valve and a port nearer the forward extreme of the piston stroke. The port is covered by the piston when it is full in; and as the piston moves out to take in a charge of gas and air, a second passage (leading back to the air and gas inlet-port, from one end of the front port) allows a portion of the gas and air drawn into the engine to pass into the port, and fill the passage leading to the compression space. The second passage is controlled by a check or flap valve, opening into the front port with but slight resistance. Another flap or check valve opens from the atmosphere into the front port, but is loaded by a weight or spring sufficiently to keep it shut with the amount of "suction" which opens the first-mentioned check-valve. This second check-valve has a flame playing against it or near it from the atmosphere.

The arrangement acts as follows: When the piston moves from the in-end of its stroke to take in a charge of gas and air, the mixture passes into the cylinder by the first and second passages through the front port as well as by the main inlet-valve. The "suck," however, is at first insufficient to open the second or external flap-valve; but when the piston has moved sufficiently to uncover the front port, then, as it enters directly to the cylinder, the "suction" increases very much, and the outer valve opens so that the flame is introduced and ignites the mixture in the cylinder. This gives the piston an impulse at low pressure; and the low-pressure impulse is repeated at every revolution till the engine has attained its speed. Then the igniting-starting arrangement is shut off by a suitable cock or valve; and the ordinary compression ignitions proceed.

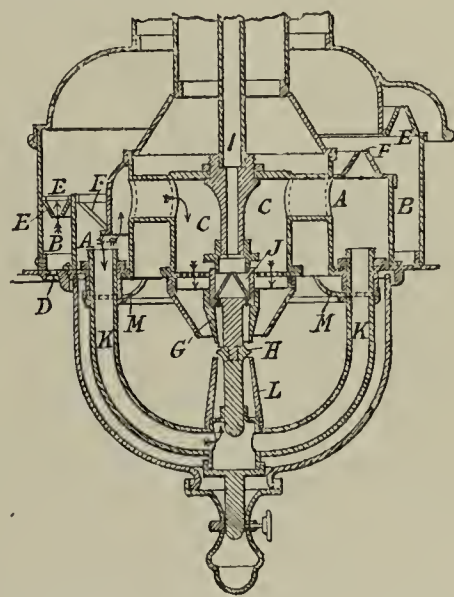
Igniting and Starting Gear for Gas-Engines.—Lanchester, F. W., of Bedford Row, Holborn, London. No. 19,846; Dec. 5, 1890. [8d.]

This invention relates to igniting-starting gear for gas-engines utilizing that type of gear in which the ignition is accomplished by the passing back of a flame when the speed of efflux of the inflammable mixture is reduced sufficiently, as described in patent No. 5479 of 1890. The present invention is intended to apply this type of igniter in starting gas-engines at a greater or less degree of compression; and the various devices described are designed to allow the communication of a flame to the explosion space from an external flame against compression.

In one mode of carrying the invention into effect, the starter nozzle connects to the compression space or cylinder by a tube, which opens to a small chamber. An annular or other passage also connects to the compression space, and communicates with the lower side of an automatic valve. When the engine is to be started, the automatic valve is allowed to be thrust down by a spring or by its own weight; and an external flame plays into the open space above it. A passage permits the flame to come into contact with the gases proceeding from the nozzle; and when they become explosive, the gases ignite and burn within the small chamber at the nozzle. When the current ceases, the flame at once passes back; and the first explosion takes place. This closes the valve, and the engine-shaft revolves; the piston discharging the burned gases, and taking in a fresh charge as before. The exhaust-valve, however, closes before the end of the compression stroke; and the rising pressure in the cylinder at once shuts the valve. The flame from the nozzle continues to burn in the small chamber until the pressure rises to that in the cylinder (or nearly so); and when the velocity of efflux becomes sufficiently reduced, the flame passes back, and the mixture in the cylinder explodes. The proportions of the nozzle and chamber are so arranged that the explosion occurs at or near the end of the stroke. In this manner a series of explosions are obtained under compression; giving more power than those obtained without compression. The valve opening to the nozzle in the small chamber opens when the pressure in the cylinder falls nearly to that of the atmosphere by the spring or its own weight, or by an added weight; and an ignition at every second revolution is given. A pilot-jet is adopted to re-light the main external flame as it is blown out at each explosion. The valve is supplied with a channel or gutter to cause a leakage through it to be supplied from the annular or other passage instead of from the small chamber; so that the back-firing action of the nozzle need not be interfered with in the event of the valve leaking.

Regenerative Gas-Lamps.—Thomas, T. C. J., of Finsbury Park. No. 21,300; Dec. 31, 1890. [8d.]

This invention in regenerative gas-lamps has for its object to render such lamps practically wind-proof. For this purpose the lamp is constructed with inner and outer air chambers arranged outside the ordinary regenerator, and each is provided with an annular air passage, or with an annular row of air passages of gradually increasing cross sectional area as they extend inward, and through which air flows on its way to the flame; the air inlet or inlets to the outer chamber being protected by a wind-guard. The passages are formed of sheet metal arranged to act as baffle-plates.



A and B are concentric inner and outer annular air chambers surrounding the air regenerator C. The outer chamber is furnished with air-inlet openings D, as shown at the left-hand side, formed in a plate that constitutes the bottom of this chamber, and carries a shade, reflector, or cover that protects the lamp bowl from rain, and also serves as a wind-guard to shield the inlet openings. E are two downwardly inclined annular plates, so arranged as to leave an annular space between them of gradually increasing width from bottom to top. The inlet to the inner chamber may be formed by an annular plate F carried by a cover, and inclined to the outer wall of this chamber, so as to leave an annular space between itself and this wall of gradually increasing cross sectional area from top to bottom.

A wind-proof lamp constructed as explained may, says the patentee, be advantageously provided with an inverted burner of the kind described in patent No. 3130 of 1890. The burner comprises a tube G, with perforated transverse diaphragm, carrying a stem with a deflector H. It is secured to a perforated plate, which forms the top of an air-heater, and to the lower end of the gas-supply pipe. Within the gas-chamber J of the burner is arranged a hollow truncated cone, which serves to separate dust from the entering gas, and allow the gas to expand and flow uniformly through the perforated diaphragm. The lamp may also be provided with one or more air-tubes K (two are shown), for conducting air from the air chamber A to a central air-tube L that surrounds an extension of the stem. From this tube air will issue in an annular stream below the flame, the shape of which will consequently be determined by the joint action of the air upon its upper and lower sides. Holes are provided in the burner-plate and in the reflector M.

so as to admit air to the inner side of the lamp bowl. The lamp head may be of any suitable form.

Gas Motor Engines.—Williams, H., of Stockport. No. 970; Jan. 20, 1891. [8d.]

This invention relates to improvements in the structural arrangements of gas motor and other similar engines "for the more effective and economical working of the same." In gas motor engines of the compression type, as at present constructed, says the patentee, a considerable proportion of power is lost owing to the high tension of the ignited gases within the cylinder at the termination of the effective stroke of the piston; and the object of the present invention is to avoid this loss, and utilize as far as possible all the expanded gases for useful work by furthering their expansion behind the pistons to the utmost limit.

In one arrangement, the power cylinder is bored of two different diameters; and there is fitted therein a piston of two diameters to correspond. The combustion chamber of the smaller cylinder is connected by a suitable passage controlled by a valve to the inner end of the larger cylinder; and the inlet passage to the combustion chamber for the explosive fluid mixture is also controlled by a suitable valve—both valves (the admission-valve and the valve controlling the passage between the two cylinders) being opened and closed by connections from eccentrics on the crank-shaft, or in any other convenient manner. There are also suitable means for igniting the charge of explosive fluid mixture, and for exhausting the products of combustion at the proper time.

For convenience of description, the patentee supposes a charge of combustible mixture has been admitted and compressed within the smaller or initial power cylinder (No. 1); and that the charge in the larger or supplementary cylinder (No. 2) is also in a similar state of tension, either through the presence of air or the products of a previous combustion. At this stage—the pistons of both cylinders being at about the extent of their instroke—communication is made between the two cylinders; and the combustible charge within the initial cylinder is ignited. The gases are thus caused to expand simultaneously within the two cylinders, and propel their respective pistons on their outward or effective stroke up to a point when the expansion of the gases shall have ceased, and a tendency to a vacuum commenced. The first passage of communication between the two cylinders is then closed; and another passage of communication is formed between them by the uncovering of a port in the initial cylinder by its piston. Owing to the superior capacity of the supplementary cylinder, the products of combustion from the initial cylinder are drawn into it through the last-named passage of communication, so as to create a partial vacuum in the initial cylinder, which is filled by a new charge of combustible mixture during the remaining part of the outstroke of the pistons.

On the commencement of the instroke of the pistons, the admission-valve for the combustible mixtures is closed, and an exhaust-valve communicating with the supplementary cylinder is opened. Its piston on the instroke is thus made to expel the products of combustion up to a point where it is desirable to compress a portion of the products to form an equilibrium of pressure between the two cylinders; and at the same time the piston of the initial cylinder is compressing the charge of combustible mixture which it contains. Then, upon completion of the instroke of both pistons, the compression is complete, and communication between the two cylinders is made; the charge within the initial cylinder being ignited, and the cycle of operations repeated as before.

As an alternative arrangement, applicable to gas motor engines having an impulse at every alternate revolution of the crank—such as in the "Otto" type—the cylinders are arranged as previously described; but the cycle of operations is altered. Assuming, for convenience of description, that the initial cylinder is charged with combustible mixture, compressed by the instroke of the piston, the supplementary cylinder will at the same stage have a charge of air or other inert gas at similar tension. As before explained, a communication is made between the two cylinders; and the combustible charge within the initial cylinder is ignited—the gases expanding simultaneously within the two cylinders, so as to propel the two pistons to the full extent of their outward stroke. The pistons then return simultaneously on their inward stroke, and expel the products of combustion contained in their respective cylinders through one common exhaust-valve. On the next outstroke of the two pistons, the exhaust-valve is closed, and a valve admitting a combustible mixture is opened to the initial cylinder; while a valve admitting either air or other inert gas is opened to the supplementary cylinder. The pistons on their next outstroke will draw into their respective cylinders—i.e., the initial cylinder, a combustible charge, and the supplementary cylinder, a charge of air or inert gas. On their next instroke, the two pistons will compress the charges within their respective cylinders up to the full extent of this stroke, when the connection between the two cylinders is again made. The combustible charge in the initial cylinder is then again ignited; and the cycle of operations is repeated as already described.

Withdrawing the Surplus Water from Reservoirs.—Thompson, C., of Baildon, Yorks. No. 1464; Jan. 27, 1891. [8d.]

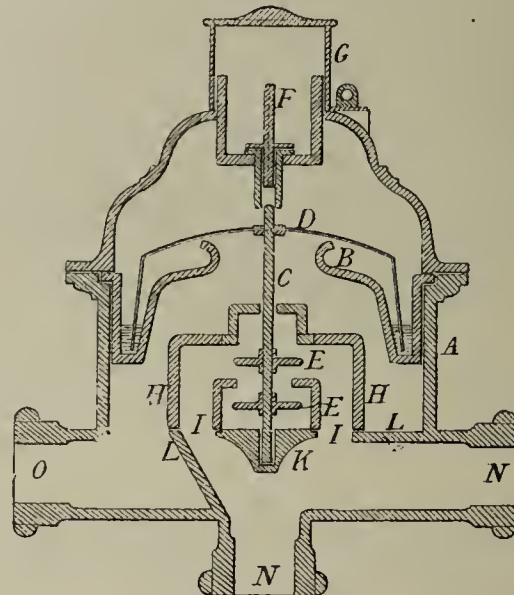
This invention relates to improved appliances for withdrawing the surplus or "overflow" water from reservoirs and other water storage works in such a manner that the water which has been longest in the reservoir (and is consequently more likely to be impure), and water in which there is more or less sediment, is first drawn off, when there is a supply greater than the demand; and the water being drawn from the bottom of the reservoir, instead of the top as heretofore, tends to keep the bottom of the reservoir clean and free from sediment.

The patentee proposes to employ outlet or overflow pipes, or a conduit built somewhat similar to an inverted U. One end of the pipe or conduit is bent along the bottom of the reservoir, and is open for the passage of water; while the other end is connected with the overflow-pipe. At or near the apex of the conduit, the latter is open, and formed with one of the edges overlapping the other. The action is as follows: Water passing into the inlet end of the overflow conduit will

necessarily ascend the pipe or conduit to the same level as the surrounding water; and when it rises above the apex of the U, the water will commence flowing down the other side to the outlet; and it will so continue until the level of the water falls. The opening at the top of the conduit will prevent the U acting as a syphon, and also allow more water to pass down the U and to the outlet, in the event of water coming into the reservoir in greater quantity than can flow through the inlet end of the overflow conduit. The pipe supplying the main outlet is placed in the usual position.

Gas-Controllers.—Brownhill, E., of Hornsey. No. 2423; Feb. 10, 1891. [6d.]

The object of this invention of improvements in gas-controllers, which are actuated by an inverted cup sealed in mercury or other liquid, is to obtain "steadiness in the action of the float, and also a double-way for the inlet of gas to the valves, combined with greater simplicity of construction."



In the sectional elevation shown of a gas-controller, A is the outer casing or body, preferably made of cast iron; B is the trough containing mercury or other liquid; and C is the spindle, on which is fixed the float D and the equilibrium valve E. F is the spindle to carry regulating weights if required. G is a brass cap for protecting the weight spindle; and H is the valve-box, with double inlet I. K is the guide-plate, which fits into a hole bored in the platform L. M is an aperture for the guide-plate. N are inlets for uncontrolled gas from the main. O is the outlet for controlled gas.

It will be seen that the gas in its passage to the valve is not throttled; the passage being greater than the capacity of the main pipe. Thus, when the pressure of gas falls below that at which the controller is set, the flow will not in any way be impeded in its passage to the burners, &c. It will also be seen that the guide-plate K and the opening in it, being both turned to one gauge (the centre of the opening coinciding with the centre of the outer casing), will ensure the valve-box being fitted in a central position without any difficulty.

APPLICATIONS FOR LETTERS PATENT.

21,868.—BARTLETT, G. H., "Ignition device for gas, petroleum, and similar engines." Dec. 14.

21,881.—FAIRWEATHER, W., "Manufacture of gas." A communication from the Acme Liquid Fuel Company. Dec. 15.

21,955.—GIELIS, H., "Charging inclined retorts." Dec. 15.

21,993.—RODERICK, R., "Taps or cocks for liquids, steam, air, and gas, and jointed or folding pipes for conveying liquids, steam, air, and gas." Dec. 16.

22,071.—ROCK, T. D., "Gas-heated forges." Dec. 17.

22,236.—TAYLOR, G. H., and LOWE, W. O. A., "Gas-fired steam generator." Dec. 19.

Messrs. D. Hulett and Co., Limited, were entrusted, at short notice, with the contract to provide all the iron brackets and lamps used for lighting the streets of "Modern Venice" at Olympia. They number upwards of a hundred; and they were delivered and fixed in less than a fortnight.

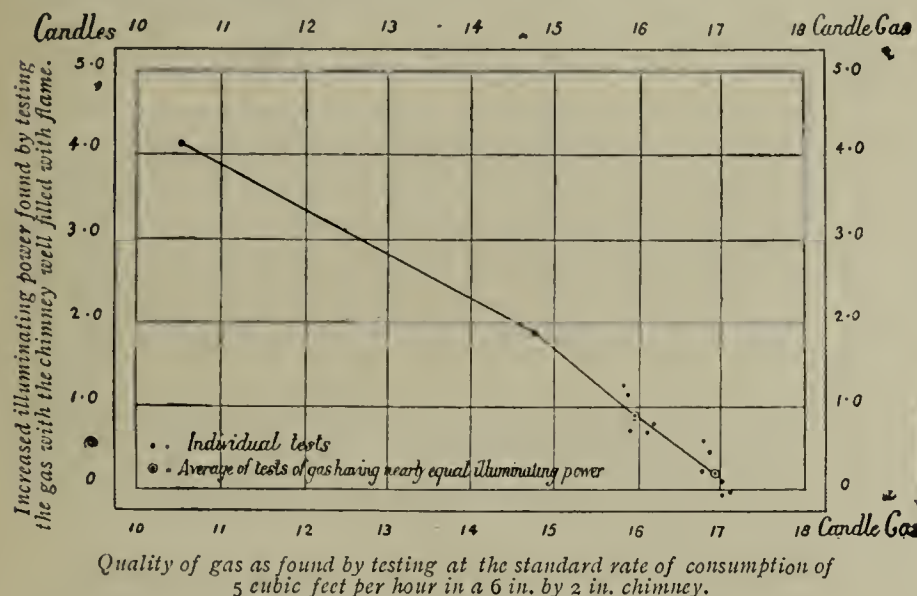
The Reading-Room at the Dover Gas-Works.—A few days ago the employees of the Dover Gas Company had an interesting gathering at the works, to celebrate the fourth anniversary of the establishment of the workmen's reading-room and library. The Company's Manager (Mr. R. Herring), who is President of the library, occupied the chair. The Secretary (Mr. Harman) briefly referred to the business of the past year, and gave a list of gifts received from the Directors, officers, and others. There are now 305 books available for home use by the men. The Chairman expressed his pleasure at the satisfactory statement made by the Secretary; and his appreciation of the kindness of the Chairman of the Company (Mr. W. Mannering), who was present, towards all the employees. After giving some timely advice to the men, he concluded by asking them for their continued assistance; trusting that the good feeling and harmony at present existing would grow stronger year by year. Mr. Mannering, in proposing a vote of thanks to the President, remarked that the movement of which they were celebrating the anniversary originated entirely with Mr. Herring, who was always desirous of promoting the interests and welfare of the men in every possible way. It was gratifying to find that his efforts had been so successful; also that the circulating library in connection with the reading-room enabled the wives and families of the men to share the privileges they enjoyed. He hoped the use of the room would be a continued source of pleasure and profit, not only to themselves but to their successors, who he trusted would continue the good work they had so successfully commenced. The proceedings closed with a musical entertainment, which was thoroughly enjoyed.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

The Proposed Investigation into the Standards of Light.

SIR,—I should like, with your permission, to supplement my letter of last week by the accompanying diagram, with the particulars of the experiments from which it has been constructed. It shows the improvement which results from varying the rate of consumption according to the quality of the gas, so as to obtain the proper amount of air for luminous combustion; in other words, the depreciating effect of adherence to the 5-feet rate.



Gas which has been carburetted with oil may be expected to give somewhat different (although not discordant) results, since the composition of such gas would differ from that produced from coal alone.

Birmingham, Jan. 1, 1892.

CHAS. HUNT.

Tests of Gas from Various Coals Carbonized at a Temperature of about 1700° Fahr.

[The Methven Screen was used as a Standard of Comparison.]

Series A.*	Average.	Series B.†	Observed Increase in Illuminating Power.	Average Increase.
Candles.	Candles.	Candles.	Candles.	Candles.
10.52	—	14.62	4.10	—
14.72	—	16.61	1.89	—
15.82	15.96	17.17	1.35	0.96
15.83		17.04	1.21	
15.84		16.58	0.74	
16.14		16.86	0.72	
16.18		16.98	0.80	
16.72	16.93	16.95	0.23	0.22
16.80		17.34	0.54	
16.88		17.39	0.51	
17.01		17.12	0.11	
17.08		17.05	0.03 (a)	
17.11		17.09	0.02 (a)	

(a) Decrease in illuminating power.

* In this series, the gas was tested with a No. 1 "London" standard Argand burner, with a 6 in. by 2 in. chimney, and at the standard rate of consumption of 5 cubic feet per hour.

† In this series, the same gas was tested with the same burner and chimney, but with the latter well filled with flame; the indicated illuminating power being corrected to the 5-feet rate.

The Gaslight and Coke Company's Assessment Appeals.—On the 23rd ult., an application was made to Sir Peter Edlin, at the Sessions House, Clerkenwell, on behalf of the Vestry of St. Mary Abbots, Kensington, by Mr. Houghton, for leave to add to the evidence already given in connection with the recent assessment appeals of The Gaslight and Coke Company, which were fully reported in the last and the preceding volumes of the JOURNAL. The ground of the application was that the evidence given by Mr. Eve and Mr. Valon for the respondents was based upon an estimate as to the price of gas; and since it was given, the appellants had notified their intention of raising their charges after a certain date. Mr. Littler, Q.C., raised the preliminary objection that, as the case was closed, the application came too late. Sir Peter Edlin asked Mr. Houghton if he wished the Court to re-open the inquiry for the purpose of considering how far the act alluded to ought to influence them in determining the issues joined in the appeal. Mr. Houghton replied that he did not; and that if the application would, in his Lordship's judgment, involve the taking of any oral testimony, or discussion of any kind, he would at once concede that it would be unreasonable to ask the Court to do so. Sir P. Edlin pointed out that the Company's power to raise their price had been put before the Court; so that what was being asked for had not the merit of being something that was unavoidably absent from the inquiry. Mr. Houghton admitted that a certain increase in the price of gas was taken into consideration by the respondents' witnesses; but he said the application was conceived with a view to avoid supplemental lists. His Lordship thought it had been misconceived, and, moreover, presented impossibilities which the Court should bear in mind in a desire to depart from all the recognized rules of procedure, not only in cases of the kind before them, but in litigation generally. The application must be refused; and the Company would be allowed their costs of attendance.

MISCELLANEOUS NEWS.

THE MARKET FOR SULPHATE OF AMMONIA DURING THE PAST YEAR.

As in previous years, we have received from Messrs. Bradbury and Hirsch, of Mason's Buildings, Liverpool, a copy of their "Annual Review of the Market for Sulphate of Ammonia," for notice in our columns. It consists, as before, of some general introductory remarks, and a review of the course of the market month by month; the usual tabulated statistics being given at the end.

Messrs. Bradbury and Hirsch commence by remarking that a retrospect of the year just closed reveals those idiosyncrasies which perhaps no commodity in the field of commerce is more prone to than the one under review. When the position and surroundings are favourable, when prices are attractive—when, in fact, an article in general demand, and absolutely necessary for specific purposes, becomes intrinsically so cheap as to defeat all rivalry, and still the market is depressed, and prices are on the decline—one's judgment is apt to become obscured, because it is no longer possible to deal with the matter upon its merits. But since, in these matter-of-fact days, the office of a reviewer would rapidly become extinct unless he can in some tangible shape satisfy and convince an exacting commercial mind, it becomes a necessity to dive deeply beneath the surface to bring to light these evidently powerful influences, which have wrought such unfavourable conditions. We have been assailed before, and it will, no doubt, be the case again, for our fearlessly and undauntedly exposing illicit practices; but this cannot deter us from unreservedly stating that, after careful and impartial investigation, the present low range of value is found to be almost solely due to speculation—i.e., speculation of the "bear" description.

Passing on to consider in detail the past, present, and future market, the reviewers say: First and foremost comes the question of production—i.e., whether there is an over-production or not; and it is well to sift this matter thoroughly, as it already has been, and certainly will be freely used in argumentation, by those who have an interest in the maintenance of low values. Our own opinion, based upon the figures before us, is that as yet there is no over-production; and the probability of such a feature does not present itself to our minds, as regards the immediate future. An event of this kind in the far distance is not impossible, when the great developments and possibilities of the sources—to which we will especially refer later—are considered; but there is hardly any need to concern ourselves with them at present. It will be seen from our tables that, so far as the gas industry as the principal source of our ammonia supplies is concerned, the progress in the production is slow and steady—quite insufficient to affect the market seriously for years. The average increase during the past ten years has been at the rate of about 4000 tons per annum. The output from carbonizing works does not make great strides, and, with the present low value of all tar products (pitch excepted), is not likely to be much pushed. At other works where it was thought profitable to convert the coal into gas, no progress has been made, since the high price of coal and the low value of sulphate made this process barely remunerative. It is quite a different thing as far as blast-furnaces are concerned, as a general adoption of the means of collecting the gases would become an important factor in the ammonia supply. The advance is not so much marked at home as on the Continent—Germany principally—where the supply from this source certainly tends to affect the market; and we must not forget that Germany has for a long time been our best customer, having absorbed at one time one-third, and is still taking now about one-fifth of our whole production. The result of our observations is that the increase in the production is not significant at the present stage, as pointing to the danger of over-production; and when the production does assume dangerous proportions, the conditions of the market may have changed too, for the uses of ammonia appear to us to be still capable of considerable extension.

Considering next the query: "Can the question of a falling off in the consumption be raised?" the reviewers say: We think not, because the figures, as regards the shipment and the home consumption, do not sufficiently show it; and the figures to-day hardly furnish a reliable barometer. We would, in fact, prefer to consider this question more fully after the coming spring season—say, at the end of April, as we believe the present position somewhat misleading. Attention will no doubt be called to the rather large stocks; but we say that neither at home nor abroad have the usual quantities been bought, so far. As far as Germany is concerned, the small demand during the past three months has been most marked; and the cause is the almost entire cessation of autumn manuring and the petulance of the large dealers and manure manufacturers in view of a falling market. There can be little doubt that, as ammonia is not going out, a strong demand will set in shortly; and as the requirements will be for prompt or near delivery, the speculators will have not so much scope afforded to them in preventing the orders reaching the proper channel—i.e., the makers. Should the demand actually show some falling off in one or two countries, others are sure to take their place—probably more than counterbalancing any deficiency. It seems almost needless to say, at the present time, that the whole world draws supplies from us; and many of the colonies are but in their infant stage of consumption with respect to the use of fertilizers. Let us, however, just for satisfaction's sake, recapitulate the countries to which shipments have been made; and it may tranquillize the mind of some nervous producer. We will take them, as far as possible, according to the magnitude of the supplies they receive: Germany, Belgium, France, Holland, Spain, Italy, West Indies, United States, Russia, Java, Mauritius, Africa, Canary Islands, Denmark, Sweden, New Zealand, Australia, and East Indies. As an instance of rapid development in many countries, we cite Java, which took nearly 4000 tons in 1891, against 200 to 300 tons in 1890. And should not the exceeding cheapness of sulphate—not merely per ton, but intrinsically per unit—furnish an argument, too, for a large increase in the consumption during the coming spring? We need but remember the enhanced consumption of nitrate last spring—a strange fact, after the

already marvellous increase in 1890, and which was principally due, we should say, to the extremely low range of prices. (Nitrate could, at one time, be bought at 7s. 6d. per cwt.) Nor is there any reason why one should not look forward to a similar occurrence as far as sulphate is concerned, if prices remain at anything like the present level. And we must assume that consumers have not gone deeply into the matter, or they would be more eager to secure cheap supplies, while the opportunity remains of buying at the bottom of the market.

Messrs. Bradbury and Hirsch next proceed to briefly compare, as follows, the unit values of the different sources of ammonia, so as to place the full facts before their clients:—

	Per Unit.
Sulphate of ammonia (24½ p. ct.).	8s. 1½d.
Nitrate of soda (95 p. ct.)	9 6
Dried blood	9s. 6d. to 10 0
Horn meal, ground hoofs, &c	9s. 3d. to 9 6
Peruvian guano	10 0

For their further guidance, they also give the annual averages per unit during the previous ten years—*i.e.*, sulphate compared with nitrate alone. The average over the period taken is: Nitrate, 10s. 8d.; sulphate, 11s. 6d. The statement shows the present position to be quite unique. In six years out of the ten, more was paid per unit of ammonia in sulphate than in nitrate; in two, the values were about equal. In the two years of great depression, 1885-6, however, the unit in sulphate was cheaper, though not by any means to such an extent as now. But the authors point out that, although in December, 1885, the prices were almost as low as at present, they advanced to £13 in the following March, and were maintained above £12 to the end of April; while in December, 1886, the figures were below £11 as well, but they reached £12 in January, and £12 10s. in March, 1887. It would therefore pass comprehension, they say, if the full weight of the spring requirements should not fall upon sulphate, and bring about a quick change in the position. Nothing disparaging can be said against its use; and they have frequently shown in their reports that there is much in favour of it.

Referring next to the great success of nitrate of soda in the past, Messrs. Bradbury and Hirsch say it is due to its many friends, while sulphate of ammonia had but few, and those either powerless or lacking energy. But it has never been conclusively proved that nitrate holds the sceptre of superiority. It holds the sway in so far as, quantitatively, it cannot be done without; but the reviewers once more point to the fact that the production of the two commodities is out of all proportion. That of sulphate is necessarily limited; that of nitrate practically unlimited. The producing power of the combined nitrate companies per month is equal to that of Great Britain's production of sulphate per annum; and for this reason alone, to draw comparisons in respect to the movement of figures would, they urge, be illogical. Moreover, if ever one ought to be convinced that a simple rule-of-three sum, as far as these two fertilizers are concerned, is out of place, it should be through the events of last year; and the past has nearly always shown that both high prices and low ones of nitrate are misleading for the guidance of the operator in sulphate. The difference between the market prices has usually been from £2 to £3 per ton; and it is a fact worthy of note that to-day it is not even £1 per ton.

Messrs. Bradbury and Hirsch next give a few details to follow out the course they have usually taken in their arguments: At the beginning of 1891, we find sulphate at £10 12s. 6d. per ton; nitrate at 7s. 6d. to 7s. 9d. per cwt. In March, we find nitrate advanced nearly £2 per ton (to 9s. 6d. per cwt.); while sulphate had only improved 15s. (£11 7s. 6d.). In May, nitrate had lost nearly £1 of the advance (8s. 7½d.); while sulphate still remained at £11. But although nitrate maintained the same value until the end of July, sulphate had meanwhile declined to £10 12s. 6d., which was the same figure as that quoted at the beginning of the year; nitrate being £1 per ton dearer. From the end of August to the early part of December, nitrate gradually advanced until 9s. 3d. per cwt. was reached; while sulphate by slow degrees fell to £10 2s. 6d. Thus, while sulphate at the end of the year is 10s. per ton lower than at the beginning, nitrate, when comparing the two periods, shows an advance of £1 10s. to £1 15s. per ton, or a practical advantage for nitrate of about £2 per ton. We find, accordingly, that at the beginning of the year sulphate was £3 per ton dearer than nitrate, and at present, as already mentioned, is less than £1 per ton. This adds weight to the fact that sulphate is unprecedentedly cheap; and it has rarely compared so favourably with other fertilizers. To imaginings, or unwarranted predictions, that as yet the lowest point has not been touched, one cannot attach much importance, as no reasons are given for such statements; and they are generally wilful and wanton representations, emanating from selfish motives. Let us but call to mind how nitrate was talked down at this time last year; and the wisecracks would have it that it would come to 7s. per cwt. But we all know the change in the kaleidoscope before the end of February, when, instead of 7s., we had to face a price of 8s. 6d., and 9s. 6d. in March. Certainly, violent causes brought about the change in nitrate; but the unforeseen will happen, in spite of all forecasts, and a less turbulent element will suffice to bring sulphate on a different basis. The cheapness of sulphate must assert itself during the coming season; and if some advantages must be conceded to nitrate, especially during dry seasons, and for its quick and stimulating action, sulphate answers as well in most cases, if used early enough, and certainly shows better results during wet seasons. Should the, so far, open winter continue, and the season be an early one, there is certain to be a large demand for sulphate, especially as nitrate will not be superabundant in the early part of the year, as, based upon the consumption of last spring, there will only be just about enough of it. In previous years the shipments have been largely in excess of the consumption. Partly through the war, and partly through the efforts of the combination among the producers, a more equal state of things has been brought about. It is necessary to keep nitrate before our eyes, as the weight of such a large quantity of nitrogenous material must always be of influence upon the markets generally; and it should not be forgotten that the producing power of this commodity is nearly double that of the present consumption. It is easy, therefore, to recover lost ground, and make up deficiencies in this commodity—quite

contrary to what would be the case if, for some reason, there should be a falling off in the ammonia supply. We think our remarks above sufficiently indicate that as yet the production and consumption of ammonia go hand in hand; and, so far as can be seen, no disturbing element will appear in the near future to seriously upset this balance. In the routine of things commercial, minor influences will always cause oscillations in a market one way or the other; and as a bright, open winter will check the supplies from the gas-works, so will frosty weather, prolonged into spring, coupled with floods and famine, hamper the consumption. However, while disposed to let the consumption take care of itself, we cannot ignore the attempts constantly made to increase the ammonia supply, though in many cases it is impossible from a pecuniary point of view; in others, it is purely chimerical. To the former belongs the carbonization of all coal, and the adoption of gaseous fuel universally; to the latter, the conversion of atmospheric nitrogen.

After referring to the interesting process suggested by MM. Bauduin and Escarpit for producing ammonia from nitrate of soda by means of a hydrocarbon such as naphthalene, and to the ammonia engine invented by Messrs. Campbell as a possible means of increasing the consumption of ammonia, passing allusion is made to the electric light, which, although regarded at one time as a possible serious factor in reducing the production of ammonia from gas-works, seems, the authors remark to affect it but little, inasmuch as its competition has not at all reduced the use of gas. In fact, the desire for more light which its introduction has stimulated, appears to have had a beneficial effect upon the gas industry. With regard to the immediate future, they consider the facts to be that producers will not sell forward prices being at such a low ebb. This, however, will not deter speculators from taking orders of those who are willing to buy. A severe battle for supremacy between these factors may therefore be expected very early in the year upon which we have just entered.

The review of the market month by month is next given, as follows:—

JANUARY.—Although the market opened somewhat dull, great activity prevailed as the month progressed. Considerable inquiries came in from France, Germany, and Spain; and we find at the close of the month an advance of fully 5s. per ton established. There was even some anxiety, when the frost broke up, to secure suitable parcels; and the speculators, especially those who had to complete engagements previously entered into, dropped all reserve, and were the foremost of the buyers. Among the Continental purchasers, many came to a halt towards the close of the month, as the enhanced values did not quite suit them. Others, however, took more hopeful views; and there was some buying for February delivery at the extreme figures. As far as the actual transactions were concerned, the following were the prices realized: £10 10s. and £10 12s. 6d. at the beginning; £10 15s. to £10 17s. 6d. during the closing week. Nitrate had nothing to do with the advance, although it might have been thought so, on account of the reports of a final arrangement among all producers to reduce the output. But sulphate was actually a trifle easier, while nitrate advanced a little during the first fortnight; and when this became weaker, sulphate took an upward turn.

FEBRUARY.—The position early in the month continued firm, although attempts were not wanting to weaken the market. A large business was doing; both dealers and consumers participating in the buying operations. Germany alone seemed to abstain—doubtless in consequence of the higher prices on this side, which were contrary to the anticipations of the consumers in that country. During the second half of the month, the market became somewhat unsettled—the dealers attempting to force prices to a lower level. But, notwithstanding this, the market fairly held its own; and quotations were little affected. The transactions during the last days were small. The quotations, which were £10 17s. 6d. at the beginning of the month, were the same at the end; but, meanwhile, £11 had been touched. It will be seen that, on the whole, the hopes of rapid improvement, to which the position in January led up, were not fulfilled; yet there was not much room for complaint. It was thought that, when the weather on the Continent moderated, a good business, especially as far as Germany was concerned, would eventuate; and makers consequently remained stiff in their ideas. Stocks were meanwhile being reduced. Nitrate was very quiet in the early part of the month, no doubt on account of the extremely heavy arrivals off coast (80,000 tons during a fortnight); but at the end of the month, it had advanced quite 10s. per ton.

MARCH.—The course of events during this month must, on the whole, have proved satisfactory to producers; and, on these grounds, the reverse of satisfactory to dealers and speculators, as well as to those consumers who had been too tardy in covering their requirements. The market, instead of falling away, as it was prophesied, soon showed symptoms of hardening; and in this firmer feeling the strong tone of nitrate certainly assisted. It advancing so rapidly—nearly £1 per ton—and reducing the difference between it and sulphate so markedly, naturally drew the attention of consumers to the comparatively cheaper commodity (sulphate); and the consequence was that they, especially those at home, vied with the speculators in picking up available spot parcels, as well as any forward contracts which could be obtained at moderate figures. Nitrate secured its advantages, as so frequently occurs in these markets, owing to unforeseen circumstances—*i.e.*, through the delayed arrival of cargoes in consequence of a spell of easterly winds; through the disturbances in Chili making future supplies a matter of some uncertainty, which in turn caused increased firmness among holders of stocks, in which they were justified also by the sharp demand that set in when consumers found they had missed favourable opportunities. Something of this kind happened in sulphate as well; and when buyers came to consider that nitrate had advanced about £1 10s. per ton since the beginning of February, while sulphate had hardly moved at all, it was not surprising that there was some anxiety to secure the necessary sulphate. If sulphate did not move up to the fullest extent warranted by the circumstances named, it was entirely due to the opposition formed by the dealers, who were considerably short of parcels wherewith to fulfil their engagements. Still, £11 10s. was touched; and the lower quotations given out towards the close of the month referred almost entirely to the dealings in second-hand parcels, in which business there was, of

course, a purpose. The figures at the beginning of the month were at £10 17s. 6d.; and by slow degrees the quotations advanced. The home demand was exceptionally good; while America was buying steadily, and France and Spain sent good orders as well. Even Germany was at last making a move, though hardly with good grace; having missed all favourable opportunities for buying.

APRIL.—The extremely dull condition of the market during April could only be ascribed to the very backward state of the season; the persistent cold and dry weather making the farmer indifferent about spending his money (of which he has no superfluity) in manures which would have no effect upon the crops sown until moist or more genial atmospheric influences supervened. This state of things assisted speculators and dealers in being able to defer deliveries on contracts entered into, while it was also conducive to re-sales by those who had secured supplies in anticipation of an early season. A dry season, too, gave nitrate an advantage over sulphate; and it became evident that the deliveries of the former were heavier even than in the previous year. Causes like these, necessarily militating in the first instance against a brisk sale of sulphate, must eventually affect values. This, unfortunately, was the case during April, though not to any such extent as to warrant a feeling of depression. Prices certainly became easier during the early part of the month, and a similar feeling prevailed at the end; but it was noticed that, during a brief time (about the middle of the month), when speculators had to complete urgent deliveries, the market at once changed its aspect, and took a slightly upward turn. This showed both that the dealers held no stocks, and that the available sulphate was none too plentiful. During the closing week of the month, there was rather more inquiry; and as the shipments continued on a very fair scale, we argued that there need be little fear of a further reduction in the prices. It was claimed by those who had an interest in the prophecy, that they were justified in asserting that values would fall below £11 in May. It was in this month that foreign consumers first gave indications of their willingness to contract for long periods ahead. But little of this kind of business was passing, because makers would not enter into contracts; and even speculators hesitated in view of the uncertain future. As regards the prices realized during the month, they alternated, according to the requirements, from £11 5s. to £11 2s. 6d.; they being barely steady at the latter figure at the end of the month. Nitrate, too, was rather easier.

MAY.—The market was by no means active; but, at any rate, the prognostication of a decline to below £11 was not fulfilled. A steady business was passing—quite sufficient to maintain values. It requires no great effort at this season of the year to keep the market steady—the production being so small; for otherwise the most unseasonable weather would have had a very serious effect. The agricultural trade was a poor one; and the season altogether unsatisfactory. It could then be foreseen that, unless more life was infused into the market during the summer, an improvement in values could not take place. There were some inquiries for summer and autumn delivery; but sellers did not seem inclined to move much. Nitrate, although the small rainfall indicated its use in preference to sulphate, nevertheless shared the fate of the latter. The trade was extremely slow; and prices remained at a much lower level than was anticipated. In sulphate, quotations never exceeded £11 1s. 3d., nor were they less than £11; showing the fluctuations to have been extremely small.

JUNE.—The depressed condition of the market during June was due to an almost unprecedented absence of demand, coupled with the unfortunate fact that the orders of the few buyers willing to operate were taken early in the month for speculative account below the then existing values. It was difficult to account for the stagnation of business; and it occurred probably in sympathy with the dullness of trade in other departments. But the Colonial business, which is usually brisk at this time of the year, was very slack; while the demand for America suddenly ceased, and the shipments to Java, hitherto on a large scale, came to an end—the season being over. The production being at this season at a low ebb, there is generally not much pressure to sell; and prices do not fluctuate much. Very often indeed the market at this season is firm, owing to small supplies. In this instance, however, the dealers, from whom all the demand emanated, held full sway over the market; and they only paid respectable prices under pressure—*i.e.*, when they were forced to complete contracts. As many makers like to clear their stores before the end of the half year, buyers scored a little by being able to secure such parcels at the lower prices; and other producers, a little scared by the aspect of the market, decided to accept the lower rates as well, rather than carry their stocks over. In this way prices came down about 7s. 6d. per ton—not a startling decline, perhaps, but still a sufficiently serious infliction at the already existing low figures. The actual figures were: £11 at the beginning, £10 17s. 6d. to £10 15s. about the middle, and £10 12s. 6d. at the close. Nitrate prices had not fallen since the beginning of May; nor were there any signs of a decline, notwithstanding the fact that the visible supply at date was, after all, equal to that of the previous year.

JULY.—The sluggish state of business, which was such a prominent feature of the market during June, remained unchanged during the greater part of July. It was not that there was an absence of demand, for there were buyers for every parcel offered, but that the requirements emanated from a quarter where the interest in the movement of the values lies in an opposite direction to that desired by the manufacturer. Admittedly, the buying of the dealers was not for a rise; and the shipments indicated that somehow orders had been taken by them which were but very gradually reaching the market. It was only towards the end of the month, and when the low sales of the rather plentiful supplies of the Leith market had ceased, that greater steadiness became perceptible, with a simultaneous slight hardening of prices. Taking the lowest figure accepted as £10 10s. f.o.b. Leith, there was eventually an improvement of at least 2s. 6d. per ton; and the same may be said of the Hull market, where quotations were made early in the month at £10 10s. to £10 12s. 6d.—£10 15s. being the lowest value there at the close. The Liverpool market had been irregular; and while ordinary quality was offered as low as £10 10s., high-class parcels brought 5s. to 7s. 6d. per ton more. Better values were, however, finally obtainable; and spot ordinary parcels were quoted at £10 12s. 6d. to £10 15s. again.

The generally strong demand during the last days of the month seemed to augur well for prices in August; and it was an equally satisfactory feature that Continental consumers were beginning to compete for near parcels—thus weakening the influence of the dealers in their endeavours to keep prices back. The inquiry from the month of September forward was very considerable; and it was pretty clear, from the movements of the consumers, that they did not find it easy to place their orders.

AUGUST.—The market during August was not distinguished by any special features. The position was pretty much the same as it was in July, and there was again a slight advance; but the latter was too insignificant to call for any special notice or explanation. There was some eagerness, about the middle of the month, to secure the supplies of both present and future delivery. It was then that the improvement referred to took place; but the small advantage gained was partly lost again. It was, after all, not to be wondered at that the coveted better state of things was so slow in becoming apparent, when actual circumstances were taken into consideration. There was so little hopefulness in trade generally; and as regards the fertilizer department, what was there of a cheering nature, as far as the prospects of the market were concerned? The possible failure of the crops, and the consequent disastrous position of the farmer, was in itself sufficient to mar the anticipations of even the least sanguine; and those who based their ideas of higher sulphate values upon an upward movement in nitrate were, according to the events in Chili, doomed to disappointment as well. The conclusion of the Chilean war, and the resumption of regular shipments, did not provoke arguments in favour of a rise; and it could not well be prognosticated—as it was a little while before—that we should run short of nitrate in the spring. Something of the kind must have been felt by the speculative element in the sulphate market; for, eager as many of the dealers were, a few weeks previously, to pick up contracts for future delivery, as anxious did they seem to get rid of them, and, during the last days of the month, the “bear” operators were very much to the fore. Consumers appeared to be little inclined to operate; because it was impossible for them to gauge their requirements; and this, no doubt, was one of the causes of the dullish state of the market. It was, in fact, a period when it is impossible to obtain a clear view of the future. Spot values were £10 15s. at the beginning of the month; £11 to £11 2s. 6d. being paid for October-March delivery for London and Scotch makes. A firmer tone at the middle of the month caused an advance from £10 16s. 3d. to £10 17s. 6d.; the market closing at the latter figure. Nitrate was rather dearer.

SEPTEMBER.—A glance at the course of the market during this month shows that matters did not improve; and there was a lowering tendency from no adequate cause. A superficial analysis revealed nothing beyond an apparent scarcity of orders, and perhaps an unseemly anxiety to get rid of spot parcels; but if we sift the real facts, we find that it was mostly the speculative movement in “futures” which affected the spot market. At all events, makers did not accept the lower prices till nearly the close of the month. There were sellers, principally second-hand, at the beginning of the month, at £10 15s.; great weakness, however, emanating from the Leith market, where sulphate was offering at £10 12s. 6d. A little better feeling sprang up about the middle of the month; and, with a scarcity of prompt lots, prices were firm at £10 15s. A weaker tendency, however, almost immediately supervened, much to the surprise of almost everybody, as the position remained unchanged. It was due to speculative quotations, which, at Leith, at all events, were made as low as £10 11s. 3d. to £10 10s. for spot parcels, and at £10 13s. 9d. for October-December delivery. Hull delivery at the close was offering at £10 11s. 3d. All this time nitrate was dearer, and firm at 9s. to 9s. 1½d.

OCTOBER.—There was very little change at the beginning of the month; but the sudden reduction in the Beckton quotations intensified the already-existing depression. Buyers, especially those who had sold for a fall, were quick in grasping the situation; and they endeavoured by their low offers and quotations, to influence it adversely still further. In this way, the quotations during the first half of the month were £10 10s. to £10 7s. 6d. There was a slight rally during the second half—buyers showing greater willingness to operate both for spot and future delivery; and parcels changed hands at £10 11s. 3d. to £10 12s. 6d. f.o.b. Hull, and £10 10s. f.o.b. Leith and Liverpool. The month closed barely so firmly; still there was no change in the values. The paucity of the Continental demand was remarked upon; and it was difficult to understand this, as it was admitted that sulphate was the cheapest nitrogenous material. But the disinclination of these consumers arose probably from the fact that the low quotations made by the speculators induced the belief that prices would sink still lower. Nitrate was firm at 9s. to 9s. 1½d.

NOVEMBER.—It had been imagined by many that in October the lowest point had been touched; but this anticipation proved a delusion and a snare. The causes of the further relapse seemed to be twofold—first, the complete control of the market by the speculators; secondly, the absence of orders from consumers direct. The greatest source of weakness was the London market, where quotations were daily lowered to suit the requirements of the hour. A remedy for this state of things lies entirely in the hands of the producers; but one would have thought that the great cheapness of sulphate would have asserted itself without other measures. Some rather wild selling of “futures” was noticed, as if the bottom was out of the market; but it seems doubtful whether these ventures will eventually pay. The quotations were made lower as soon as the month began; there being sellers at £10 8s. 9d. Hull, £10 7s. 6d. Liverpool, and £10 5s. Leith. A little more buying took place in the middle of the month, which steadied the market for a short time; but before the end this feeling entirely disappeared, and the values did not exceed £10 5s. at Hull, and £10 3s. 9d. at Leith. Nitrate of soda maintained a firm tone throughout the month; and the prices ranged above those of October—9s. 3d. per cwt.

DECEMBER.—There was very little change in the early part of the month, with the exception that buyers' ideas did not, as a rule, exceed £10 2s. 6d. It was, however, noticed that not a few of the consumers began to think well of the low prices, and considered it a fair venture to accumulate a little stock while prices were so low, in anticipation of

future requirements. In this way a good many spot parcels found willing buyers, though it was not possible to secure any tangible advance; the still low quotations of speculators destroying all chances of obtaining better prices. France participated largely in these buying operations; Germany phlegmatically abstained. The quantities offering were not so large as might have been anticipated during a month of such heavy production; and prices towards the close showed a steadier tendency—quotations generally being at £10 5s. Nitrate was more or less inactive; but prices were well maintained.

From the tables which are given at the end of the "Review," we take the following.

Production, Deliveries, and Exports of Sulphate of Ammonia during the Past Three Years.			
	1889. Tons.	1890. Tons.	1891. Tons.
Production—			
England, Scotland, and Ireland from all sources	133,000	134,000	143,000
Deliveries and Exports—			
Germany, Denmark, Sweden, Russia, &c.	32,000	30,000	28,000
France, Spain and Italy.	18,000	16,000	19,000
Belgium and Holland	20,000	22,000	23,000
America and Colonies	17,000	18,000	20,000
Home consumption	41,000	42,000	43,000
Stocks at works.	5,000	6,000	10,000
	133,000	134,000	143,000

Comparative Weekly Prices of Sulphate of Ammonia and Nitrate of Soda during the Year 1891.

Week ending	Sulphate of Ammonia. Per Cwt.	Nitrate of Soda. Per Cwt.	Week ending	Sulphate of Ammonia. Per Cwt.	Nitrate of Soda. Per Cwt.	Week ending	Sulphate of Ammonia. Per Cwt.	Nitrate of Soda. Per Cwt.	Week ending	Sulphate of Ammonia. Per Cwt.	Nitrate of Soda. Per Cwt.
	s. d.	s. d.		s. d.	s. d.		s. d.	s. d.		s. d.	s. d.
Jan. 3	10 7½	7 7½	April 4	11 3	9 3	July 4	10 7½	8 7½	Oct. 3	10 6	9 0
" 10	10 7	7 9	" 11	11 1½	9 3	" 11	10 7½	8 6	" 10	10 6	9 1½
" 17	10 7½	7 10½	" 18	11 3	9 0	" 18	10 7	8 6	" 17	10 7½	9 1½
" 24	10 9	7 9	" 25	11 1½	9 0	" 25	10 7	8 6	" 24	10 7½	9 1½
" 31	10 10½	8 0	May 2	11 0	8 10½	Aug. 1	10 9	8 6	" 31	10 7	9 1½
Feb. 7	11 0	7 10½	" 9	11 1	8 0	" 8	10 9	8 9	Nov. 7	10 6	9 1½
" 14	11 0	8 0	" 16	11 0	8 7½	" 15	10 10	9 0	" 14	10 5	9 3
" 21	10 10½	8 1½	" 23	11 0	8 7½	" 22	10 10½	8 10½	" 21	10 4	9 3
" 28	10 10½	8 6	" 30	11 0	8 7½	" 29	10 10½	8 9	" 28	10 3	9 3
March 7	11 0	8 6	June 6	11 0	8 7½	Sept. 5	10 9	9 0	Dec. 5	10 3	9 3
" 14	11 4½	9 6	" 13	10 11	8 7½	" 12	10 9	9 1½	" 12	10 1½	9 1½
" 21	11 5	9 6	" 20	10 10½	8 7½	" 19	10 8	9 0	" 19	10 1½	9 1½
" 28	11 4½	9 4½	" 27	10 8	8 7½	" 26	10 7	9 0	" 26	10 2	9 3

Average Prices per Ton of Good Grey (24 per cent.) Sulphate of Ammonia, f.o.b. Hull.

YEAR.	JAN.	FEB.	MARCH.	APRIL.	MAY.	JUNE.	JULY.	AUG.	SEPT.	OCT.	NOV.	DEC.	Average.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1882	20 17 6	21 2 6	21 6 3	20 10 0	20 4 3	20 10 6	20 15 0	20 11 3	20 9 6	20 1 3	19 6 9	19 7 6	20 8 6
1883	18 15 0	18 3 9	18 8 0	17 3 9	16 18 3	17 5 6	16 5 0	16 7 0	16 10 0	15 5 8	13 17 0	13 13 0	16 11 0
1884	14 0 6	14 5 0	14 11 6	14 10 6	14 7 6	14 13 9	14 19 0	15 8 6	15 6 3	14 12 6	13 12 0	13 3 1½	14 9 3
1885	12 12 9	12 1 3	11 18 3	11 15 4	11 3 6	11 18 3	11 14 3	11 16 6	11 2 6	10 12 6	10 8 9	10 5 9	11 9 1½
1886	10 14 6	11 5 7½	12 11 11	12 5 0	10 17 0	11 0 7½	11 3 6	11 5 7½	10 18 5	10 13 9	10 11 11	10 15 7½	11 3 7½
1887	11 12 0	11 14 6	12 3 9	11 5 3	11 13 3	12 3 9	12 12 6	12 12 0	11 17 0	11 9 0	11 9 9	11 19 6	11 17 8
1888	12 15 8	12 5 8	12 0 0	11 18 2	11 7 6	11 13 0	12 12 10	11 9 8	11 7 9	11 14 8	12 6 7	12 5 0	11 18 0½
1889	12 10 7½	12 4 8	11 19 0	11 18 9	11 19 1	11 19 6	11 16 7	12 0 9	12 2 10	11 18 2	12 1 0	12 5 4	12 1 4½
1890	12 0 11	11 16 10½	11 16 0	11 7 2	11 5 3	11 4 1	11 8 5	11 12 3	11 11 3	11 10 4	11 1 3	10 14 1	11 9 0
1891	10 13 2	10 18 9	11 5 11	11 3 9	11 0 3	10 17 6	10 13 0	10 16 3	10 14 0	10 11 3	10 7 6	10 3 9	10 15 5

Average Prices, 1869-1881.

1869	1870	1871	1872	1873	1874	1875	1876	1877	1878	1879	1880	1881
£15 15s. ..	£16 ..	£19 ..	£21 ..	£18 3s. 9d. ..	£17 2s. 6d. ..	£18 10s. ..	£18 12s. 6d. ..	£19 16s. 3d. ..	£20 5s. ..	£18 8s. 9d. ..	£19 ..	£20 4s. 6d

MR. T. CANNING'S LECTURES ON COAL GAS.

Explosions: Their Causes and Prevention.

The second of the course of lectures which Mr. T. Canning, Engineer and Manager of the Newport (Mon.) Gas-Works, arranged to deliver before the members of the Young Men's Friendly Society in that town, was given on the 21st ult.; his subject being "Explosions: Their Causes, and How to Prevent Them."

The lecturer commenced by saying that a gas explosion is the result of applying a light to a considerable admixture of inflammable gas and oxygen, whether the latter is supplied through the medium of atmospheric air or otherwise. But there was a range of admixture. Few demonstrators had ever been successful in producing an explosion with a mixture of coal gas and air, when the former was present in less quantity than 7 per cent., except when there was another inflammable substance. This might be called the lower limit. In many experiments he had tried to go below it; but he had not yet succeeded. With an admixture of fine coal dust in agitation, he could go as low as from 1½ to 2 per cent. The range then took a rising curve; reaching its highest altitude at from 15 to 18 per cent., after which the explosions became feebler. The upper limit was when from 30 to 35 per cent. of coal gas was present. This gas, by reason of its odour and slow diffusion in air, was not specially dangerous.

The causes of gas explosions, the lecturer went on to say, are various; the two greatest being ignorance and carelessness. When a chandelier is left unsealed, and its owner distinctly smells gas, supposes there must be a leak, and then approaches with a light to seek a confirmation of his opinion—although such a man might have his opinion emphatically confirmed, he was not entitled to be called a philosopher. When gas is discovered anywhere, all lights should be removed, as much air admitted as possible, and notice sent to the gas-works. The architect who puts down in his specification a certain amount to the "jerry" builder for fittings, has much to answer for. Many architects now, however, specify the sizes and quality of pipes to be used; but they cannot ensure the capability of the gas-fitter, and therefore, as one help in this direction, the lecturer advised the registration of this class of workmen. With respect to street-mains, they were only dangerous to consumers when broken by steam-rollers, frost, or similar causes. The advice given above was all that Mr. Canning could offer in these cases also; but he said that, if any of his audience became main layers, he would recommend them, when searching for a leaky joint, to take a bucket of thick soapsuds specially made for the purpose, and dab the joint with a painter's brush. If a leak was there, it would blow out bubbles in proportion to its extent. For testing newly-filled mains or vessels, samples of the contents should be taken off in bags. The nose was the best detector of ordinary escapes; and although the odour of coal gas was not that of Arabia the Blest or of the groves of Ceylon, it was a thoroughly honest, disagreeable smell, indicating better than any contrivance the presence of gas. Coal gas could be deodorized, or

even rendered fragrant; but in these cases one element of its safety would be gone. It was the safest of all lights, if properly used. Scarcely a city, town, or village in the civilized world was without it; and yet the accidents from its use were considerably fewer than those from mineral oils and electricity, in proportion to the use made of these illuminants. The lecturer illustrated the danger of electric lighting by several experiments with a current of not very high tension, and quoted from the *Electrical Review* of Dec. 20, 1889, an instance at Toledo, in Ohio, where a glazier who was measuring for a skylight on a roof accidentally touched with his wet sleeve the electric wires feeding the incandescent light, and was instantly killed and then carbonized. These wires were supposed not to be in high tension; the check of what were then called "converters" (now "transformers") having been applied to them.

Turning to the subject of explosions in coal mines, Mr. Canning remarked that these were caused by escapes of "blowers" of gas mingling with the air of the mine. Fans as now worked had not caused much diminution in the number of explosions. An especial danger attending the use of these fans was the raising of clouds of coal dust, which, mingled with small quantities of gas, formed highly explosive mixtures, and striking, in the full force of the current, the gauze of a safety-lamp, carried the flame from the interior to the exterior, thus giving rise to an explosion. What was needed to prevent such accidents was the regular and copious sprinkling of the floors of mines, and the largest possible intake of air drawn through the upcast shaft at the lowest velocity consistent with due ventilation. It still required the invention of a perfect safety-lamp, more knowledge, and more care upon the part of all who had to deal with gases, before explosions could be entirely prevented; but to a degree they were preventible. In many mines carbon disulphide, which will fire at the temperature of boiling water, is rapidly produced, and falls to the floor, being heavier than air—in fact, 4·93 cubic feet weigh 1lb. The miner looks for gas only at the roof. The late Mr. Lewis Thompson pointed out some years ago, in the *JOURNAL OF GAS LIGHTING*, that no gauze can prevent the ignition of carbon disulphide in a state of vapour. Ignorance of its existence and its qualities still constitutes a cause of explosions in coal mines. Absolutely non-preventible accidents rarely occur; but still they do happen. Mr. Canning gave an instance of one on Feb. 9, 1889, when two holders at the Brooklyn Gas-Works, New York, were destroyed by a tornado overturning them; the escaping gas becoming ignited at a street lamp, and causing an explosion.

The lecturer next considered the rate of combustion of explosive gaseous mixtures. He said it had been asserted by Dr. Michelson, of Berlin (following Bunsen, Mallard, and others, in their method of experiment), that, in an admixture of coal gas and air, combustion is propagated at a maximum rate of 70 centimetres (27·3 inches) per second. The experiments were made in a stout glass tube about a metre long. Mr. Canning thought the conclusion was doubtless correct as far as the tube went; but as a basis for calculating the rate of combustion, he considered it to be worse than worthless, because it was misleading, and even ridiculous. It had, however, been accepted

because a professor had gravely stated it; but let any professor tell a South Wales collier that the rate of combustion in an explosive mixture in his fiery mines was less than two miles an hour, and then let him see if that man would ever form one of his audience again. The rate of combustion, in Mr. Canning's opinion, depends, on the volume and character of the initial wave of the explosion. Explosions, according to his view, proceed in waves. In a shed in which one occurred, and which he investigated, he found three waves marked plainly by the curvature of the roof. The shed was 40 feet long, and the duration of the explosion four seconds. In the *Tankerville* petroleum ship, which exploded at Newport some months ago, the rate of progress was more rapid. An immense wave in coal workings creates intense heat, and, acting with projectile force, propagates combustion at the rate of a hurricane. In determining, therefore, the cause of an explosion, this point is well worth considering. Referring to the frequent explosions of vessels from what is called the spontaneous combustion of coal, Mr. Canning pointed out that coal does not burn spontaneously, any more than it delivers itself spontaneously into the coal-cellar. It burns with or without flame when oxidized under favourable conditions, the same as iron rusts when oxidized. The iron would burn too, only it is not carbon. When oxidation goes on in the presence of carbon, great heat is evolved. Without venturing to determine what causes the so-called spontaneous combustion of coal, he would simply say that he never found it occur except under the following conditions: (1) At the bottom of a heap of coal; (2) the coal had been stored in a wet condition; and (3) iron disulphide and sulphide of calcium were invariably present. Furthermore, he always noticed that the iron disulphide, commonly called pyrites, and sometimes "brasses," had been oxidized in the process. A diaphragm indicator with an index was used to find when gas was being evolved; but a much better plan than this was to insert wrought-iron tubes at various points in the heap of coal with a thermometer near the bottom, suspended from a plug at the top of each tube. The pipes might be perforated, and the thermometers looked at daily. In his own experience, he always found that this plan was effectual. The rising temperature showed him when to expect danger, and he took steps accordingly.

The lecture, like the former one (reported in the JOURNAL for the 22nd ult.), was illustrated by experiments, which were witnessed with marked interest.

BIRMINGHAM CORPORATION GAS SUPPLY.

An Interesting Report.

At the Meeting of the Birmingham City Council to-day, the Gas Committee will report that they have received a memorial from the day labourers and a portion of the mechanics employed at the works, asking that their hours of labour may be reduced from 54 to 53 per week; and for some other concessions as to the hours when they are entitled to payment for overtime. The Committee find on inquiry that the reduction of hours asked for by the men is becoming general in the larger manufactories in Birmingham; and having ascertained that action on their part in this direction would not affect the other Committees of the Town Council principally employing labour, they have complied with the first request, and have suggested modifications in the other proposals of the men, which have been accepted. The altered arrangements were put into operation on Dec. 10. They will affect about 450 men, and will involve an additional expenditure on the present output of about £700 per annum. With a view to economy in the stacking of coke at Saltley, the Committee have authorized the expenditure of £265 in the purchase of portable tramways and tip-trrolleys. Horse-power is used in connection with these tramways; and their use will result in a considerable reduction of the number of men employed in this laborious work. The Committee regret to report that the experiment made at the Swan Village works with Elliott's stoking machinery has not proved successful. They also state that they have received notice of a re-assessment of the gas-mains in the parish of Harborne; and, being advised that this assessment is excessive, they have given notice of their intention to appeal to Quarter Sessions against it. On the application of the Improvement Committee, the Gas Committee have agreed to provide gas-fittings for the additional artisans' dwellings now being erected by the Council, and to supply the houses with prepayment meters. The result of the experiment already made with these meters has, apart from the difficulties naturally arising on the introduction of a new system, been fairly satisfactory. Improvements have been made in the construction of the meter in use, which, it is believed, will overcome some of the difficulties to be met with, and which will also enable the Committee to dispense with the frequent supervision of the meters that has hitherto been required, and has added considerably to the cost of the experiment. The Committee find that in the artisans' dwellings where these meters have already been fixed, nearly all the tenants have become consumers; and that where they have been provided in terraces of houses to which gas was previously supplied, the number of consumers has increased, although the average consumption per house has diminished. The experience which has been obtained with the use of these meters in houses at a lower rental than those already referred to, has not been encouraging; and it seems to show that it is premature at present to attempt to carry a supply for domestic lighting into courts. The Committee are of opinion that, where the collection of the pence placed in the meter can be made by the landlords, or their agents, so as to avoid the cost of frequent collection by the officers of the department, the system may be made to pay its way; and they are, therefore, willing to make a trial of it on a larger scale. With this object, they have agreed to fix prepayment meters in houses let at a weekly rent in which the landlord provides fittings, and will undertake the collection of the amounts paid for the gas supply, and the supervision of the meters. The Committee report that, while the local demand for coke was well maintained during the past summer, there was a considerable falling off during that period in the quantity sold to the iron and cement trades, on which the Committee have had to rely in former years for the disposal of a large portion of the production. As these circumstances have also affected surrounding towns, they found that the

small quantity of coke which is generally imported for sale in Birmingham was increasing; and to meet this competition, they reduced the retail prices 2s. per ton from Oct. 1 last. Since that date, while the retail sales and the sales for ironmaking have been well maintained, there has been no improvement in the other markets in which the Committee have hitherto found a ready sale for this residual; and, owing to the unusual accumulation of stocks in the past summer, the stocks at the Saltley and Windsor Street works are now larger than they have been for several years. The Committee have no reason, however, to suppose that they will not be able to dispose of this accumulation in the coming summer months; the demand for coke being on the increase, and greater now than it has been for some months past. The statistics for the half year ended Sept. 30, 1891, as compared with the corresponding period of the previous year, show that the sale of gas was 1,367,060,800 cubic feet—an increase of 10½ per cent. The new services laid on were 1358, as against 910.

COVENTRY CORPORATION GAS SUPPLY.

The Alleged Nuisance from the Gas-Works—The Proposed New Works.

At the last Meeting of the Coventry City Council—the MAYOR (Mr. Singer) presiding—the report of the Gas Committee dealing with the above subjects was brought forward for approval. A summary of the document was given in the JOURNAL for the 22nd ult. (p. 1148).

Mr. ANDREWS, in moving the adoption of the report, said it would be remembered that two questions were referred by the Council to the Gas Committee—one was the memorial from persons residing in the neighbourhood of the gas-works; and the other was the general future of the gas undertaking, reckoning upon an annual increase in consumption of 6 per cent. for the next ten years. The memorial was somewhat vague; and it was rather difficult to make out in some respects precisely what the memorialists asked for, because they referred to the question of the gas being produced and stored at the present works, and afterwards they appeared to confine themselves to a demand that the whole of the manufacturing portion only should be removed to some place outside the city. The report stated very clearly that to remove the manufacturing part only, and place it outside the city, would cost £100,000; and therefore the Gas Committee could not recommend the step to be taken. He might point out that, if it was thought desirable to expend the £100,000, and remove the manufacturing plant, the city in the meantime could not do without gas; and consequently the greater portion of the money would have to be expended before the present works were touched. He might further remark that they could not erect new works without the sanction of Parliament; and he was quite certain Parliament would never sanction the citizens of Coventry borrowing and expending £100,000 merely to relieve occupiers in the neighbourhood of the gas-works of some little annoyance, and at the same time keep the manufacturing capacity of the works at its present pitch. With regard to the other question—the general future of the gas undertaking—that was still under the serious consideration of the Gas Committee, and would be reported upon again at a later date. He might point out as to this question that it confined itself to either enlarging the present works or constructing auxiliary works outside the city. Auxiliary works to produce a million cubic feet a day—that was the smallest quantity that the new works would be constructed for—would cost £50,000, or thereabouts. In any case, if additional works were erected, they would not affect the existing ones at all, because it would be necessary, to cope with future increase, that the auxiliary works should be used together with the present.

Mr. CALCOTT seconded the motion.

Mr. WEST pointed out that, when the old Gas Company were proprietors of the works, directly there was the least smoke, somebody would complain in the Council; and the Town Clerk was instructed to write to the Gas Company, threatening them with all the pains and penalties of the law. This seemed to have had the desired effect. Personally he could not believe but that the Gas Committee were quite as capable of conducting their business without causing annoyance to the residents near the gas-works as the Gas Company; and this being the case, he certainly should like to see them take the matter into consideration, and do the best they possibly could for their neighbours. At the present time the Committee were spending about £12,000 in erecting a new retort-house; and from this, he presumed they would get an increased amount of smoke and smell. He was glad to hear the Committee were contemplating the erection of auxiliary works, which he believed would result in a saving.

Mr. LEE thought the erection of new gas-works should not be entertained at the present time; but that an effort should be made to reduce the nuisance of which the memorialists complained.

Mr. WORMELL asked whether Mr. Andrews could tell them what the estimated capacity of the works would be when the new retort-house was finished. From what he could see, the Committee were preparing for an enormous increase of gas at the old works, and yet they were considering the question of auxiliary works equal in capacity to the production of a million cubic feet of gas per day.

Mr. ANDREWS, in reply, said Mr. West had stated that the Gas Committee were spending £12,000 on a new retort-house; but if he had mentioned half that sum, it would have been nearer the mark. As to the complaint regarding smells, it must be remembered that large gas-works could not be carried on without some odour. There had always been complaints; so that the subject was not new. When the new retort-house was finished, he did not think there would be any occasion for fearing that the smell would be doubled. The number of retorts to be constructed was only the same as they were going to pull down, or rather six less. With regard to the question that Mr. Wormell had put, he could not answer it straight off without referring. His impression was that the present manufacturing capacity of the works was 2½ million cubic feet per day. This quantity was not used every day, nor was it likely to be. The capacity had to be sufficient not only for the largest day's consumption, but also to allow of a reserve in case of breakdown in any portion of the works.

The report was unanimously adopted.

GAS SUPPLY IN FOGGY WEATHER.

The short spell of fog and frost with which the Metropolis and a large portion of the country were lately visited necessarily taxed to the utmost the resources of those who were responsible for keeping up the supply of gas. The extent to which the pressure was felt in the principal centres of commerce, will be gathered from the figures contained in the following paragraphs:—

Dealing first with the Metropolis, the largely increased general demand for gas may be deduced from the extra consumption which took place in the most important district served by the Metropolitan Gas Companies—that of The Gaslight and Coke Company. It is perfectly well known that the one day of the year looked forward to with the greatest anxiety by gas managers is the 24th of December; and that this was successfully passed without any failure, is something for which credit may fairly be taken. It was truly a memorable day in the Company's history; the unprecedented amount of 128 million cubic feet of gas having been sent out from the various stations. This is an enormous quantity; and something like 13,000 tons of coal were consumed on that day to help to produce it. To meet the strain, the reserves of both gas and coal—especially the latter—had to be largely drawn upon; for, owing to the fog, it was impossible to bring up to the wharves at Beckton, and discharge, the Company's colliers, laden with raw material, lying idle in the middle of the river. By way of contrast to the output of gas on the 24th ult., we give the figures for the 30th, which was a dark, but not foggy day. The quantity delivered was 80 million cubic feet—a drop of 48 millions. According to what transpired at an interview which took place last Thursday between the Company's Secretary and General Manager (Mr. J. Orwell Phillips) and a representative of the *Daily News*, the Company are pretty well prepared for a foggy week; but a longer period of black weather, especially if accompanied by an interrupted coal supply, would be serious. A proposal has therefore been laid before the Board to increase the storage plant by the erection of three additional holders, at a total estimated cost of £225,000. These holders are to be used as reserves, to meet emergencies like that through which the Company have just passed.

At the meeting of the General Purposes Committee of the Manchester City Council last Thursday week, Mr. Batty asked the Chairman of the Gas Committee what was being done by them to remedy the great defect as to the supply of gas during the previous few days. This was not a matter which occurred at intervals; but for several years, almost yearly about this time, there had been a short supply of very impure gas. The public mind was very much disturbed upon the matter, trade was paralyzed; and many tradesmen in the city who used gas-engines for the purpose of illuminating their premises with the electric light, were unable to obtain a sufficient supply of gas to work the engines. It would be a great relief to the public mind if some authoritative statement could be made by the Chairman of the Committee upon the subject. Mr. Brooks, the Chairman of the Gas Committee, in reply, said their efforts had been directed for some time previously to the particular emergency which had arisen, and of which Mr. Batty complained. He assured the Council and the public that such a state of affairs could never occur again. They had adequate preparations in an advanced state, which would undoubtedly for many years to come prevent a contingency arising such as then prevailed. [Some figures relating to the consumption in the city during the previous week were given in our last issue.]

The consumption of gas in connection with the Birmingham Gas Department during the week ended on Christmas Eve was larger than in any previous week on record by upwards of 3 million cubic feet. The total consumption for the week was 144,276,000 cubic feet. The highest previous record was for the week ended Dec. 18, 1890, when the consumption was 141,025,000 feet. There is always an extraordinary demand upon the resources of the department during the week preceding the Christmas holidays, owing chiefly to the long hours worked at the shops and factories. This fact and the foggy weather placed the officials of the Gas Department in an awkward dilemma; and there were fears on Thursday that the supply would not be equal to the demand, because of the continuance of the fog. The consumption for the day, however, was less than on the corresponding day of the previous year, the figures being: Dec. 24, 1891, 23,967,000 cubic feet; Dec. 24, 1890, 24,076,000 feet.

According to a local contemporary, the resources of the Leeds Gas-Works have never been put to such a severe test as during the late fogs. That they were not equal to it was, it says, apparent to anyone who noticed the diminished illuminating power of the gas, whether in the street or elsewhere. In certain parts of the borough, the pressure at times was so weak that resort had to be had to candles and lamps; while those who had to depend upon gas-engines for motive power were equally conscious of the deficiency. Up to Sunday, the 20th ult., when the fog commenced, the quantity of gas sent out from the whole of the works had closely approximated per day 12,000,000 cubic feet. On the 17th ult. the record was 14,500,000 feet. That is exactly the quantity which the whole of the plant will produce; and as it was not fully in operation—more than 200 retorts being in reserve—there was little opportunity for storing any considerable stock before the unusual demand arose. Fortunately the holders contained 2,000,000 cubic feet on Monday. On that day the consumption was above 14,000,000 feet, and this included the accumulation mentioned. On Tuesday 12,750,000 feet were sent out. The fog was less dense on Wednesday forenoon than it had been on the two previous days; and the issue for that day was upwards of 12,500,000 feet—all that was produced.

Failure of the Birmingham Compressed Air Power Scheme.—An order has been made for the winding up of the Birmingham Compressed Air Power Company. The undertaking was started a few years ago with good promise of success; but the initial expenses proved heavier than was anticipated, and consequently the demand by power users for connection with the Company's mains was not great. Further than this, the efficiency of the apparatus is stated to have been low; only about 30 per cent. of the power at the generating station being obtainable at the motors without heating the air at the point of delivery.

THE PROPOSED PURCHASE OF THE SUTTON COLDFIELD GAS-WORKS.

Opposition of Ratepayers.

Last Tuesday, a preliminary meeting was held at Sutton Coldfield to organize an opposition to the proposed purchase of the Sutton Coldfield Gas-Works and the mains through which the Birmingham Corporation supply a portion of the borough. Mr. F. Parkes, a member of the Town Council, presided. Letters of apology were received from several prominent ratepayers who were unable to attend, and who were all in favour of the object of the meeting. One of them—a Mr. Wills—contended that the works were obsolete, and could not be worked economically, while the mains were so bad that, of the 27 million cubic feet of gas manufactured per annum, 6 millions went into the atmosphere. He dissented from the estimate of the cost of the scheme presented to the Corporation. His own estimate was as follows: Purchase of the Sutton gas undertaking, £7000; compensation to the Birmingham Corporation, £5500; plant to produce 41,000,000 cubic feet per annum, £20,500—total, £33,000, to which he added 5 per cent. for contingencies (£1650), making £34,650. Besides this, there would be the purchase of additional land, sidings, &c., the expenditure for relaying mains, and a charge for loss by leakage. Therefore he was convinced that the cost of the scheme would be much nearer £40,000 than £30,000. Mr. Wills also pointed out that the Sutton Gas-Works had only been making a profit of £500 a year; so that the ratepayers were asked to pay £7000 for some obsolete works and the goodwill of a concern which had been making only a nominal profit. The result, he believed, would be that in a short time the Corporation would have to raise the price of gas. The Chairman remarked that the ratepayers were recommended to adopt the gas scheme on the report of engineers whom the Council had consulted. The engineers' report was perfectly honest with regard to the facts; but it went further and dealt with matters of opinion which the engineers had no right to deal with, but which ought to have been left to the ratepayers. He very much questioned the wisdom of the proposed purchase. Of all the reports adverse to any undertaking that he had read, the engineers' report on the Sutton Gas-Works was the most damaging. From beginning to end, it described the works as worn out and obsolete. If the shareholders had not the confidence to put into it sufficient capital to develop it, why should they expect the ratepayers to find the money? The works had been in existence about forty years; and the original capital was some £10,000 or £12,000. The plant was in such a bad state that 25 per cent. of the gas that passed through the works' meter was lost. The only good thing the engineers could say was that the retort-settings were of some value; but as they also stated that the retorts themselves were too small to make gas economically, the settings were of no use. The unsatisfactory nature of the supply was shown by the fact that some time ago a number of residents asked the Birmingham Corporation to carry their mains to Sutton. He had authority for stating that the Birmingham Corporation was prepared to supply the whole of the borough, and that, if they did so, they would not use the Sutton Gas-Works. He concluded by suggesting that the meeting should appoint a Committee to conduct the opposition to the scheme, and to raise funds for that purpose. Mr. Pickerill, Mr. Skelton, and Mr. Evans spoke in opposition to the scheme; and Mr. Parkes quoted against it the experience of some of the towns which had purchased their gas undertakings from the Birmingham Corporation. These places, he said, had a much larger consumption, a much more concentrated population, and better opportunities of obtaining coal than Sutton had. But Smethwick, which consumed 140 million cubic feet of gas per annum as compared with the 40 millions Sutton Coalfield would require, was obliged to charge 6d. per 1000 feet more than the consumers would have had to pay if they had remained customers of Birmingham. In Oldbury the consumption was above 60 millions; but there the price was 6d. per 1000 cubic feet more than in Birmingham. In West Bromwich and Tipton the difference was less marked; but still the price was greater than in Birmingham. He thought these facts conclusively showed that they in Sutton could not hope to make gas as cheaply as it could be supplied by Birmingham. The meeting decided to offer strong opposition to the scheme, and appointed a Committee for the purpose.

AUTOMATIC COAL-GAS RETORT COMPANY, LIMITED.

The Annual General Meeting of this Company was held last Wednesday, at the Offices, 88A, Leadenhall Street, E.C.—Mr. T. C. HERSEY in the chair.

The SECRETARY (Mr. W. M. Kight) read the notice convening the meeting; and it was agreed to take as read the Directors' report and the accounts, which covered the period from the formation of the Company in July, 1890, to Sept. 30, 1891. The report stated that there had been a slight loss on the year's operations, amounting to £460. This was due to the reluctance of gas companies to order large installations of inclined retorts before a trial had been made on a small scale. The Directors, however, anticipated that next year (as these trials had been uniformly successful), there would be a large increase in the Company's business.

The CHAIRMAN, in moving the adoption of the report, said he would first direct attention to the fact that the Company was not formed till the latter half of 1890; and very little business was then done by them, because gas companies all over the country had at the time made their arrangements for the ensuing winter. After the winter passed by, the engineers of different gas-works began to make overtures to the Company; and since then they had done very well indeed—not, as they all wished, in making money, but in sowing seed from which, they firmly believed, they would soon commence to reap. In many of the principal gas-works installations of inclined retorts had been put up; and in two or three most important works, they had been extended. Only a few days ago, a deputation from the Burnley Corporation Gas Committee visited the Brentford Gas-Works; and they

were so satisfied with what they saw there, that they had practically arranged for a further installation of 112 retorts. It was nearly a year ago that the first installation was put up at Burnley; and it was very satisfactory to find that, after the twelve months' experience, the Gas Committee had resolved to extend the system. At their Southall works, the Brentford Gas Company had had an installation of inclined retorts for three years; and now they had extended the system to their Brentford works. The installation there had been finished, and was working very satisfactorily—so satisfactorily indeed that the men were actually able to charge the retorts at the rate of 30 tons per man per hour. Although success had attended the Company's system, the Directors had not been without difficulties during the year. At the meeting of the Institution of Gas Engineers in May last, Mr. G. C. Trewby, the Chief Engineer of The Gaslight and Coke Company, stated that he had put in some inclined retorts at Beckton under a patent which he had himself taken out; and the working had been eminently satisfactory. This statement was published at the time; and the result was that many orders which were then coming in were withheld, because the gas companies did not know whether the system at Beckton was not cheaper than that shown by the drawings and estimates which had been submitted by the Automatic Company. Consequently, the Directors were compelled to take Counsel's opinion on the matter of Mr. Trewby's patent, which was entirely in their favour; and he was happy to say that the result of negotiations was that they came to terms, and the installation at Beckton was now being carried on (though the license was not yet actually signed) under agreement with the Automatic Company, and on payment of a royalty. Having mentioned that the South Metropolitan Gas Company were contemplating an extension of the two installations they had at the East Greenwich works, the Chairman went on to say that the Directors were expecting to develop a new branch of business in connection with chemical works. One of the proprietors of large chemical works in the Midlands, where some inclined retorts had been erected, told him that in 23 days they had paid, by the use of the system, the cost of the royalty, and had saved 1s. per ton on the coal they used in their operations. With regard to the sale of the foreign patents, they had been endeavouring to dispose of those for Italy, France, Belgium Germany, and the United States. Negotiations were still pending for four of these countries; and he was convinced that the German patent would soon be taken up by responsible people. Two gas engineers from the Colonies had been making inquiries about the Company's system; and one of them had determined to carry out in the future an installation on the Van Vestrout system.

Mr. WALTER KING seconded the motion, which was unanimously carried.

The retiring Director (Mr. J. H. Sheldrake) and the Auditors were re-elected; and after a few remarks from Mr. Van Vestrout (the Company's Consulting Engineer), the proceedings terminated.

YORKSHIRE WATER-GAS COMPANY, LIMITED.

The Second General Meeting of this Company was held last Tuesday, at Leeds—Mr. J. MITCHELL, C.E., presiding.

The report and accounts (of which a notice appeared in the JOURNAL for the 15th ult.) having been taken as read,

The CHAIRMAN moved their adoption; and, in doing so, remarked that, at the last meeting, the Directors reported that they had acquired the rights over water gas in Lancashire, and one of the results of this had been the laying down of plant at the Lancaster Waggon Works. He asked the shareholders to remember that their interest was in the success, and not in the downfall of water gas; and instead of depreciating it, as he saw by the accounts of various meetings some shareholders had been doing, they should remember that by the reports of Sir Henry Roscoe, by practical demonstration at the Leeds Forge, by practical demonstration in Harrogate for lighting, and at Lancaster for the purposes of welding, it had all the elements of success. If the shareholders had not confidence in water gas, how could they expect the public to take the matter up, and use it? He asked them to impress upon their friends that there was something in water gas, that it was what it was represented to be; and, although but slowly developed, it had done what was promised by the promoters so far as its application to metallurgical and lighting purposes was concerned. As to lighting, he had adopted the gas at his own residence, and should be pleased to allow any shareholder to see it. His friends who had seen the light were delighted with it, considering it better, steadier, and more agreeable than electricity. The difficulties of applying water gas to the welding of bosses, and more particularly to the "glutting" of wheels, at the Lancaster Waggon Works had been overcome; and it must soon be adopted by similar firms. In his opinion, water gas possessed all that he thought it did when the Company started; and he asked the shareholders, as sensible men, to stick to their interests in the Company. It was no use going about saying that water gas was a fraud, but rather let them work to make it a success. If they were to wind up the concern, their money would go. (A VOICE: "I think it has gone.") If they were to wind it up, he should be one of the first to reconstruct it; but he hoped they would see that it was to their best interests to hold their shares, and help to push the use of the gas forward.

Mr. BELLAMY seconded the motion.

Mr. T. BROOK, in moving as an amendment that the report and accounts be not adopted, remarked that the Chairman had referred to shareholders speaking of water gas as a fraud; and he stated that it was all the Directors had ever represented it to be. Let them look at the record of the past. In 1889 they were going to have water gas in London, and the country was to be turned upside down with the new gas. What was the result? They had an explosion at Windsor, and they had another at the Yorkshire Show at Hull, when a man was killed. Then, two men were killed at the Leeds Forge. He did not know whether they were aware of it, but there had been a lot of explosions at the Leeds Forge, and several furnaces had been burnt down. When the British Association visited Leeds, a number of gentlemen went to the Leeds Forge to see the water gas at work; and they had

not been out of the place many minutes, when an explosion occurred, bulging out the sides of the engine-house and blowing the roof off. The Chairman had also spoken of water gas being applied to glass and steel smelting. He had been down to Castleford to see the water-gas appliances there; and he met one of the principals, who told him that they did not want the plant. Mr. Brook then referred to a pamphlet which had been issued by the British Water Gas Syndicate, and was about to quote from it, when the Chairman ruled him out of order; and this led to a little altercation between them.

Mr. LEACH seconded the amendment.

Mr. WORTH, the Managing-Director of the British Water Gas Syndicate, addressed the shareholders on the progress water gas was making, and declared his continued confidence in it.

Mr. SAMSON FOX said he could assure Mr. Brook that for lighting a house requiring from 100 to 200 lights, each consuming 5 feet of gas per hour, there was a great saving effected by using water gas. His own house at Harrogate had been lighted by water gas for upwards of three years; and there had never been any trouble with it. During the winter, when Harrogate was suffering from the want of coal gas, his house had been brilliantly illuminated. It was, in his opinion, the duty of the shareholders of the Yorkshire Company to endeavour to promote the use of water gas throughout that county and Lancashire; because he firmly believed that, if its advantages were only made known, it would be largely adopted. The worst thing that could happen to a few men who were trying to make a company a success, was to be constantly bothered and interfered with by a small number of shareholders, and held up to the contempt of the outside world. Of course, he was sorry that the shareholders had not received the dividends some of them expected; but he could not help it, and did not grumble, because the Company had only been in existence two years. They might rest assured that, if, as he believed was the case, they could produce a material which was cheaper and better than another used for the same purpose, it was bound to succeed in the end. That was just the position of water gas. One man could make of water gas as much as twenty men could make of coal gas; and by the addition of carburetted oils they could get an illuminating power of from 25 to 30 candles. In his opinion water gas would be largely adopted by the great gas companies of the country. The Yorkshire Company had not lost much money yet—£3000 in the first year, and less than half that amount in the second. He should like to see a better feeling among the shareholders towards those who were trying to make it a success.

The amendment was rejected, only four shareholders voting for it; and the adoption of the report was agreed to.

The retiring Director and the Auditors were re-elected; and the proceedings then terminated.

THE EDINBURGH ELECTRIC LIGHTING SCHEME.

At the Second Annual General Meeting of the Edinburgh Electric Supply Corporation, Limited, which was held in Edinburgh on the 23rd ult.—Mr. W. Berry in the chair—the Directors presented a report, in the course of which they stated that there were 206 shareholders upon the roll, representing a privately subscribed capital of £31,175; and as this placed the Company in a very strong position locally, they had not thought it advisable to take any public steps towards extending the list. On the 10th of September last, they addressed a letter to the Town Clerk (with a request that it should be laid before the Lord Provost's Committee at their next meeting), setting forth the advantages that would result to the city if an arrangement were arrived at whereby the lighting of the compulsory area comprised in the Provisional Order granted to the Council should be undertaken by the Company. The letter was considered, and remitted to the Lighting Committee for report. Other matters had, however, engaged the attention of the Council to the exclusion of this; but the lighting question would shortly have to be considered, as the Council, under their Order, were compelled to carry out within three years the work of lighting the compulsory area therein defined. In the meantime, the Directors had collected a large mass of information and statistics connected with similar undertakings, finished and in progress, within the United Kingdom and elsewhere, which would enable them to tender for the electric lighting of the city should the Council decide on delegating their powers to the Company. Up to the present, the shareholders had incurred no liability with regard to the expenses; nor would they do so, unless the desired contract was obtained from the Council, when the shares would be issued to the public, and the business at once proceeded with. The Chairman, in moving the adoption of the report, said he had to express the regret the Directors felt in being still unable to intimate any progress towards the definite fulfilment of the object for which the Company was formed; but no one was to blame for it. Without being too pressing, the Directors had not failed to urge their claims on the Town Council; and he could not doubt that these would be favourably considered when that body was in a position to come to a decision. They must, of course, recognize that their representatives in the Council might decide that, in the public interest, it would be preferable for them to undertake the work themselves. In that case, the existence of the concern would terminate, and the preliminary subscriptions of the shareholders returned in full. If the city entrusted the electric lighting of Edinburgh to the Company, they would do their best to keep in the front rank, both scientifically and practically. They were naturally anxious to have the business; but the shareholders might rest assured that, although the Directors would not be greedy for profit, they would not undertake any contract which did not, in their view, leave a good margin for interest and risk. Mr. G. Barclay seconded the motion; and it was carried unanimously.

Hoyland Nether Local Board and the Gas-Works.—Mr. T. Newbigging, of Manchester, has been appointed by the Hoyland Nether Local Board to inspect and value both commercially and structurally the Elsecar, Wentworth, and Hoyland Gas Company's property. The Directors of the Company raise no objection to this; but they have intimated to the Board that they do not wish to sell.

METROPOLIS WATER SUPPLY.

The Water Bills of the Corporation and the County Council.

The two Bills—alike in all essential particulars—relating to the Water Supply of London, which have been promoted by the Corporation of London and the London County Council, in virtue of an arrangement with which our readers are familiar, were duly deposited in the Private Bill Office on the 21st ult. Provision is made therein for the appointment of a Water Committee to consist of 48 members, 42 of whom are to be nominated by the County Council and the remainder by the Corporation. This Committee is to be a Committee of the Council, who are to be empowered to promote Bills to enable them to acquire, construct, and maintain water-works, and do any necessary acts in connection with affording a new or a supplemental supply of water in the districts now served by the eight Metropolitan Water Companies; to acquire or take on lease any existing or future water-works, or the undertaking of any Water Company or any part thereof, or any interest therein, or any water or right to take or convey water; to provide for the dissolution and winding up of any Water Company whose undertaking they shall acquire; to sell, lease, or dispose of any undertaking which may become vested in them; to make provisions for the raising of such moneys as may be required for carrying the Acts into operation, to supply the inhabitants of any county, or any local authority or corporation, within the defined area, and on such terms as Parliament shall authorize or direct, with water by meter or otherwise, for public or private purposes; and to carry on, consolidate, enlarge, or improve such undertakings as the County Council may acquire or construct, or to provide, by arrangement with the Companies, as to any equitable division of future profits. The Committee are to have power to make and enforce regulations for prescribing the strength, character, weight, and materials of fittings and appliances to be used for preventing the waste, misuse, and consumption of water; and to make any public or private inquiry as to the existing supply of water within the Metropolitan water area, and the charges made therefor, and as to the possible sources of supply, and to enter into negotiations with any public authority, water company, or person for the acquisition or taking on lease of any of their powers or undertakings, or any part thereof, and (subject to ratification by the County Council) to enter into and carry into effect contracts in respect thereto. The Council or the Committee are to have authority to inspect the works and plant, books, and accounts of any Company; and there are to be delegated to the Committee absolutely, and without reference to the Council, all the administrative and executive functions of carrying on the supply of water from any works acquired or constructed by the Council. They will not, however, have any power of purchasing or acquiring, selling, disposing of, or letting on lease such works, of constructing any new works, of enlarging any old works for obtaining water involving capital expenditure, of raising money by creation of stock or borrowing, or of fixing or altering the rates leviable for water, or the principal of charging or levying rates in respect of water supplied. The foregoing matters occupy the first six clauses of the Bills. The remaining six deal with the making of regulations by the Corporation as to the nomination of members of the Committee; the selection of offices and the appointment of officers; the preparation of an annual report, and other matters. In a schedule to the Bills are the names of the London Water Companies, to whose works and districts the operation of the measures will be confined.

CAPE TOWN DISTRICT WATER-WORKS COMPANY.

The Third Ordinary General Meeting of this Company was held at Winchester House, E.C., last Wednesday—Mr. J. S. Prince presiding. In moving the adoption of the report, the Chairman congratulated the shareholders on the satisfactory progress made by the Company. He said that, although the works were only certified as complete in February last, and the accounts were made up to June, the total gross revenue came to £3117; and the local Directors estimated that for the next financial year a considerable increase of revenue might safely be reckoned upon. Their report was dated Oct. 28 last; and advices since received showed that they had been too cautious in their estimate, as they now put down the revenue at £5000, and probably more. In a subsequent letter, the local Directors stated that they had each day numerous applications for water; and that new buildings were springing up in all directions. He was pleased to say that the present yield of the springs was quite ample for the purpose. Cape Town itself being still short of water, it was proposed to make another reservoir at great expense; but it was just possible that, to avoid this outlay, an arrangement might be made with the District Company for a supply from their springs. Their Mountain Spring was an exceedingly valuable source of water, especially during the winter season, when it supplied the whole of the requirements of the Company for a considerable period; and, being at a high level, pumping was rendered unnecessary—thus saving the expense of fuel and other charges connected with working the engine and pumps. The Engineer (Mr. A. W. Ackerman) reported that the spring had yielded more than sufficient to supply the whole of the district for the last six months, although, owing to the small storage they possessed, two-thirds of the yield had run to waste. Turning to the question of finance, the Directors had not availed themselves of the authority given them to issue the 4000 preference shares; believing that it would be more to the interest of the shareholders to raise the necessary amount by the issue of 7 per cent. redeemable debentures. The Directors had privately placed £7500 of these, of which sum the contractor at Cape Town had taken £1000; showing the confidence he had in the concern. It was, however, still necessary to issue the balance, as there were several applications for extensions on very satisfactory terms to the Company. In conclusion, looking on the whole question of the Company's prospects, and without taking too sanguine a view of the position of the concern, he had every confidence that, with the support of the shareholders, the Directors would succeed in placing the Company in the ranks of the most prosperous undertakings of a similar nature. Mr. C. Crew seconded the motion; and it was carried unanimously. The proceedings closed with a vote of thanks to the Chairman and Directors.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

There is an axiom among artists that one sees only what he looks for. The Edinburgh and Leith Gas Commissioners, whether artists or not, seem to exercise the faculty as if they were. At Monday's meeting, they had before them the report of the Works Committee on the subject of the extra consumption of lime in the Edinburgh works during last summer, the gist of which I gave on the 22nd ult.; and they agreed to it without remark. The minutes which were before the Commissioners showed the position of affairs in fuller detail than was at my command when I last wrote; and a few sentences may be given from these documents to more fully show the situation. The Works Committee entrusted the inquiry into the subject to a Sub-Committee, who reported that they interviewed the chemist at the works, but his explanations did not in any great measure account for the excessive quantity of lime used. The Sub-Committee then requested the Engineer to submit a written report to them; and after receiving this, they came to the resolution that, while they regretted that Mr. Mitchell had been unable positively to account for the abnormal quantity of lime he had found it necessary to use, his explanations were consistent with the experience of other gas managers and should be accepted. Their recommendation was that more frequent tests should be made of the materials used. It is interesting to know that Mr. Mitchell produced back numbers of the JOURNAL to the Sub-Committee, including a report of a discussion at a meeting of the North British Association of Gas Managers, in support of his contention that it was not at all unknown in operations connected with gas-works to have such an experience as he had; and that the Sub-Committee based their resolution upon the scientific evidence contained in the publications to which they were directed. In his report, Mr. Mitchell said: "About the middle of June last the lime was observed not to be doing its work so effectively as formerly. When the purifiers became foul and were put out of action for the purpose of being cleaned, the impure lime taken therefrom had quite a different appearance from that which it usually has; and instead of being of a dark cake form, it was of a dry and powdery nature. The cause of this was difficult to arrive at, as the condensers, washers, and scrubbers were working as in previous years." The annular condensers were not in operation from May 21 until Sept. 11. In detailing his procedure in testing his apparatus, he stated that in the inlet-pipes to the liquor scrubber an excess of back-pressure to the extent of 25-10ths was discovered; that this back-pressure was found to exist in the two topmost tiers of boards; and that the three top tiers having been taken out, cleaned, and replaced, the pressure to work the scrubber was normal. The report proceeded: "As the whole of the purifier boxes were filled with a mixture of all the limes in store, and as a period ranging from three to six weeks must elapse before a rotation of one set can be completed, I could not ascertain until the expiry of that time whether it was due to the lime alone, or to the scrubbing apparatus being thrown out of action, or to both of these causes combined, that the purifiers required to be changed quicker than usual. On consideration of the whole matter, I am of opinion that, had the lime in question been of uniformly good quality, the inconvenience and extra cost occasioned would not have been so great." Mr. Mitchell appended a statement showing that for the months of July, August, and September the extra cost of lime was £128 12s. 4d., and of wages, £52 6s. 4d.—a total of £180 18s. 8d. Mr. Wells, who was a member of the Sub-Committee, dissented from their finding, and submitted an independent report, in which, after giving his view of the scientific aspect of the question, he said that in his opinion no blame could be attached to the lime, that the small quantity of gas passing through a large plant in the summer time arrived at the scrubber, into which an insufficient quantity of water was entering; that had there been sufficient water, the ammonia would have been completely eliminated, and the gas would have absorbed enough water to have kept the lime in the purifiers in a moist state; that there was not a sufficient quantity of water in the scrubber; that consequently the gas passed to the purifiers in a very dry state, when the ammonia, having a strong affinity for water, together with the dry gas, eagerly absorbed what little moisture there was in the lime; and that the lime, deprived of moisture, refused to perform the function of removing the sulphur, and hence the necessity to change the purifiers in rapid succession. There was sufficient in Mr. Wells's report to have warranted inquiry or experiment; but the Commissioners did not face an inquiry, but practically shelved the whole question, and to that course Mr. Wells assented. Therefore I conclude that they did not wish to see anything wrong. I do not blame them. It is no part of their duty to damage their own business; and they have probably discovered that now, but only after they had driven Mr. Wells to the course of making public a matter it would have been as well for them to have kept dark.

The Engineers' report for the month of November, showed that from the Edinburgh works the output was 130,435,000 cubic feet, an increase, as against November of last year, of 9,107,000 cubic feet; and that from the Leith works the output was 44,969,000 cubic feet, a decrease of 11,105,000 cubic feet—making a total decrease from both works of 1,998,000 cubic feet. Mr. Mitchell, in Edinburgh, got 10,002 cubic feet of gas from coal of an average price of 18s. 6rd. per ton, as compared with 9808 cubic feet in November of last year from coal costing 15s. 9d. per ton; while Mr. Linton, in Leith, got 10,557 cubic feet from coal costing 19s. 10³d., as against 10,357 cubic feet last year from coal costing 16s. 6¹d. The average illuminating power in Edinburgh was 26.56 candles, as compared with 25.52 candles last year; and in Leith, 29.50 candles, as against 26.75 candles last year.

An elaborate table was submitted which showed the quantity of gas manufactured, with the cost of coal, wages, and manufacturing and distribution charges upon revenue from the 1st of August, 1888, when the Commissioners took over the gas undertakings. In the three years dealt with, it was shown that in the Edinburgh works the yield of gas per ton of coal was 9825, 9728, and 9676 cubic feet respectively; the average cost of the coal per ton, 12s. 5.29d., 11s. 6.29d., and 16s. 4.16d.; the net cost per 1000 cubic feet of gas made, 11.07d., 10.11d., and 14.87d.; the manufacturing wages and charges, including purification,

per 1000 cubic feet made, 6'40d., 7'48d., and 8'07d.; repairs, maintenance, and renewals of works and plant, per 1000 cubic feet made, 1'41d., 1'09d., and 6'4d.; the repairs, maintenance, and renewals of mains, service pipes, and meters, per 1000 cubic feet made, 1'54d., 2'09d., and 2'41d. The total charges for coal, manufacture, and distribution per 1000 cubic feet made, were: August 1, 1888, to May 15, 1889, 20'44d.; May 15, 1889, to May 15, 1890, 20'78d.; and May 15, 1890, to May 15, 1891, 26'30d. In the Leith works, the yield of gas was 9761, 10,360, and 10,032 cubic feet per ton of coal; the average price of coal, 10s. 5½d., 11s. 9½d., and 15s. 5d.; the net cost of coal per 1000 cubic feet of gas made, 9'22d., 10'12d., and 14'03d.; manufacturing, &c., charges, per 1000 cubic feet made, 6'75d., 7'00d., and 8'16d.; repairs, &c., of works and plant, per 1000 cubic feet made, 1'22d., 1'76d., and 2'25d.; repairs of mains, &c., 1'24d., 3'24d., and 5'22d.; and the total cost, per 1000 cubic feet made, 18'43d., 22'12d., and 29'66d.

A question of considerable interest to gas companies and corporations was before the Edinburgh and Leith Gas Commissioners in a report by the Finance and Law Committee, that the Inland Revenue authorities proposed for the first time in the experience of the gas companies and the Commissioners not to allow the ordinary law and parliamentary expenses to be deducted before fixing the surplus on which income-tax was payable; and that the Committee, considering that it involved a payment of £70 or so of tax, had resolved to appeal against it. The action of the Committee was approved of. The result of this appeal will be eagerly looked for by others; as it will determine for them the course which the taxing authorities will pursue with regard to gas undertakings all over the country.

A very decided movement in favour of the acquisition of the gas-supply undertaking of the burgh has just been taken by the Town Council of Stirling, within which body there has frequently been talk with that object in view during the last ten or twelve years. At the last meeting of the Council, a motion was submitted by Councillor Dougall that the Lighting Committee report at an early date on the existing powers and limitations of the Council relative to the purchase or construction of gas-works for the burgh; also on the probable cost and producing capacity of the present gas-works, and the nature of existing agreements relative to burgh lighting and street wayleaves. In supporting his motion, Councillor Dougall said that he hoped its spirit and scope would commend the motion to the members of the Council. It was merely a preliminary inquiry that he asked for, for the purpose of endeavouring to correct the misapprehension which existed in the public mind, and also, judging from recent speeches, in the minds of some members of the Council itself, concerning their position in regard to the gas question. When they had the information which was asked for in his motion, they would be better able to judge the whole case on its merits. There were, he admitted, difficulties surrounding the question, which bound them down to very narrow limits in regard to their action; but it was well, he thought, that those limits should be known not only to the Council, but also to the community at large. He trusted that the terms of his motion, if carefully carried out, would yield them a full and particular understanding of their powers and their limitations as a Council. He thought they ought to adopt and work upon the broad general ground that all monopolies, such as gas supply, ought to be under the municipality. Therefore, he asked his colleagues to support his preliminary motion; and he did so in no spirit of antagonism to the Gas Company. When they considered the present enormous, or alleged enormous, profits, they should also remember that there must have been a day when there was a certain measure of risk connected with the Company, and a corresponding benefit to the community, who were enabled to enjoy the advantage of gas without any risk as to the capital employed. They should approach the Gas Company in no antagonistic spirit, but solely as discharging a public duty. The motion was seconded; and it led to an interesting discussion, in which there was practically no opposition. It was put in such a fair spirit and moderate terms that its unanimous approval followed almost as a matter of course. It was eventually agreed to remit the motion to the Lighting Committee, on the understanding that if the expenses went beyond the usual amount allowed to Committees, and if they required a report from a skilled engineer, they must go back to the Council. The mover of the motion was added to the Committee. One of the local newspapers, in dealing editorially with this subject, says that the gas consumers of Stirling "have every reason to complain that, for such bad gas, they are charged such a high sum. We trust that, as a result of the remit, the Lighting Committee will be able at the next meeting to bring up a report which will pave the way to a speedy solution of the whole question. The Council must insist on better and cheaper gas, resolve to take over the present works, or if neither of these is found practicable, consider seriously whether it would not be the best plan to start an opposition company. The present state of matters cannot be allowed to continue much longer."

It has been stated, apparently on the very best authority, that the total amount of money borrowed for the Greenock Gas Trust undertaking down to March 25, 1891 (not deducting the amount repaid), is £142,154; the period over which the loans extend being seven years, at 3 to 4 per cent. The total amount repaid, redeemed, or placed in the sinking fund is £42,749.

Within the area of Greater Glasgow and the districts beyond, to which the Corporation Gas Commissioners now supply gas, there are rather more than 155,800 meters, which are measuring, more or less correctly, the amount of gas consumed. Over the past year there was an increase of considerably more than 3000 meters. That area is something like nine or ten miles in length by six miles in width. Of course, much of it is rural territory. There are six gas-works employed in producing the requisite lighting material, and in no case does the price exceed 2s. 6d. per 1000 cubic feet.

There has been a quiet business in the Glasgow pig iron market this week, which ended on Thursday.

It is reported by an eminent local firm of chemical brokers that the opening price of the year for sulphate of ammonia was £10 12s. 6d. to £11 per ton for spot and forward, and that the close was £10 5s. to £10 12s. 6d. per ton as in delivery. The highest price was in March, when £11 15s. per ton was reached; and the lowest in December, about £10 per ton.

CURRENT SALES OF GAS PRODUCTS.

LONDON, Jan. 2.

Tar Products.—Unfortunately, the position of these shows no improvement, but rather the reverse. Buyers of benzol seem indisposed to pay more than 1s. 7d. to 1s. 7½d. for 50's, and 1s. 11d. to 2s. 1d. for 90's; but even at these prices they hold off in the expectation of a further fall. Anthracene is also weaker, at from 1s. to 1s. 1d. for "A" quality, and 8d. to 9½d. for "B." Oils also are sharing in the depression; and creosote is quoted very low—producers offering at as low as ¾d. per gallon on rails. There is no improvement in carbolic acid, the price for which is 1s. to 1s. 1d. per gallon for 60's. The value of tar is being seriously affected by these low prices, and were it not for pitch, the position would be a very serious one, approaching the minimum prices of a few years ago. Prices are: Tar, 18s. to 20s. Pitch, 33s. 6d. Toluol, 1s. 2d. Benzol, 90's, 1s. 11d. to 2s. 1d.; 50's, 1s. 7d. to 1s. 7½d. Solvent naphtha, 1s. 1d. Naphtha, 30 per cent., 11d. Creosote, ¾d. to 1d. Crude carbolic, 60's, 1s. 1d.; crystals 5d. Cresol, 8d. Anthracene, "A" quality, 1s. to 1s. 1d.; "B," 8d. to 9½d.

Sulphate of Ammonia shows very little improvement; but to-day's price is about £10 5s., less 3½ per cent. f.o.b. Hull, although £10 17s. 6d. has been spoken of.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Except that the usual holiday stoppages of the pits for Christmas and the New Year (which, in most cases, have extended over more than a full week) have caused a temporary pressure for supplies in nearly all descriptions of fuel, there is no real improvement to notice in the coal trade of the Lancashire district; and the year opens without any upward movement in prices. The better qualities suitable for house-fire purposes remain, however, very firm, at fully late rates. Best Wigan Arley averages 12s. 6d. per ton; Pemberton four feet and second qualities of Arley, 10s. 6d. to 11s.; and common house fire coals, 9s. to 9s. 6d. at the pit mouth. Inland requirements for iron making, steam, and general manufacturing purposes, continue only moderate; and steam and forge coals do not average more than 8s. to 8s. 6d. per ton at the pit mouth. For shipment, however, there has been an active demand during the past week; and rather better prices have been ruling. Steam coals delivered at the ports on the Mersey readily fetch 9s. 9d. to 10s. 3d. per ton. The better qualities of engine fuel are moving off readily; and common sorts are not being pushed at the low figures recently accepted for special lots. But there is no actually quotable advance upon late rates. Burgu at the pit mouth ranges from 6s. and 6s. 6d. per ton for ordinary to 7s. for special sorts; best slack, 5s. to 5s. 6d.; good ordinary descriptions, 4s. to 4s. 6d.; and common sorts, about 3s. to 3s. 6d.

Northern Coal Trade.—There has been a very good demand for coal during the last few days; the supply having been reduced by the holidays. Best Northumbrian steam coal is steady, at about 10s. 3d. per ton, free on board; and second classes, 1s. per ton lower. Small steam is very quiet. The locomotive steam-coal contracts have been placed at from 1s. to 1s. 3d. per ton reduction on the prices that ruled for the 1891 contracts; and some of the most northern collieries would have taken slightly less had they been able to obtain larger contracts. Gas coal has been very firm; and the enormous consumption must have reduced the stocks held by some gas companies very considerably. A good demand may for some weeks be anticipated; though the heavy drain will now diminish. The price for odd cargoes of best Durham gas coals has of late been about 9s. 6d. per ton, free on board; but for contracts over next year, from merchants supplying orders for export, about 9s. per ton is the current price. Bunker coal is steady, with not a very large demand; a few more of the older type of vessels being laid up. Manufacturing coal is dull; the consumption being lessened by the prolongation of holidays at some of the chemical factories. Coke is rather firmer; best blast-furnace coke being in demand on rumours of duty being about to be levied in Spain. The price varies from 16s. to 16s. 6d. per ton, free on board. Gas coke is being sold at rather lower prices, to reduce the heavy stocks at some works. For contracts, about 10s. per ton seems the price.

West of Scotland.—The coal trade is practically at a standstill; and work at the collieries will be generally suspended until the middle of this week. Quotations are nominally unchanged. Splint coal is in good demand for gas purposes, and 9s. 6d. per ton f.o.b. is the closing price for this quality. The cannel outputs for the next few months are all sold at good prices. There are great complaints against the railway companies for the delay of traffic. Shipments of Scotch coal in the past week were less than in the previous week by fully 10,000 tons. A comparison with the same six days of last year shows an increase of over 48,000 tons; but it must be remembered that traffic was then practically at a standstill on account of the railway employees being on strike. This also accounts for the increase on the year to date having risen to 309,747 tons.

Fatal Accident at the Vauxhall Gas-Works.—An inquiry was recently held by Mr. A. W. Wyatt, Deputy-Coroner for East Surrey, into the circumstances attending the death of Henry Davis, a stoker in the service of the South Metropolitan Gas Company. Deceased was employed at the Vauxhall station; and while engaged in clearing a regenerator furnace, one of the fire-bars slipped out and fell into the ash pan, allowing the red-hot coke which it had supported to fall with it into the water. The body of steam generated scalded the deceased very badly, and he had to be conveyed to the hospital. On arriving there he stated that his hands only were burned. These were attended to, and he was allowed to go home. But he was subsequently admitted an in-patient, when an examination revealed the fact that the scalding extended over nearly the whole of his body. To these injuries he succumbed. There was no evidence to show negligence on the part of the Company. One of the foremen at the works stated that the bars were in fair working order; and it was deceased's duty to procure others if he found anything wrong with them. The jury returned a verdict of "Accidental death."

Proposed Water-Works for Marlborough.—The Marlborough Town Council have appointed a Committee to make preliminary inquiries as to the probable cost of erecting water-works for the borough, the cost of engineering, and the suitability of various sites.

The Wages of Gas Workers at Kingston-upon-Hull.—Regarding the paragraph on this subject which appeared in the JOURNAL for the 15th ult., we learn that the Directors of the Kingston-upon-Hull Gas Company have conceded the whole of the demands of the men, with the exception of those of the yardmen, to whom they decided to offer 3s. 10d. per day.

A Generous Gift.—Miss Talbot, of Margam, has presented to the Margam Local Board, a reservoir, having a capacity of 10,000 gallons, for the water supply of Llittihiri, Penycaid, and Gwarycain. It appears that some time ago the Local Board took the matter in hand of supplying the district; and when Miss Talbot heard that delay would be caused by the necessary application to the Local Government Board for power to borrow the money, she generously came forward, and bore the whole expense, which has amounted to £1000.

The New Water-Works for Burnley.—The new water-works of the Burnley Corporation at Cant Clough are nearly completed; and water will now be impounded. The capacity of the reservoir is estimated at 264 million gallons. The works, which were started about seven years ago, were computed to cost about £70,000; but the total expenditure has been something like £200,000. The most remarkable feature of the works is a puddle trench, varying in depth from 100 feet, and said to be the deepest reservoir puddle trench in the world.

Longton (near Preston) Water Supply.—In addition to having received a condemnatory letter from the Local Government Board, the Preston Rural Sanitary Authority have had a letter from the Clerk to the County Council, containing a resolution passed by the Public Health Committee, calling the attention of the Authority to the possible danger to the public health of the district south of the Ribble through the absence of a proper water supply. Unless steps were taken to supply the want, the Committee threatened to recommend the County Council to make a representation to the Local Government Board. In acknowledging the letter, the Sanitary Authority stated that notices had already been served upon the property-owners.

Rushden Gas Supply.—In continuation of the particulars given in the paragraph which appeared in the JOURNAL for the 15th ult. on the above subject, we have to record that after the resolution was carried in favour of purchasing the Rushden Gas Company's property by the parish, a poll was demanded, and it was taken on the 21st ult. Very little interest was shown in it; and only 285 persons voted. The result was as follows: For the purchase, 154 votes polled by 124 voters; against it, 241 votes polled by 165 voters—giving a majority of 87 votes and 41 voters against the proposal. The Rushden and Higham Ferrers Companies are now taking the necessary steps for voluntarily winding up each concern; and they are uniting to form a new Company, which will at once erect works in a central position for the supply of both places and the adjoining districts.

The Relative Cost of Gas and Electric Lighting.—The Accrington Corporation have under consideration a scheme for the construction of a central generating station; but before establishing it, they are anxious to ascertain what demand for the supply of electricity can be depended upon, and the inhabitants have been asked to state whether they purpose making use of the light on their premises, and to what extent. For their guidance, Mr. J. N. Schoolbred was requested to report as to the cost of the electric light as compared with the present price of gas in Accrington; and this he has done. He says that the price of the electrical energy to be supplied by the Corporation is limited by their Provisional Order to 8d. per unit. The illuminating value of a unit of electrical energy is equivalent to that of 100 cubic feet of gas; so that 10 units with incandescent lamps of 16-candle power each, will produce an amount of illumination about equal to 1000 cubic feet of gas. This electrical energy, if supplied at 6d. per unit, is equivalent to gas at 5s. per 1000 cubic feet. The cost of supply will, of course, vary with the demand; the greater the demand, the less the Corporation will be able to supply the light at. Beyond the cost of the light, will be the meter-rent at 10 per cent., as with gas-meters. As against the extra price over that paid for gas are to be set, adds Mr. Schoolbred, the undoubted advantages of cleanliness, brilliancy, and clearness of light, absence of heating, and purity of the atmosphere of the rooms where used, and a perfect freedom from danger of explosions.

Welsh Rivers and English Water Schemes.—Mr. Stuart Rendel, M.P., leader of the Welsh Parliamentary Party, in replying to a correspondent upon the proposed schemes for supplying Birmingham and London with water from Welsh rivers, writes: "I do not quite understand what is meant by protecting Welsh water for Welsh consumption. We do not protect Welsh coal or Welsh iron for Welsh consumption. The Severn and Wye carry the bulk of Welsh water into England. Is this unpatriotic and unjust? Welsh waters artificially supply Liverpool, but not at any expense or detriment to Wales. On the contrary, Lake Vyrnwy, made at the cost of Liverpool, is, or should be, of value to Wales. It should prevent the injurious flooding of the Vyrnwy and Severn, and render their flow somewhat more uniform. The enterprise generally brought much money into Wales. What the Birmingham water scheme may be, I do not know. I am sure that there is no ground for supposing that, if it interferes with Welsh waters to Welsh disadvantage or without full compensation to Wales, it will obtain parliamentary sanction. If the cry of 'Wales for the Welsh' can be justly discredited, it will be by interpreting it as meaning such follies as 'Welsh water for Wales alone.' County Councils are quite right in claiming that Wales shall not part with its water to its own loss, or without full value received; but to start at the present juncture a Welsh national cry upon the catch-word of 'Welsh water for Welsh use' would only be to bring Welsh nationality into ridicule." Sir Hussey Vivian, M.P., writes in favour of carefully providing for the fullest enjoyment to the inhabitants of Wales of all such water as they may require for all time. Mr. A. J. Williams, M.P., insists that adequate compensation should be given not only to a few landowners, but for the benefit of the people.

The General Gas Lighting and Heating Company of Brussels.—According to the report presented by the Directors of this Company to the shareholders, at their annual general meeting on the 19th ult., the net profit realized by the undertaking in the year ending Aug. 31 last was 2,253,490 frs., as compared with 2,298,014 frs., in the preceding twelve months. Deducting the sinking fund and other charges, there was left a disposable balance of 899,532 frs. After paying the statutory dividend of 25 frs. per share, and making certain allowances to the Directors and chief officers, a final dividend of 11 frs. per share was recommended; making 36 frs. per share, or 7.2 per cent. (the same as before), and leaving 22,799 frs. to be carried forward. The Company have a share capital of 11,677,500 frs.; and a sum of 9,773,000 frs. has been raised on bonds. The reserve and sinking funds make together a total of 8,703,356 frs. The Company possess 19 works, and have an interest in two gas undertakings—one at Carcassonne, the other at Lisbon. Towards the close of the year 1890, the concession for the supply of gas to Raismes, a suburb of Valenciennes, was acquired; and the Company have lately completed an electric lighting installation at Catania. At Carcassonne the sale of gas increased; and consequently there was an augmentation of profits. In Lisbon, where the amalgamation of the two Gas Companies was determined upon in July last, the concession, in regard alike to the supply of gas and the electric light, has been prolonged under improved conditions. Notwithstanding the severity of the winter 1890-91, the floods with which many of the towns in France were visited, the frequent threats of strikes by the workmen (necessitating the accumulation of unusually large quantities of coal), and the sudden rise which took place in the price of raw material—all circumstances entailing expense and loss—the results were regarded by the Directors as very satisfactory. The financial position of the undertaking has further improved, owing to the substantial amounts which have been applied to the amortization of the capital. With regard to manufacturing operations, the quantity of gas made in the year covered by the report was 25,273,792 cubic metres, of which 21,813,713 cubic metres were sold. The sales in the preceding year were 21,412,484 cubic metres; being an increase of 401,229 cubic metres. Of the 86,605,632 kilos. of coal carbonized, 61,359,962 kilos., or 70.85 per cent. remained as coke; the other products being 4,476,665 kilos. of tar, and 88,650 hectolitres (1,950,300 gallons) of ammoniacal liquor. The report was adopted.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 15.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon invest. ment.
£			p. c.					£ s. d.
GAS COMPANIES.								
590,000	10	15 Oct.	10½	Alliance & Dublin 10 p. c.	10	15½-16½	..	6 7 3
100,000	10	"	7½	Do. 7 p. c.	10	11-12	..	6 5 0
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105-107½	+½	4 13 5
100,000	20	27 Nov.	8	Bahia, Limited	20	12-14	..	11 8 6
200,000	5	12 Nov.	7½	Bombay, Limited	5	6½-6¾	..	5 11 1
40,000	5	"	7½	Do. New	4	4½-5	..	6 0 0
380,000	Stock.	13 Aug.	12½	Brentford Consolidated . . .	100	210-220	..	5 11 4
125,000	"	"	9½	Do. New	100	157-162	..	5 14 2
220,000	20	16 Sept.	11½	Brighton & Hove Original . .	20	40-42	..	5 9 6
888,500	Stock.	16 Sept.	5	Bristol	100	98-103	-2	4 17 1
320,000	20	15 Oct.	11½	British	20	42-44	..	5 2 3
50,000	10	28 Aug.	11½	Bromley, Ordinary 10 p. c.	10	18-20	..	5 15 0
50,380	10	"	8½	Do. 7 p. c.	10	13-15	..	5 13 4
328,750	10	"	—	Buenos Ayres (New) Limited	10	5½-6½	-½	—
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	90-95½	+1½	6 6 4
150,000	20	13 Aug.	8	Cagliari, Limited	20	24-26	..	6 3 1
550,000	Stock.	15 Oct.	13½	Commercial, Old Stock . . .	100	240-250	..	5 10 0
165,000	"	"	10½	Do. New do.	100	185-195	..	5 10 3
130,000	"	30 Dec.	4½	Do. 4½ p. c. Deb. do.	100	117-122½	+½	3 13 9
800,000	Stock.	11 June	13	Continental Union, Limited .	100	215-225*	..	5 15 6
200,000	10	"	10	Do. 7 p. c. Pref.	100	185-195*	..	5 2 7
75,000	Stock.	16 Sept.	10	Crystal Palace District . . .	100	190-200	..	5 0 0
486,090	10	15 July	10	European, Limited	10	19-20	..	5 0 0
354,060	10	"	10	Do. Partly paid	7½	14-15	..	5 0 0
5,470,640	Stock.	13 Aug.	13	Gaslight & Coke, A, Ordinary	100	221-226	+2	5 15 0
100,000	"	"	4	Do. B, 4 p. c. max.	100	94-97	..	1 2 5
665,000	"	"	10	Do. C, D, & E, 10 p. c. Pf.	100	248-253	..	3 19 1
30,000	"	"	5	Do. F, 5 p. c. Prt.	100	118-123	..	1 4 1
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	172-177	..	1 4 9
1,300,000	"	"	7	Do. H, 7 p. c. max.	100	153-158	-2	1 8 7
463,000	"	"	10	Do. J, 10 p. c. Prt.	100	245-250	..	4 0 0
476,000	"	"	—	Do. K, 6 p. c. Prt.	100	145-150	..	4 0 0
1,061,150	"	11 Dec.	4	Do. 4½ p. c. Deb. Stk.	100	110-114	..	3 10 2
294,850	"	"	4½	Do. 4½ p. c. do.	100	118-123	..	3 13 2
908,000	"	"	6	Do. 6 p. c. do	100	160-165	..	3 12 9
3,800,000	Stock.	12 Nov.	12	Imperial Continental	100	219-224	+1½	5 7 2
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4-4½	..	6 13 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p. c. Deb.	100	109-111	..	4 10 1
541,920	20	27 Nov.	6½	Monte Video, Limited. . . .	20	15-16	..	8 2 6
150,000	5	27 Nov.	10	Oriental, Limited	5	8½-9	..	5 11 1
60,000	5	30 Sept.	7	Ottoman, Limited	5	4-5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited.	10	2½-3½	..	—
People's Gas of Chicago—								
420,000	100	3 Nov.	6	1st Mtg. Bds.	100	94-99	..	6 1 3
500,000	100	1 Dec.	6	2nd Do.	100	93-98	..	6 2 5
150,000	10	15 Oct.	10	San Paulo, Limited	10	11-12	..	8 6 8
500,000	Stock.	28 Aug.	15½	South Metropolitan, A Stock	100	265-275	..	5 12 9
1,350,000	"	"	12	Do. B do.	100	220-225	+1	5 6 8
200,000	"	"	13	Do. C do.	100	225-235	..	5 10 8
700,000	"	30 Dec.	5	Do. 5 p. c. Deb. Stk. . . .	100	138-143*	+½	3 10 0
600,000	Stock.	16 Sept.	11½	Tottenham & Edm'ton, Orig.	100	—	..	—
WATER COMPANIES.								
729,331	Stock.	30 Dec.	10	Chelsea, Ordinary	100	255-265*	+5	3 15 6
1,720,560	Stock.	15 Oct.	8	East London, Ordinary . . .	100	203-208	+5	3 16 11
544,440	"	30 Dec.	4½	Do. 4½ p. c. Deb. Stk. . . .	100	136-140*	..	3 4 3
700,000	50	11 Dec.	8	Grand Junction	50	98-103	+1	3 17 8
708,000	Stock.	13 Aug.	10½	Kent	100	205-275	+7½	3 16 4
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max. . . .	100	220-230*	..	4 2 7
406,200	100	"	7½	Do. 7½ p. c. max.	100	189-194*	..	3 17 4
260,000	Stock.	30 Sept.	4	Do. 4 p. c. Deb. Stk.	100	120-123	..	3 5 0
500,000	100	13 Aug.	12½	New River, New Shares . . .	100	335-345	+5	3 10 4
1,000,000	Stock.	30 July	4	Do. 4 p. c. Deb. Stk. . . .	100	125-127	..	3 3 0
902,300	Stock.	30 Dec.	6½	S'thwk & V'xhall, 10 p. c. max.	100	147-152*	+1½	4 5 6
126,500	100	"	6½	Do. D 7½ p. c. do.	100	138-143*	-1½	4 10 11
1,155,066	Stock.	11 Dec.	10	West Middlesex.	100	245-255	+2½	3 18 5

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THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JANUARY 12, 1892.

Technical Societies and their Methods.

THE appearance of the Transactions of The Gas Institute for 1891, and the non-appearance as yet of the book which may be supposed to be in preparation for the purpose of worthily recording the proceedings of the first meeting of the Institution of Gas Engineers, constitute two reasons for devoting a little consideration to the general subject of the reporting of the papers and discussions which supply one of the chief reasons for the existence of technical and scientific Societies. The same subject, curiously enough, is also discussed in the current number of our contemporary the *Electrician*. It is not going out of the way to remark that this matter of the publication of "Transactions" of Societies of the character of those in which our contemporary and ourselves are most nearly interested, is something that calls for particular attention from those who are concerned for the continued prosperity

and welfare of these organizations. The notion that every respectable body of the kind ought to publish its own annual report, is an idea that belongs distinctly to the order of conventional, or traditional, opinions; and all such opinions ought from time to time to be overhauled and corrected up to date. There are good reasons why this should be done in regard to the publication of Transactions, because such publication always constitutes a heavy tax upon the resources of the organizations which follow the practice; and it must often have occurred to members of these bodies that there is a great waste of money in this respect. It never seems to occur to the authorities of technical Societies to consider their procedure in this matter from a rational common-sense point of view, in order to satisfy themselves, as men of business, whether the publication of Transactions is necessary or desirable, taking every case upon its merits; or, if this question is answered in the affirmative, how the publication can be best arranged for, and at the lowest cost. Every Society must be a rule for itself in this matter; because the resources, needs, and circumstances of no two bodies are alike. It is perfectly reasonable and natural that a Society should like to preserve a permanent record of what is said, written, and done under its auspices; but how this is to be accomplished, and the form the record should take, are greatly affected by circumstances. When the Society meets frequently, the best form in which its Transactions can be cast is that of a "Journal;" and this is the method adopted by the Society of Arts, the Society of Chemical Industry, the Chemical Society, and others. Some organizations, such as the Institution of Civil Engineers, produce quarterly volumes of reports of their proceedings. Others, however, like The Gas Institute, publish Annual Transactions. Publications of this nature, again, exhibit one striking line of distinction among themselves, which refers to their matter, and not to the period of their appearance: Either they are strictly and solely reports of the proceedings of the Society which publishes them, or they also comprise collected information relating to the subject-matter with which the name of the Society is identified. Obviously, the preparation and production of a volume of the latter class is a different business altogether from, and depends upon a different order of sanctions to, those which govern the publication of a mere report. The question whether a Society shall undertake the issue of one or the other kind of Transactions depends upon many considerations, and not least upon the existence or absence of a need for a record of any particular class of matter. It would be superfluous for a Society to undertake work that is performed by other means; yet that is precisely what is done in some instances, to the neglect of necessary tasks.

Let us explain. Supposing that a technical Society is devoted to a cause in which no newspaper takes an interest, and which has no special journal to represent its current developments. In such a case—hardly conceivable, indeed, in this age of swarming hebdomadal publications—it would be necessary for the Society to draw up its own report and publish it, independently of all other appeals to a pre-occupied public. But when a Society cultivates a department of industry which is well represented by more than one special journal, and when these journals, for their own purposes, take good care to acquaint the world with what the Society does every time it meets, where is the sense in doing the work over again—after it has all "gone cold"—at the trouble and expense of the Society, and laboriously publishing a volume of Transactions ever so late in the day? "Ah! but," we shall be told, "no really respectable Society can take for a satisfactory report of its proceedings just what an editor of a technical journal sees fit to give. The authoritative report must be fuller, it must be corrected, and much must be included in the Transactions in the shape of plates of illustrations, diagrams, &c., which an editor of a weekly paper would not think it worth his while to re-produce." This observation is perfectly just; but it is not the less certain that, by a little sensible pre-arrangement in the majority of cases, a great deal of wasteful repetition in publication might be prevented. Plans, &c., must, of course, be reproduced in authoritative Transactions much more fully than they can be, as a rule, in a weekly paper, or the latter would usurp the office of the former altogether. But apart from this consideration, the official report is rarely so much better than that given by a good technical journal as to warrant the exorbitant

cost at which it is usually prepared. Why could not the Council of an Institution give it out before a meeting that they are prepared to adopt, as the basis of their official report, the best rendering given by the attendant press? They would secure every possible attention; procure better reports; and save much money. Some bodies of the kind will not do this because, forsooth, it would be "undignified," or more often because they are afraid that some rubbishy print will accuse them of "favouritism." Foolishness of this kind leads to waste of money, which is no great harm where cash is plentiful; but it sometimes happens that the best interests of struggling Societies suffer from the prevalence of absurd ideas respecting ways and means of publication, as well as lack of backbone, in their administrators. And after all is said, it often happens that the most piquant and instructive portions of the proceedings of technical Societies never appear in the formal Transactions at all, but only occur as criticism and correspondence in those journals which it is the preposterous cue of Institution managers to affect to disdain.

Apart altogether from the question of reporting transactions, however, there is another aspect of the general subject of the utility of technical Societies, which is the point enlarged upon at the present time by the *Electrician*. It refers to the prodigious number of papers, articles, and technical matter generally which the Societies, the patent offices, and the journals of the civilized world continually pour out ostensibly for the instruction, but really for the bewilderment, of professional men. "Things have already come to such a pass, that it is almost impossible for anyone to read more than a fraction of the literature referring to his own special class of work; and science is spreading so rapidly that in the near future matters may be expected to be much worse." The need, therefore, has arisen for clear and concise abstracts of every special class of publications, to serve for reference. It is unnecessary to prove at length how desirable such abstracts, if only in the form of what the French call a *catalogue raisonnée*, would be in the gas industry. "The scientific Societies could do much to forward this work, either singly or in combination. We have already pointed out that the technical press has relieved these bodies of the need of publishing results, and the aim of Societies should now rather be the discussion of papers which have not been read before them, than, as too often happens, the reading of papers at such length that no time is left for discussion. The *raison d'être* of all Societies and similar Institutions is the bringing together of 'birds of a feather' for the critical examination of new devices, discoveries, and theories, and the collection and editing of scattered scientific memoirs." With these observations we heartily agree; and we think that the sooner our several Gas Engineering Societies put themselves abreast of the times, and, discarding mere conventionalities of use and wont, which have outlived any useful purpose they ever served, set their machinery to do good and necessary work, the better they will deserve of their patrons, members, and supporters. At present, it is certainly open to be said that they get very little in return for their outlay.

The Crystal Palace Electrical Exhibition.

LAST Saturday was fixed for the opening of the Crystal Palace Electrical Exhibition, for which extensive preparations have been in progress during several weeks past. There will, of course, be many points of difference between the exhibits now or shortly to be visible at the Crystal Palace and those which occupied the same place ten years ago; but it is by no means certain that those differences will be either as remarkable, or as important, from the popular point of view as the ordinary public will be likely to expect. Visitors to the Crystal Palace will still see a lot of hissing, reeking steam-boilers. Nobody can truthfully pretend that the Davey-Paxman boiler plant of 1882 was not every whit as good as anything of the kind that can be bought to-day. It is the same with the steam-engines. The same types of generators will be seen driving (apparently) the same snapping, sparking, buzzing dynamos; and the uninstructed public will fail to mark any radical difference between the general aspect of this and the last Electrical Exhibition. Moreover, there have been plenty of electrical exhibitions, of a sort, since 1882. Not one of the popular shows held at South Kensington or at Chelsea has been without its electric lighting section.

There is reason for supposing that strong partisans of the electric lighting industry cherish the delusion that the boilers and steam-engines and dynamos which have been so much in evidence at these displays were admired by the people who attended them as a means of amusement; but it is tolerably certain that even of the pleasure seekers at these places who admired the electric lighting itself, very few regarded the generating plant as other than a nuisance. We shall probably be quite safe in asserting that of the thousands of people who will stroll through the parts of the Crystal Palace appropriated for the present exhibition, during the time that it remains open, very many will be disappointed to learn that dirty boilers and humming steam-engines are still absolutely necessary adjuncts to the production of electricity on the large scale. From time to time one hears a good deal of vague talk about electricity superseding steam as a motive power. The general public really look for this, as an advance in modern material civilization. Whenever they hear of electrically-driven trains, and of electro-motors for various purposes, the popular notion unquestionably is that, in some unexplained way, electricity is to take the place of steam as a motive power; and when it is seen at the Crystal Palace that nothing of the kind is within the range of possibility, the popular feeling will be that the main thing about electrical generation stands just where it did ten years ago—which is perfectly true. There are to be plenty of gas-engines at the Crystal Palace; and the slower speed at which dynamos are now driven, as compared with similar machines ten years ago, will betray itself in other modifications of driving apparatus. The freedom with which incandescent electric lamps are now used for decorative purposes will also be noticeable in this display; and there will be much upholstery and ornamental interior lighting. Altogether, it is to be supposed the exhibition will be worth seeing; and we shall take good care to acquaint our readers with everything instructive that may transpire in regard to it. But there is nothing as yet to show that it will greatly impress the public with its evidence of the improvement in electric lighting technique since 1882. It will, of course, be clear that the business has grown; but we are by no means inclined to think that public opinion will hold that it is materially better in its methods or its results than it was ten years ago.

A Question of Hygrometry.

AN interesting little discussion took place last month, in the correspondence columns of *The Times*, upon the question whether burning gas in a room tends to dry or to wet the walls. One of the disputants consulted Mr. A. Vernon Harcourt on the subject, "as there is no higher authority where any matters relating to the combustion of gas are concerned;" and the verdict was "that, in a room with no provision for ventilation beyond a chimney with no fire burning, and on a still, cold day, the burning of gas in the room is more likely to have a wetting than a drying effect." On the other hand, when there is a current of air through the room, Mr. Vernon Harcourt "has no doubt that the drying effects would exceed the wetting." Upon this head it may be remarked that the experience of shop-front designers is fairly conclusive. The glass of a window is a capital indicator of the condition of the air as regards moisture. In the case of a shop, which is an apartment having the whole of one side as a window, the condition of this large surface of glass, whether clean and dry or blurred and opaque with condensed moisture, is a matter of great importance to the proprietor. It is worse than useless for the shopkeeper to keep open, and burn gas with a view to attracting custom, if nobody can see through the window. And it is certain that, unless the shop is properly ventilated, lighting the gas will so increase the humidity of the enclosed atmosphere as to render the obscuration of the window by condensed moisture a question of a very few minutes when the outside temperature is low. The shop-front builder usually gets over the difficulty by arranging for ventilation along the whole length of the window—inserting a sort of open-work frieze immediately above the glass; and this, as a rule, has the desired effect. It is not that the gas produces by burning all the steam that appears condensed upon the window. Gas makes so little water, that any other method of lighting which raised the interior temperature without involving the combustion of hydrogen would produce practically the same effect. The result of steaming the glass is due

mainly to the fact that the temperature of the enclosed air is raised by the lighting agents, be they gas or anything else, and it therefore absorbs moisture from every available source, only to deposit it again when chilled by contact with a cold surface like that of the inside of a glass window. Thus we arrive at the somewhat paradoxical conclusion that it is really the drying—*i.e.*, the moisture-absorbing—capacity of the air of a gas-lighted room which is responsible for the streaming damp seen inside a closed window, or on a chilly wall, some time after the gas has been burning, and the ventilation has been insufficient.

The Weakness of the Labour Party.

THE attempts of a certain class of professional agitators to create a strong Labour Party, which should make its influence felt at the next general parliamentary election, and should also secure a share of representation upon all elective local governing authorities, are bound to fail while so many of the wire-pullers are at cross purposes. It has been repeatedly pointed out in these columns that a Labour Party, honestly and intelligently conducted by men of character and insight, might be expected to play a very useful part in the effort which we are all in our various degrees making to the best of our ability—the effort to leave the world better than we found it. Unfortunately, the first thing that a professional labour agitator thinks it his duty to do, is to set himself up in business as the only fountain of wisdom and tower of strength for those whom he designs to convert into his supporters. The new “leader” clambers into notoriety over the shoulders of the crowd; and, to begin with, he is content to play second fiddle to the recognized star performers. It is not long, however, before he essays a leading part on his own account. Anything which will ensure him a little individual prominence serves him for an opportunity—a successful strike, a conflict with the police, a right-of-way case, or a question of “intimidation.” Active participation in a little noisy performance of this nature, especially if attended with some cheap martyrdom, gives the budding agitator a sort of claim upon the managers of the Trade Union “fake;” and when the individual is next heard of, he is perhaps an assistant-secretary, a paid organizer, or something of the kind in connection with a new Union, with nothing to do but “spout.” After he has passed a certain point in the agitator’s career, the self-appointed “leader” wants a party all to himself. He narrowly scrutinizes the old lions of his hunting-ground, and passes much of his time in weighing the chances of an attack upon the positions of such as appear to him feeblest. He has no respect for the past of these veterans, and never loses an opportunity for undermining their influence and sapping their reputation in the present—all in order that he may occupy their place in the future. A recognized leader who has been at the head of his division of the Labour Party long enough to have earned the respect of the community at large, and to have seen the futility of some of the old nostrums so continually reappearing as wonderful new principles in the crude charters vaunted by the new-comers, is sure to be branded as old-fashioned and useless by those who fancy themselves in the line of succession to his dignities and emoluments. There is little mutual confidence among the horde of agitators, and few of them would not sell their rivals at slight provocation. This is the main reason why the so-called Labour Party has so little coherence, and why the specific programmes of its professional counsellors make so little headway in popular elections, in comparison with the ordinary generalized party principles.

The Proposal to Place a Bust of Murdoch in the Wallace Monument at Stirling.—Our readers will doubtless remember that, at the annual meeting of the North British Association of Gas Managers last July, it was decided to apply to the Provost and Town Council of Stirling, as custodians of the Wallace Monument in that borough, for permission to place, among the worthies of Scotland therein represented, a bust of William Murdoch, the inventor of gas lighting. Accordingly, the Secretary and Treasurer of the Murdoch Memorial Committee of the Association (Mr. J. M’Gilchrist, of Dumbarton) has addressed a letter on the subject to the above authorities, accompanied by a statement setting forth Murdoch’s claim to the honour solicited. Mr. M’Gilchrist points out that the next meeting of the Association, at which the centenary of the invention of gas lighting will be celebrated, is fixed to be held in Stirling in July next, provisionally on the permission now asked being granted; and occasion would then be taken to unveil the bust.

WATER AND SANITARY AFFAIRS.

THE address delivered at the meeting of the Balloon Society last Friday, by Mr. Harry Wilkins, the Vestry Clerk of St. James’s, Westminster, of which a report will be found in our present number, was remarkable for the fact that, while dilating on the Metropolitan Water Question, it was not altogether unfair to the Water Companies. In saying this, we do not mean to imply that Mr. Wilkins is at any time wilfully unfair. That of which we complain is the general recklessness with which the water supply, and the Companies who furnish it, are attacked by public speakers and writers. We do not agree with all that Mr. Wilkins said or proposed; but the animus of his remarks was in no respect objectionable. He acknowledged that, on the whole, the London Water Supply was never in so satisfactory a state as it is now; yet he had the idea that the inhabitants would be better served if the undertakings were in the hands of a public authority. The argument is one which reminds us very much of the epitaph: “I was well; I would be better; and here I am.” Admitting it as conceivable that the water supply might be more advantageously conducted by a public authority than by the Companies, it must be acknowledged that there is just a risk the other way. Is London prepared to see the water supply handed over to the County Council? Is Mr. Wilkins himself desirous of seeing such a change? He objects to the Water Bill which the Council, under cover of the Corporation of the City of London, are going to bring forward in the coming session. In his opinion, it is rather worse in some of its features than the rejected City Bill of last year; and he regrets, in very expressive terms, that the Corporation have been induced to sacrifice their dignity in order to further the designs of the County Council. Mr. Wilkins would prefer, as the Water Authority, a federation of the Municipal and County Councils of Greater London, with the Corporation of London at the head. He also objects to the notion of drawing a supply from some distant source, and is in favour of Sir Robert Rawlinson’s plan for the establishment of adequate storage reservoirs in the basin of the Thames. Accordingly, Mr. Wilkins sets aside the London County Council and their schemes for fetching water from Mid-Wales or Devonshire. Mr. Wilkins might also perceive that while there is no need to go to remote mountains or lakes in order to supply water to London, so in like manner the existing Water Companies are quite equal to the task of making the extra storage reservoirs in the Valley of the Thames. If it were necessary, they could go farther; but they are not disposed to fling away the money of the shareholders, in extravagant projects based on Utopian conceits. Perhaps the County Council also intend nothing of the kind; but they talk as if they did, and expect to be looked upon as very “progressive” and enlightened in consequence. The resolution adopted by the meeting at the close of Mr. Wilkins’s address was a very proper one, presuming it to be certain that London would be benefited by the transfer of the supply to a public authority. As the first step towards the change, it was agreed that the present undertakings should be purchased “on equitable terms.” This again is at entire variance with the policy of the County Council. With them, such purchase is the last thing, even if it comes to pass at all. But what are “equitable terms?” On this point Mr. Wilkins is not quite so clear as we could wish. This is certain, that if a shareholder is to lose part of his annual income, the bargain is not fair to him, let the calculation be ever so ingenious. Mr. Wilkins defends the lost Bill of the Vestries, which included a scheme of arbitration. But even that may be framed unfairly; and Mr. Wilkins admits that the opposition of the Companies was intelligible, while in his opinion the antagonism of the County Council to the arbitration clause was incomprehensible and inconsistent. However, Mr. Wilkins need not have been surprised, especially as the Water Trust were to proceed to purchase within two years after the passing of the Act. If the “equitable” only were intended, there would be a royal road to the end of this question, but—as suggested on a former occasion—the “if” is a big one.

The watershed question, to which we have often adverted, is the subject of a communication addressed to the Chief Inspector of Fisheries by the Chairman of the Severn Fishery Board. Although forwarded to this latter authority, the terms of the application are not limited to

any one interest, but comprehend all rights and parties that are in any way affected by the appropriation of water for outside purposes. The scheme of the Birmingham Corporation, to take some of the head waters of the Wye, is the immediate cause of the document being drawn up; but regard is also had to the different proposals that are being made from time to time "to take water out of one watershed area, for the benefit of a place outside the watershed." The Severn Fishery Board have arrived at the conclusion that the time has come for the Board of Trade, or some Government Department, or for Parliament by means of a Standing Order, to lay down certain general rules that should apply to all such cases, so as to define the terms under which an outside authority is to be entitled to abstract water from a watershed. It is remarked that, although the abstraction is based on public grounds, the promoters of these water schemes are seeking to acquire very valuable rights, from which they will obtain a large revenue, while making compensation to only a few of the parties prejudiced by such a proceeding. The water of the Wye is a very valuable property to the City of Hereford, and to various towns and persons on the banks of the stream; but if the Birmingham Bill becomes law, all these will suffer damage, without any opportunity being offered them of defending their interests. A suggestion now emanates from the Severn Fishery Board, that the appearance of the Birmingham Bill should be made the occasion to lay down authoritatively the conditions under which water may be diverted from its natural area. The Chairman of the Board, on his own responsibility, suggests certain details to be comprehended in the regulations. The first proposal seems to be eminently reasonable—that the promoters of a scheme should only be entitled to take the surplus water of another area. This is important both ways. A foolish cry has been raised, that the Welsh rivers are for Wales. Primarily they are so; but not absolutely and entirely. That which Wales does not want, may fairly be given to those districts which are in need. How to estimate the surplus water is a question which may involve some research and trouble; but clearly the principle at stake is a right one. The mode of providing compensation water is also to be dealt with; and embraces several particulars. The rules throughout are only to apply to promoters "coming out of their own district to take water from another district." The principle has long ago been recognized; but the present proposal is to embody it in a well-defined code, so that the whole question should not have to be threshed out over each particular Bill. The subject will come up for further consideration at a meeting of the Severn Fishery Board to be held in Birmingham in the course of the next few days. We trust we may take this as the beginning of a serious attempt to grapple with a question which is becoming of increasing importance every day, and which attracted attention as far back as the date of the Royal Commission on Water Supply, which reported in 1869.

The Bituminous Coal of Japan.—At one of the recent meetings of the London Section of the Society of Chemical Industry, Mr. Watson Smith read a paper entitled, "A Contribution to our Knowledge of the Soluble and Resinoid Constituents of Bituminous Coals," in which he dealt chiefly with the composition of the Miike coal of Japan. Although large quantities of this coal exist in Japan, its value for the manufacture of gas, tar, and residuals has not yet been demonstrated. The author has had an opportunity of examining this coal; and he finds it very rich in bituminous constituents. By means of a model gas-making plant, he has been able to ascertain the yield of gas, tar, and residuals which an average sample of the coal would furnish; and the coke obtained is very hard and suitable for blast-furnace work. Although he gave in his paper the quantity of sulphur present in the coal, he has not yet made an analysis of the coke; but he intends to investigate this point, and thus determine the value of the coke for other kinds of metallurgical work. The yield of sulphate of ammonia from the experimental plant shows that, if the coal were converted into coke, the salt obtained would form an important source of revenue as a fertilizer. The tar has been fractionated, and the relative amounts of phenols and light and heavy oils ascertained; and from an examination of the soluble constituents of the coal, the author has demonstrated the presence of naphtha and paraffin scale in the bitumen. The Miike coal appears to be intermediate in character between the lignites and English cannel coals; and, although information on the geological nature of these beds is still wanting, the author pointed out that the large quantity of bitumen indicates its origin from a forest of coniferæ and spore-bearing trees.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 79.)

DESPITE the fair show of renewed activity which the Stock Markets made on the opening day of the New Year, business was rather dull during the past week. Still, there is a stronger disposition generally; and this is perhaps illustrated by the slight effect produced by two incidents, both occurring, by a strange coincidence, in the Dark Continent. A few months ago, the death of the Khedive and the looming of trouble near Gibraltar would have caused much greater disturbance. The Money Market continues in the same condition of ease. The Gas Market has been only moderately active; but the tendency to improve is still steadily marked, and all changes in quotation are in the upward direction. Gaslight "A" is $1\frac{1}{2}$ better; but the last prices were not equal to the best of the week. A good share of business was done in the secured, preference, and limited issues at fair figures all round. The announcement not long hence of the dividend to be recommended for the past half year, is being awaited with interest; and some speculation is excited as to the rate at which it will be. The opinion expressed in some quarters is that, having regard to the large advance in the price of gas just made, which has evoked much unfavourable comment, and also to the fact that the dividend which may be declared next August cannot exceed 12 per cent., the wisest policy for the Company would be to come one step down now, and reduce the February dividend to $12\frac{1}{2}$ per cent. In this opinion, we entirely coincide. Such a measure will, to an extent, relieve the reserve fund of the strain it must bear, and will, in the long run, have a healthy effect upon the position of Gaslight issues in the market. South Metropolitan "B" has moved along—quietly and steadily improving its position, and marking a further rise of 2. Commercially looked healthy, but made no move. Very little notice was taken of the Suburban and Provincial undertakings; but the few bargains noted were at very fair prices. Alliance and Dublin stocks were each $\frac{1}{2}$ better. The Continental Companies are still very firm. The Union was the busiest, and the open stock advanced 5. Imperial advanced 2; but the transactions were very limited. Among the rest, the Indians had the best of it; and both Bombay issues rose $\frac{1}{4}$. The Water Companies were very quiet; but the tendency to improved values was apparent by advances in a few quotations.

The daily operations were: Gas issues generally were strong at the opening on Monday, and everything dealt in went at good figures; but the only advances in quotation were a rise of 1 in South Metropolitan "B," and $\frac{1}{2}$ in Imperial Continental. In Water, Kent rose $2\frac{1}{2}$. Gas was quieter, but fully as firm on Tuesday, without any change in quotations. On Wednesday there were several advances scored. Gaslight "A" rose $2\frac{1}{2}$; South Metropolitan "B," 1; Imperial Continental, $1\frac{1}{2}$; and Continental Union, 5. Southwark Water rose 1. Quiet, steady business in Gas was the rule on Thursday; prices undergoing no alteration. In Water, both Southwark issues advanced 2. On Friday the Gas Market was not quite so firm, and Gaslight issues showed an easier tendency; but quotations held good. East London Water was in some demand, at a rise of 1. On Saturday, the tendency of the previous day was confirmed, and Gaslight "A" was lowered 1. The only other Company dealt in was South Metropolitan, which showed out firm. Water was quiet and unchanged.

ELECTRIC LIGHTING MEMORANDA.

The Comparative Cost of Electric and Gas Lighting—The Areas occupied by the Metropolitan Electric Lighting Companies—The Obstacles to the Progress of Electric Lighting in Residential Neighbourhoods—The First Electric Lighting Undertaking to be Acquired by a Municipality.

THE interesting little controversy respecting the cost of electric lighting, which we mentioned last week as having been started in the correspondence columns of the *Financial News*, has been continued long enough to serve the useful purpose of confirming the general impression that electric lighting, as actually supplied by the London central station companies, costs the user about three times as much as gas. Whether it is even then quite as efficient, remains a matter upon which some difference of opinion exists. Messrs. Crompton and Co. took part in the discussion, with a view to making public the essential difference between their system of supply and that of the House-to-House Company. The Crompton system is that of the Kensington and Knightsbridge, the Notting Hill, and the Westminster Companies; and in regard to it the contractors declare that "the actual consumer's bill is not greatly in excess of his previous gas bill." They do not say, however, whether the same consumers have or have not still a gas bill as part of their expenses for light, which we fancy is generally the case. The Manager of the House-to-House Company did not like his system of supply to be disparaged by a partisan of another method; and he accordingly wrote to point out that since the charge per unit to the consumer is exactly equal in his Company's district and in those cited by Messrs. Crompton and Co., any comparison with gas which holds good in the one must also apply to the others. Messrs. Crompton and Co. have not been able to contest this

point; and so they fall back upon the argument that, taking the cost of raw material, wear and tear of machines, and manufacturing wages, as representing the "sheer cost" of electricity, this would be as low as, if not lower than, that of gas, if the production of both commodities were reckoned for in sufficient quantity to supply (say) two square miles of London. Meanwhile, the discontented consumer who started the controversy is satisfied to compare the cost of electric lighting, as a commodity, with that of gas; and he declares that the two costs are as three to one. Whether the "sheer cost" of electricity is more or less than that of gas at the works, is a question with which the consumer has nothing to do. All he looks at is the amount of his bill. The London Companies mentioned in this correspondence charge 8d. per unit for their supplies; and when a subscriber, after paying this rate, finds it in him to state that "the light for working and reading compares unfavourably with gas," it is easy to understand why the companies' business is not of a more flourishing character.

Our contemporary the *Electrician* naturally takes a deep interest in the fortunes and the progress of the London electricity supply companies, and is bringing out a map of the different districts covered by these organizations, which is to be accompanied by some statistical information relating to the working capabilities of the undertakings. We gather from the preliminary statements of our contemporary respecting this proposed publication, that the Company having the largest net area for development is the Metropolitan, with 4.6 square miles. Next comes the London, with 3.37 square miles; the Westminster, with 1.9 square miles; and the Chelsea, with 1.13 square miles; None of the others covers a mile; and the bright and shining exemplar of the electric lighting interest in Great Britain—the St. James's and Pall Mall Company, to which reference is always made in prospectuses, after-dinner orations, and on all other occasions when the commercial success of electric lighting is advertised—occupies a district not more than 0.24 square mile in extent! It has for the supply of this district plant capacity for 40,000 lamps, which is after the rate of 167,000 lamps per square mile. If this is the scale of business upon which alone the supply of electric lighting can be said to pay, where is such another instance to be found? The two largest Companies—the Metropolitan and the London—have each a plant capacity of about 21,000 lamps per square mile. What a difference is here!

It is remarked that "the spread of electric lighting in residential districts is largely impeded by the uncertain and short tenure of house property." During 1889, about 100 miles of cable were laid in front of some of the best houses in London; but 90 per cent. of these are not wired, nor are they likely to be, until the termination of the existing leases. Expressed in another way, the expense of wiring a good house for electric lighting is so great that even many of the "best people," who could otherwise afford to patronize the supply companies, regard it as a hazardous outlay when the premises do not happen to be their own property, or when their enjoyment of them is not likely to be prolonged over a considerable period. In so many ways does the costliness of electric lighting war against its prospects of success! The fact of this difficulty having arisen illustrates once more, and in a very striking way, the radical difference between the circumstances of the electric light industry in America and in England, which renders all arguments from one to the other so futile and misleading. In North America there is no doubt that electric lighting, of a sort, has spread like wildfire; but it is supremely ridiculous to say that this is because, in some mysterious sense, the people there are more "advanced" or "go-ahead" than the inhabitants of the United Kingdom. This explanation may be good enough for a cheap evening newspaper; but it will not satisfy the least alert critical faculty. In the United States, electric lighting companies are scratch concerns, tied to the larger manufacturing companies which exploit particular "systems." They get their plant upon credit, or in exchange for "bonds," taken at a heavy discount, and they scrape together a connection anyhow, doing the indoor as well as the outdoor work, all of which is usually of the cheapest and most trashy character. It is comparatively nothing to wire and light a "city" of frame-built shanties, bordering unpaved roadways, where the side walks are planked, and posts and wires along all frontages are not objected to. Contrast this sort of thing with the standard of work required in a Piccadilly or a Park Lane mansion, and no further explanation is needed of the fact that American practice is no guide to the English trade in electric lighting.

The contemplated purchase of the city electric lighting undertaking of Messrs. Muir, Main, and Coulson by the Corporation of Glasgow for the respectable sum of £15,000 is the first transaction of the kind. It is not likely to have many followers; the circumstances being quite unique. It was the odd case of a firm going into an electric lighting speculation for what could be made out of it, without obtaining statutory rights or any sort of sanction save the commercial one. It was, in effect, a reproduction in Glasgow of the same class of venture that Sir Coutts Lindsay started at the Grosvenor Gallery in Bond Street. The Glasgow speculators managed to secure some paying contracts, including the lighting of the Post Office, and went on working, while the Corporation were thinking and talking about obtaining a Provisional Order. The firm were careful to observe the Board of Trade stipulations

respecting overhead wires; so that when the Corporation had finally made up their minds to go into electric lighting for themselves, they found these enterprising people in possession of a snug little connection with which their Order gave them no right to interfere. Negotiations followed, and the electricians asked the modest sum of £30,000 to turn out, or rather more than double what their business was really worth. After a valuation, the Corporation offered the firm £15,000, which has been accepted; and Messrs. Muir, Main, and Coulson occupy the proud position of being the only founders of an electric lighting business which a municipal corporation have deemed it worth their while to acquire on any terms.

THE LITERATURE OF THE LAST FOG.

THE exceptionally dense, dark, and prolonged fog which settled down over London during the early part of Christmas week has already been mentioned in the JOURNAL; but it is well perhaps to return to the subject, for the purpose of placing upon record a synopsis of the popular contributions to the literature of the visitation, in the shape of the numerous and voluminous letters to the newspapers, &c., of which there has been a remarkably heavy crop. Whenever there is a recurrence of such a "London particular," as Dickens has described in the opening chapter of "Bleak House," the newspapers for days afterwards exhibit a varying amount of "fog matter" in the columns devoted to editorial articles, correspondence, and inquests. This time the discussion of the fog in the columns of *The Times* has been specially full; and though the writers who participated in this outburst of complaining against the Londoner's traditional horror almost to a man admit the futility of protesting against what appears to be inevitable, it is desirable to sift this mass of newspaper writing, so as to collect any novelties of suggestion or of criticism which may occur in this latest addition to the literature of London fogs.

The discussion of the subject in *The Times* was opened by the Dean of St. Paul's, with a complaint against the County Council for not lighting up the Thames Embankment during the fog; and in the same issue of the paper Dr. Balmanno Squire implored the Editor to "put a little pressure on the gas companies that they in turn may put a little pressure on the gas." This writer stated that on a foggy day "everyone turns on the gas, which indeed is needed far more than at average night time." But he went on to aver that the gas companies do not recognize fogs—"they only recognize day and night." A few days later, the same gentleman again wrote to compliment the Editor of *The Times* upon the imaginary consequence of putting the "tremendous weight" of the paper upon the gasholders, which he innocently supposed to have been instrumental in causing a good supply to be given on Christmas Day. This gentleman's ideas are scarcely creditable to the average intelligence of the age in which we live. They serve to show, however, the character of the damages suffered by gas companies from prolonged fogs. They are held up to execration as rich monopolists who require to be stirred up by newspaper editors before they will take advantage of the opportunity given by foggy days for selling more gas than usual. It does not occur to the people who make this charge of supineness against the companies, to blame their brewers in the same way for not sending out beer, or their coal merchants for failing to deliver coal, when fogs render roadways impassable. Yet it would be difficult to maintain the proposition that gas companies ought to be superior to all climatic influences. The fact remains, however, that, in times of fog and frost, every gas consumer thinks only for himself. It is nothing to him that the company are sending out double their average quantity of gas; this is their affair. He wants all the gas he can get; and if he experiences any difficulty in obtaining enough, he abuses the company, and inclines to the belief that electric light may be more satisfactory—simply because he has had no experience of it. He is shy of declaring a preference for oil, because it is not always possible to have the can filled; and the inconvenience is just as great when the boy from the oil-shop cannot find his way to the house, as it is when the gas company cannot keep up the full pressure in their mains.

The discussion of the fog itself speedily occupied the attention of the readers of *The Times*, to the exclusion of complaints against the London Gas Companies. One correspondent described how he had left London "shrouded in the chimerean [sic] darkness of fog," and had arrived in Paris the same day to find the atmosphere of the French capital so "intensely pure," that it was quite a pleasure to be in the open air. The difference he ascribed to the use in Paris of anthracite coal and wood. Another correspondent—Mr. J. A. Timmis—corroborates this evidence; reporting that although the use of open fires has extended very largely in Paris of late years, and is increasing, the chimneys remain comparatively smokeless, owing to the preference of Parisians for coke, anthracite, and wood, instead of bituminous fuel. It is admitted that wood is out of the question in the case of London; but Mr. Timmis asserts that both anthracite and coke are more easy to obtain in London than in Paris, which is probably true. His remedy for the fog trouble is that a Committee of the London County Council should consider how the general consumption of coke

and anthracite can be promoted. The inevitable *dilettante* of the Smoke Abatement variety, of course, came to the fore. Dr. Wyld, who has been heard occasionally, we fancy, at The Gaslight and Coke Company's meetings, wrote to say that thirty years' study of the subject has led him to the conclusion that "the only cure is the compulsory use of smokeless fuel—that is, hard coal, coke, or gas." He also states that, having built a house with fire-brick grates, he burns in these smokeless Welsh steam coal "with perfect ease and satisfaction."

Mr. Young, a member of the Institution of Civil Engineers, wrote to advocate the supplying of air directly to fire-places by means of a pipe through the wall; although how this is to obviate fog is not so apparent as could be wished. Another gentleman proposes that, in the next Bill dealing with the Metropolitan Buildings Acts, a few clauses drawn up by "the County Council and the Institutes of Architects and Surveyors" should be inserted, prescribing the proper construction of flues and the character of fire-grates for all future buildings. A Mr. George Herring joins in the cry of "stupidity" raised against all who do not burn anthracite in preference to bituminous coal; and he declares that the former variety of fuel "throws out more heat, is free from dust or dirt, is smokeless, and cheaper than the latter." If this is so, then the failure of anthracite to establish itself as the favourite fuel of the English householders ought to be put down to pure "cussedness" on the part of the latter; but it is difficult to accept this explanation. A correspondent wrote to recommend the well-known device of lighting fires from the top; but the weakness of this remedy lies in the fact that, sooner or later, fresh fuel must be added, and the whole thing demands a degree of forethought and carefulness in the executants, that cannot be attained by the ordinary domestic servant.

At this stage of the discussion, Dr. Alfred Carpenter, one of the founders of the Smoke Abatement Institution, came forward with a truly remarkable letter. In this communication, he repeated an old suggestion of his that all fire-places not consuming their own smoke, or not constructed for the use of smokeless fuel, should be taxed; the produce of such tax to be devoted to the reduction of the sanitary rate, or to providing "a fund for dealing with the right principle of sewage utilization," the effect of which would, in his estimation, be that in "ten years' time London would be entirely freed from its black and yellow fogs." Householders who still preferred the luxury of a pokeable, blazing fire would have to pay for their enjoyment. Dr. Carpenter, moreover, had something to say about gas supply. He delivered himself of the profound opinion that the deficient supply of gas in foggy weather is not due, as mere common people hold, to want of pressure at the works, but to the action of cold upon the gas in the mains. "The cold causes a condensation of cholesterine wherever the pipes approach too near the surface of the earth. This material is one of the great sources of illuminating power. The loss of it causes loss of luminosity in the gas, and at the same time, by diminishing its calibre, impedes its progress along the pipes. This separation," the learned expositor continues, "becomes easier in consequence of the companies trying to obtain more gas than they should from each ton of coal. If they were satisfied with 8000 cubic feet per ton, instead of trying to get much larger quantities, the gas would not be so easily acted upon by severe cold." The individual who wrote this farago of pedantic nonsense dated his letter from Ventnor; but it should have originated in the Isle of Laputa. What does Dr. Carpenter mean by his "cholesterine," and his "diminution of calibre?" The experienced gas manager may laugh at his fantastic attempted explanation of the obvious consequence of endeavours to make short stocks of gas hold out through excessive strain; but it is pitiable that such trash should be heard outside the "Mudfog Papers." Dr. Carpenter also advises gas companies to sell gas at 2s. per 1000 cubic feet, which, he thinks, will be easily accomplished "if they will meet the matter in a proper spirit, and save themselves from the downfall which tremendous dividends and wasteful expenditure are hastening forward." This is a sensible comment upon the state of things revealed by the last advance of The Gaslight and Coke Company!

Poor Dr. Carpenter was heavily "slated" by later correspondents of *The Times* for what one critic called his "quackeries;" and, with regard to his grand taxation device, a correspondent declared that the public ought to "understand that any man who talks of curing fog by forcing any pattern of grate or furnace upon the people, is alike chemically and politically a charlatan." It is charitable to suppose that the term "cholesterine" seemed as satisfying to Dr. Carpenter as "that blessed word Mesopotamia" did to another old lady. But even so there is the difficulty about the "calibre" of gas, or the mains, which a fog is supposed, upon this authority, to bring into prominence. Consideration of these eccentricities of debate, however, is more entertaining than helpful; and so, when the general subject of fog and its prevention was treated editorially in *The Times*, the issue was carefully defined and rigidly investigated. There is no dispute as to the cause of the particular abomination known as London fog. We shall never render the air of London, with its clay basin traversed by a tidal river, so dry and free from fog as the air of Paris, which is built upon a subsoil of gypsum, and is far from the sea. The only question is whether the fogs of London can ever be freed from their artificial additions of solid carbon particles, tarry vapour envelopes, and

sulphurous acid gas. Some worthy and public-spirited people claim that they can render their own houses smokeless by burning anthracite or coke; but even if this claim is justified—which would be a large concession to make—the cause is not much advanced thereby. "It is idle to say that what one man has done, others can do. So they can; but they won't." Then, how to make the backward ones fall into line? Tax their grates, say some enthusiasts. Nothing could be simpler, on paper, as *The Times* admits; but how would it work? If England were governed by the Czar of Russia, it is remarked, a ukase would long ago have been issued to put this matter straight. This happens to be a free country, however; and government *à la Russe* is one of those things which would probably be dear at the price of a few London fogs, even if it answered its purpose, which can hardly be taken for granted. Who are the County Councils, that they should be trusted with inquisitorial powers, whether for the suppression of fogs or of anything else, which would involve the inspection of every house, and the examination, testing, and certifying of every grate? "Every chimney from which smoke was seen to be issuing would be an invitation to the local inspector to pay a domiciliary visit. If the tax per grate were low, the householder would grumble and pay it, in order to save himself trouble and further expense. If it were high, it would provoke organized and inevitably successful resistance. The van and wheel tax was successfully resisted, though it affected only a limited class. The proposed hearth tax would affect every single householder in London. If this is the only way to get rid of London fogs, we must regretfully say that it seems to be hopelessly impracticable."

It is not argued that under no conceivable conditions could Londoners be expected to submit to such a hearth-tax as has been suggested. But the remedy is far too drastic to be accepted, unless as the only reliable cure for a deadly evil; and matters have hardly yet arrived at that pass. Moreover, if we are to believe Mr. John Aitken, it is by no means certain that even smokeless combustion deprives the products of the operation of all their objectionable characteristics, though the most obvious of these might be no longer apparent. The net outcome of the recent newspaper discussion of the great fog question is, therefore, practically *nil*. No fresh suggestion for dealing with fogs has arisen out of this latest controversy, which has only shown once more that it is those who know least about the matter who profess to be readiest to take extreme measures for its treatment. The fact that as London and other English towns extend, so they grow more and more liable to fogs, illustrates the immensity of the field still awaiting full occupation by gas-kitcheners, gas-fires, and coke properly prepared for domestic consumption. Beyond this evident conclusion, all is uncertain. We do not see the remotest probability that the business of the bituminous coal merchants will suffer in our time at the hands or tongues of the Smoke Abatement advocates; and the only hope of converting the householder from persevering in making smoke himself, while anathematizing the smoky chimneys of others, is to convince him in detail that his own pocket will be favoured, and the convenience of his own domestic establishment will be served, by his patronizing gas and coke to the full extent of their capabilities for cooking his food and warming his dwelling.

Mr. Daniel Till, who constructed, and was until twelve years ago the Manager of, the Keswick Water-Works, died yesterday week. The deceased gentleman had attained his 64th year.

Mr. J. B. Fenwick, of the Windermere Gas-Works, was last Friday appointed Manager of the Retford Gas and Water Works. Mr. James Bailey, son of the ex-Manager, was selected to fill the office of cashier.

The Transactions of The Gas Institute.—We have been favoured by the Secretary of the Incorporated Gas Institute (Mr. W. H. Harvey, B.A.) with the volume of Transactions of the Institute for the past year—issued under his editorship.

Death of Dr. Bernays.—The death is announced of Dr. Albert J. Bernays, Professor of Chemistry at St. Thomas's Hospital, and Water Examiner to the Kent Water-Works Company. The deceased gentleman succumbed last Tuesday to an attack of bronchitis, after five days' illness, in his 69th year.

Death of Mr. Charles Heisch.—We regret to record the death, on the 2nd inst., at Brighton, in his 72nd year, of Mr. Charles Heisch, Gas Examiner to the Corporation of London. Mr. Heisch gained his early professional experience in the laboratories of the late Professor Phillips and Dr. Leeson, with the latter of whom he laid the foundation of his extensive knowledge of photometry and kindred subjects. He was for many years Lecturer on Chemistry in the Medical College of the Middlesex Hospital; but he resigned this appointment in 1876, in order to devote more time to the duties of the office of Corporation Gas Examiner, to which position he was elected by the Court of Common Council in 1869, in succession to the late Dr. Letheby, who became Chief Gas Examiner for the Metropolis, under the Board of Trade. Mr. Heisch was a skilled microscopist, as well as a very clever mechanic; and for some years he was the proprietor of the (at one time) well-known business of Messrs. Murray and Heath, opticians. His numerous contributions to the literature of the chemistry of gas manufacture and photometry are too well known to need recapitulation.

NOTES.

The Berthelot Calorimeter Cheapened.

At a recent meeting of the Académie des Sciences, M. Mahler communicated a statement respecting an improvement of the Berthelot calorimetric bomb, introduced by himself for the benefit of industrial workers in calorimetry. This instrument, as devised by M. Berthelot, is reputed to be the most satisfactory appliance of the kind known to science. It consists of a strong steel shell, lined with platinum, in which the combustible to be examined is burnt in an atmosphere of pure compressed oxygen. By this means the combustion effects of every description of fuel can be accurately determined and compared; and so delicate is the arrangement, that M. Berthelot has employed it with success in experiments of a physiological nature. M. Witz has employed the shell for the calorimetry of coals and gases; but the great drawback to the extended use of the apparatus has hitherto been its high cost, which ranges from £80 to £100, in consequence of the large quantity of platinum required in its construction. M. Mahler now claims to have overcome this difficulty by substituting a lining of a special kind of enamel for the platinum; by this means reducing the cost of the apparatus to about £4—at which it may well find its way into industrial laboratories and technical schools. The facility with which suitably compressed and pure oxygen can also be obtained, is an additional aid to the extension of the Berthelot method in calorimetry.

Healthfulness of Coal-Dust Laden Air.

Dr. S. Rideal has written to *Industries* on the subject of the alleged immunity of coal miners from consumption, with reference to statistics recently published by Dr. Bertillon in Paris, which confirm an opinion previously expressed by Dr. Ogle. These statistics go to show that the death-rate from consumption among coal miners is 43 per cent. less than that from this disease among all men at the same ages living at the same time. Although this seems a well-established fact in the case of coal mines, the statistics for other workers in dust-laden atmospheres tell a very different story. Dr. Rideal suggests that a possible explanation of the fact in question may lie in the presence of small quantities of hydrocarbons of the marsh gas series in air which is full of coal dust. It is well known that in America the neighbourhood of the oil wells is regarded as peculiarly healthy; and all classes of workers on board the tank steamers and in the oil industry are remarkable for their robust health. The conversion of hydrocarbons into fat may be a problem which, as Dr. Rideal says, cannot be readily solved in a chemical laboratory, but may be one which takes place in the human body, and would account for these phenomena. It is suggested that an inquiry into the vital statistics of other workers in coal, besides pitmen, might reveal interesting data bearing upon this subject. It is certain, for example, that coal trimmers and gas stokers are anything but the unhealthy members of the community which the dusty nature of their occupation would appear to indicate, if dust itself, without regard to its nature, is to be esteemed as detrimental to health. It seems probable, however, that the nature of dust is everything in respect of its effect upon the respiratory organs; so that a retort-house of a gas-works—where the air is occasionally so thick with coal dust that it is impossible to see from one end to the other, and the men's faces confess the condition of the atmosphere—is a salubrious resort in comparison with a clean-looking woollen warehouse or a flour-mill.

Test of a Pulsometer.

From a paper presented at a recent meeting of the American Society of Mechanical Engineers, it appears that Messrs. C. G. Atwater and Charles B. Hodges have made a test of a pulsometer pump, to serve for the "thesis work" required of the authors by the Stevens Institute of Technology. The machine tested was an ordinary one taken out of stock, and the object of the test was to ascertain its duty as a lifting pump under varying conditions. The suction and delivery pipes were each 4 inches in diameter, and the pulsometer was run as nearly as possible under ordinary working conditions. The water as pumped was received into a tank, whence it passed through a meter to the large tank from which the suction was taken. The steam-pipe was 1 inch in diameter, and was throttled about 2 feet from the pump. The consumption of steam was computed from the increase of temperature of the water in passing through the pump. The work was computed by means of pressure-gauges and the quantity of water lifted. The actual height of suction was 7 ft. 6 in.; the actual height of lift being 25 ft. 4 in. Four tests were made, with steam pressures varying from 19 lbs. to 43.8 lbs. No attempt was made to determine what pressure would give the best duty for a particular head; and there is a field for further research upon this point. The working of the pump was entrusted to a practical man, who judged that when it was running properly and well, the pressure was right. The duty of the pulsometer under this management varied from 12,036,300 to 13,391,000 foot-pounds per 100 lbs. of coal burnt under the boiler. The efficiency of the apparatus according to the formula $U \div \text{heat absorbed}$, was 0.012. It is noticed as peculiar that in the first test a pressure of 19 lbs. of steam produced a greater number

of strokes, and pumped upwards of 50 per cent. more water than 26.1 lbs. of steam pressure—the lift being the same.

The Effect of Air on the Illuminating Power of Gas.

Dr. Schilling, in the course of a paper recently read before the German Association of Gas Engineers, quotes some experiments made by mixing air with coal gas in known quantities. The following are extracts from his tables—A representing a slit burner, and B a regenerative burner. The gas used was about 19-candle power.

Gaslight	equal	A.	Depreciation.	B.	Depreciation.
" with 2 p.c. air	"	100.0	—	100.0	—
" 4 p.c. "	"	85.5	14.5	83.3	16.7
" 6 p.c. "	"	73.2	26.8	74.2	25.8
" 8 p.c. "	"	62.4	37.6	64.7	35.3
" 10 p.c. "	"	51.8	48.2	52.2	47.8

The results of these experiments, reduced to unit percentages, are 7.25, 6.7, 6.27, and 6.02 in Table A; and 8.35, 6.45, 5.88, and 5.97 in Table B. In both, the ratio appears to become less as the percentage of air is increased. Allowing for experimental errors, it would seem to range from 7 per cent. per unit for 2 per cent. to 6 per cent. per unit for 8 per cent. of air. This agrees closely with results previously published. It is interesting to notice that, roundly speaking, the result is the same with the flat-flame as with the regenerative burner.

The Mills Sectional Boiler.

It is notorious that the new-fashioned water-tube boilers, of which the best-known type is the Babcock and Wilcox, are not economical in working, although they are much favoured for town use, and particularly by electric lighting companies, on account of their compactness, and the ease and safety with which they may be forced on an emergency. The lack of economy of this class of boilers is to be ascribed to the fact that they do not properly utilize the radiant heat of the furnace, because there is not sufficient surface exposed to the fire. To remedy this defect, Mr. Mills, of Manchester, conceived the idea of putting the furnace inside a water casing forming part of the boiler; due provision being made for preventing chilling of the flame by premature contact with cold iron surfaces. In order to ascertain the value of this improvement, a Babcock and Wilcox water-tube boiler was purchased and worked for six months, during which time its performance was frequently tested by independent experts, until a figure satisfactorily representing its average efficiency was obtained. Afterwards the same boiler was fitted with the Mills improvement; and it has now been working thus for two years—being tested at intervals by the same experts. On comparing these results with those obtained prior to the alteration, it appeared that the proportion of unaccounted-for heat had been materially reduced. The general result of a seven days' trial of the unaltered boiler was an evaporative duty of 7.1 lbs. of water from and at 212° Fahr.; while with the Mills improvements, a nine days' trial gave a duty of 9.65 lbs. of water per pound of fuel. Mr. Crossland made the two returns 6.94 lbs. and 9.20 lbs. for an ordinary and improved water-tube boiler. The improved boiler is now being made by the Mills Sectional Boiler Company, of Pendleton; and we notice it here because it is probably the only variety of water-tube boiler that might be expected to do well with gas coke for fuel.

Mr. Thomas Hudson, who has held the office of Secretary of the West Bromwich gas undertaking since it was transferred from the Birmingham Corporation, was on Wednesday last appointed Borough Accountant and Registrar of Public Stock under the West Bromwich Corporation.

Easy Methods of Laying Service Pipes.—At the September meeting of the New England Water-Works Association, Mr. Holden, Superintendent of the Nashua (N.H.) Water-Works, stated that, owing to the sandy loam soil in that city, he was enabled to put in his service-pipes at very little expense. In the principal part of the city, it is customary to dig a trench from the main to the side walk, approximately as long as the proposed service, which is now always of galvanized iron, and then to tap the main for a cock. A piece of 1-inch hose, about 20 feet long, is then connected by a union to a cock, and at the other end by another union to a length of galvanized pipe. When everything is ready, water is turned on at the cock, and the pipe pushed into the earth for its entire length. It is then disconnected, and another length added, which is pushed in by the same means. In this manner, it is often possible to run as far as 50 feet, and save breaking up a lawn. Two men will frequently put in four services in a day; and Mr. Holden estimates that nine-tenths of the supply-pipes are thus laid. At Springfield (Mass.) the soil is also a sandy loam, and much the same manner of laying services has been employed there. The pipes used are tarred wrought iron, from 1 to 2 inches in diameter. Galvanized iron could not be used, as the pipes so made became filled with rust in two years. Mr. J. C. Hancock, Superintendent of the water-works in the city, recently stated that it was possible to push the pipe from a trench, sometimes for 75 or 80 feet, through the earth. It was often possible to do this without using water. Sometimes it has been found expedient to bore a hole with a long sand auger, and insert the pipe in this.

COMMUNICATED ARTICLE.

LIGHTING.

By W. H. Y. Webber.

PART III.—A CRITICAL EXAMINATION OF MODERN PRACTICE.

(Continued from p. 19.)

It will perhaps be helpful here to recapitulate the simple trigonometrical ratios which are likely to be most frequently required in problems of the kind we have to discuss in relation to the science of lighting.

In a right-angled triangle, such as that which may be supposed to be formed by any lamp-column with the ground beneath it, and with the angular ray proceeding from the lamp to any given spot upon the ground at a distance from the base of the column, there are six parts to be reckoned with—viz., the three angles and the three sides. Any three of these being given, the others can be found by calculation (with the single exception of the three angles, which may bound sides of any length); because the sides are proportional to the sines of the opposite angles.

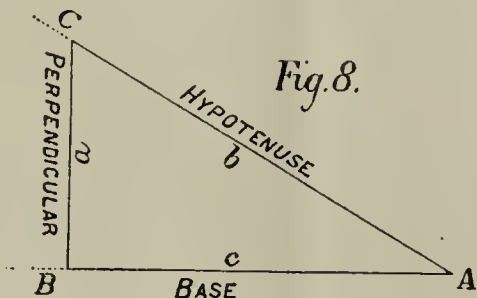


Fig. 8.

In the case of a right-angled triangle (Fig. 8), one of the angles is always known, and it is the angle of 90° . The other two angles must make 90° between them. The sides are termed respectively the base, the perpendicular—these two containing the right angle—and the hypotenuse, which subtends, or is opposite to it. The ratios, or trigonometrical functions, most commonly given in engineers' hand-books, are the sines, cosines, and tangents, of all angles of from 0° to 90° . If the second angle of the triangle—that which is between the base and the hypotenuse—is called A, then the ordinary ratios are as follows: $\frac{\text{perpendicular}}{\text{hypotenuse}} = \sin. A$; $\frac{\text{base}}{\text{hypotenuse}} = \cosin. A$;

$\frac{\text{perpendicular}}{\text{base}} = \tan. A$. The tables give the functions or proportionate lengths of these parts, for the different angles of the quadrant, taking the length of the hypotenuse as unity. Thus, supposing the case of $A = 20^\circ$, $\sin. A = 0.342$; $\cosin. A = 0.940$; $\tan. A = 0.364$. This means that in an angle like that in fig. 8, supposing $A = 20^\circ$, and b to be 1 inch long, then $a = 0.342$ inch, and the remaining side $c = 0.940$ inch, and $a = 0.364$ times as long as c ; that is, it is 0.940×0.364 , or 0.34216 inch.

Having, therefore, the two angles and one side given, the lengths of the other two sides are easily computed. Thus: A lamp-column throws rays at an angle of 42° at a distance of 30 feet from its base, what is the height of the light, and the length of the path of the rays? Here $b = 30$ feet and $A = 42^\circ$. In a table it will be found that $\tan. 42^\circ = 0.900$, so that the height $h = 30 \times 0.900 = 27$ feet.

The sides of triangles are proportional to the sines of the opposite angles. Thus in any triangle, representing the angles by capital letters, and the opposite sides by the corresponding small letters—

$$\frac{\sin. A}{\sin. B} = \frac{a}{b}, \frac{\sin. B}{\sin. C} = \frac{b}{c}, \frac{\sin. C}{\sin. A} = \frac{c}{a}$$

Since in the problem the angle opposite to the path of the rays is a right angle, and $\sin. 90^\circ = 1$, as $\sin. 42^\circ$ is to $\sin. 90^\circ$, so is the perpendicular to the hypotenuse. Here $\sin. 42^\circ = 0.669$. Whence, as 0.669 is to 1.000 , so is 27 feet to the required length, which is thus 40.36 feet.

At what angle will a light 10 feet from the ground throw its rays upon a spot 30 feet distant from its base? And how long will be the path of these rays? Here $10 \div 30 = 0.333$, the nearest figure to which in a table of tangents is 0.344 , which is the $\tan.$ of $18\frac{1}{2}^\circ$, and therefore this is the angle sought. $\sin. 18\frac{1}{2}^\circ = 0.317$; and as $\sin. 18\frac{1}{2}^\circ : \sin. 90^\circ :: 10 : x$, we have $\frac{1.000}{0.317} \times \frac{x}{10} = 31.5$ feet nearly, as the length of the path required.

These examples will be sufficient for the present purpose. We have now to consider further the proposition of Heath. If, in the case illustrated by fig. 7, it is taken as proved that $h = \frac{b}{\sqrt{2}}$

then it also follows that $b = h \times \sqrt{2}$, or $b = h \times 1.414$. Whence we may express it as a rule of lighting: (1) That for the most efficient illumination of a spot in a horizontal plane by an overhead light, the height of the light will be the horizontal distance of the spot from the perpendicular passing through the light divided by 1.414 ; and (2) That an overhead light will efficiently command a plane area comprised within a circle having for its radius the height of the light multiplied by 1.414 . Shortly expressed, an elevated light-source will efficiently command a plane horizontal area, the radius of which is 1.42 times the height of the light above the area; or, the height of a lamp for efficiently commanding a horizontal plane area will be 0.7 of the radius of such

area—the centre of the area being the perpendicular passing through the lamp. (The Chicago rule, referred to in Vol. LVIII., p. 753, is wrong if, as may be supposed, it is based on the same theorem, since it gives results only one-half as great as the above.) These rules will be applied to the working of examples as we go on.

To avoid possible misapprehension, it may be as well to remark that the effect of Heath's theorem is to define the limit of illumination from a single source, beyond which the decrease of illumination due to the increasing obliquity of the incident rays ensues more rapidly than the decrease of effect due only to the Law of Distance. Practically, we may take it that this theorem applies to the spacing of lights over areas designed to be illuminated as uniformly as is possible with any arrangement of artificial lights; so that the more this spacing is exceeded, the spottier will be the appearance. In actual lighting, the effect of spottiness would be modified by the additional diffusion of the light from irregularly reflecting surfaces—such as walls, ceilings, &c.

The first practical consideration in connection with any scheme of artificial lighting must be the amount of illumination to be supplied; and this depends upon the purpose for which the light is needed. If we begin with the smallest requirement, which is that for street lighting, we are immediately brought up by the absence of any standard whatever. Referring to those proposed by different authorities, some of which have already been mentioned in earlier parts of these articles, it appears that Dr. W. Wallace, when uttering his sensible protest against the extravagant display that threatened to become popular in 1879, laid down the requirements of street passengers in the way of lighting as consisting only in ability to see their way, and to avoid being robbed. This is a very vague expression of opinion, intelligible enough as far as it goes, but obviously incapable of serving as a datum in order to determine the minimum spacing of street lamps.

Mr. Ralph Richards and others hold that the pleasure of distinct vision should be the criterion of good street lighting; and his minimum for roadway lighting is the equivalent to the light of a standard candle at a distance of 10 feet. Mr. W. Sugg's idea of good outdoor illumination in 1879 was the equivalent of the light of a standard candle at a distance of 2 feet, which would be sufficient to enable a man with good eyes to read a leading article in *The Times*. This, however, is an extravagant standard; for in what Mr. Sugg spoke of at the same time as well-lighted neighbourhoods—meaning places where the street lamps are provided with 5-foot burners—it only obtains from a radius of 7ft. 6in. from the lamp-post, and it does not appear that anybody ever proposed to fix such lamps so closely together as 15 feet. When Mr. Deacon was led in 1878 to discuss the question of street lighting for Liverpool, he mentioned street gas-lamps spaced 27ft. 6in. apart, only to dismiss the idea as irrational. Mr. Corbet Woodall put 48 lamps in 1500 yards of street between Waterloo Bridge and the South-Western Railway Terminus, which was a little more than 60 feet from lamp to lamp on each side of the road; and the result was that "a newspaper could be read without difficulty in any part of the road." This was luxurious lighting; and the same may be said of the central Birmingham experiment, described in the JOURNAL, Vol. XLIV., p. 21. Professor Robinson takes as the standard of ordinary street lighting the intensity of the light falling upon a unit area of pavement 50 feet from an ordinary street lamp, which he computes, by an approximate rule, to be equivalent to 0.000864 candle. A 12-candle burner will give, at 50 feet distance, the same light as one candle at 14 ft. 5 in., for—

$$12 : 1 :: 50^2 : x^2; \text{ whence } x = 14 \text{ ft. 5 in.}$$

This, therefore, is greatly below Mr. Richards's estimate of what is desirable.

It is well to point out that the use which Professor Robinson makes of his determination of what he calls the minimum for a street-lighting effect is to determine the spacing at which electric arc lamps can be calculated to produce the same result. This is absurd, because it ignores the fundamental difference between the intensities of the compared sources. It is obvious that before any such minimum can be adopted as a datum for the satisfactory spacing of lights, we must know the power of these lights. If the only condition to be fulfilled in lighting a straight roadway of stated length was that the intensity of the light should in no part fall below a certain minimum, we might satisfy the requirement by suspending a single electric arc lamp on a line in the middle of the length; thus making each end exhibit the minimum illumination proposed. Such a solution of a lighting problem would be practically inadmissible, yet it would exactly fulfil Professor Robinson's one condition.

As Mr. Richards shows, the physiological aspect of street lighting must be taken into account in treating all problems of this kind; so that before we can say what is really the minimum lighting effect allowable anywhere, we must know how much the wayfarer's eye is likely to be strained in the most brilliant parts of the thoroughfare. It is this consideration that renders it practically impossible to exactly balance, upon the sole basis of the minimum lighting effect, one style of lighting with another involving the use of lights of much higher power. To avoid offence to the eye, we must raise the minima as the maxima are intensified.

(To be continued.)

TECHNICAL RECORD.

THE DESSAU CENTRAL ELECTRIC LIGHTING STATION OF
THE GERMAN CONTINENTAL GAS COMPANY.

(Concluded from p. 23.)

RESULTS OF THE FIVE YEARS' WORKING OF THE STATION.

Working with the gas-engines has proved advantageous in all ways; and under the condition that the gas need not be purchased, but that both the gas and electrical works are in the same hands, the plan is in many cases worthy of consideration for medium-sized and small towns. The advantages offered by such central stations are as follows:—

1. Small space required, and therefore a small area of land.
2. Small water supply (23 to 24 litres per horse power, and with improved new cooling arrangements even considerably less).
3. Independence of railway communication, and avoidance of coal transport through the town.
4. No nuisance from smoke.
5. No danger of explosion.
6. Lower cost for installation as compared with steam-engine plant of similar size: (a) because the area of land required is considerably less; (b) because the distributing cables are considerably cheaper, inasmuch as a piece of land in the centre of the town, in the immediate vicinity of the place where electricity is required, can be more readily found and utilized for working with gas-engines than for working with steam-engines; (c) because the cost of a gas-engine plant of more than 100-horse power is very much cheaper than a steam-engine plant of the same size, including reserve boiler, boiler-house, chimney, &c.
7. Less loss of pressure in the distributing system, on account of the more favourable situation of the central station.
8. Small number of hands required.
9. Ready and exact control of the consumption of fuel (gas) by means of gas-meters at all times for every engine.
10. More certain and convenient working, especially for moderate-sized works, where the variations in a small total supply generally occur more suddenly, and where the period of working is frequently only a very short one. When an unexpectedly large supply is demanded, gas-engines are much sooner set working than boilers.

With reference to the cost of working, more especially as regards the cost of the gas itself, as a matter of course it must be understood that, in order to make a correct comparison of any value with the cost of steam-engine works, the cost of the gas itself must be calculated on its own basis; and that required for the electrical central station must not be burdened with factors which apply solely to the supply, distributing, and disposal of illuminating gas in towns. For if a gas-works supplies a large quantity (say, 500,000 cubic metres) of gas to an individual large consumer—the central station, presumably—the general cost of management is not raised in the slightest thereby, and all that has to be taken into consideration is the expense for producing the gas, and for the repairs, renewals, &c.—the special cost of manufacture in its narrower sense. The proportion of the management expenses and salaries of officials may therefore be

neglected; and the expenses incurred in some gas-works by the public lighting and loss from the mains need not be considered, inasmuch as the augmentation of the private consumption and increasing the public lighting with the same quantity of gas as that required for the central station, necessitates the lengthening of mains and the fixing of numerous gas-meters, as well as other sources of loss. All question of participating in the total loss is avoided when the central station is situated on the gas-works, or is connected with them by a special main, which is then subjected to none of the usual variations. The division of the gas-works capital expended in street mains has to be treated in a similar way; and only that portion of the distributing plant specially laid down for the electrical department can be considered. Moreover, if the value of the gasholder has to be reckoned, inasmuch as the accumulators would be charged in the daytime, or during a working of 20 hours in the period of greatest consumption, the drawing of gas from the works does not cause any increase in the cost of storage plant. Therefore the actual cost of gas for a central electric station is practically restricted to the cost of raw material and fuel, less the value of the residuals, and with a small additional expenditure for manufacturing, including repairs and renovations.

Next to the comparison between the cost of working with gas or steam engines, an important consideration is the cost of establishing a central station. The three chief points which enable the erection of a gas-engine central station to be carried out with a small amount of working capital have been given in paragraph 6, under the advantages of such a system as that detailed above. It is only necessary to specially mention here that comparisons recently made with the cost of working stations with gas-engines, as compared with steam-engines, have turned out very much in favour of the former; inasmuch as the expense of the largest gas-engine plants hitherto made was only about as much as that of steam-engine plants of similar size, while at the present time the 120-horse power gas-engines, including erection, cost only about half as much as a steam-engine plant with reserve boilers, steam-boilers, buildings, and chimney. A double-cylinder 120-horse power gas-engine does not cost more at the present time than a 60-horse power engine did in 1886.

It may be assumed with the greatest certainty that in the course of a few years even larger gas-engines, giving increased economy, will be built, since their size has been more than doubled in the last five years. Consequently, we may reckon on not only making subsequent enlargements of central stations with more powerful gas-engines, but also on working with a considerably smaller consumption of gas. If, therefore, an electrical station is required for a town or a company with an initial capacity of 7500 simultaneously burning lights, or about 10,000 installed lamps, a comparison should be instituted between steam and gas engine installations; but not only should the cost of running the engines be considered, but certainly also the other important advantages of gas-engine installations.

A plan for such an installation for 10,000 lamps is given in fig. 3. It is furnished with four gas-engines of 120-horse power and two accumulator batteries for each, which are placed in two upper stories in the same building. Charging the accumulators with two engines would have to commence in the winter months probably at 8 a.m., and would be completed at 10 p.m., by one shift of men having 2½ hours off at midday; since, in the absence of stoking of boilers, work is lightened to an extra-

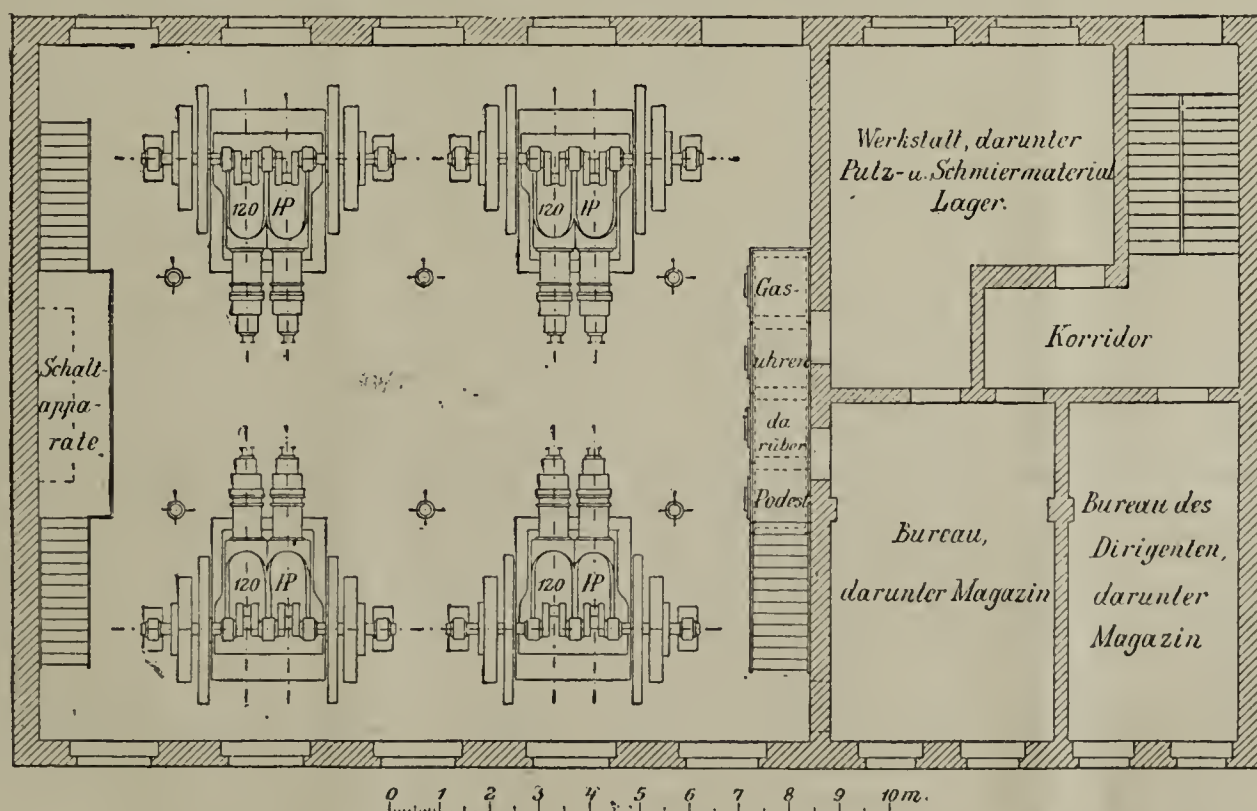


FIG. 3.—PLAN FOR A CENTRAL ELECTRIC STATION FOR 7500 SIMULTANEOUSLY BURNING LAMPS WITH 10,000 INSTALLED.

Schalt appa-rate—Switches. Gasuhren darüber Podest—Gas-meter with Supervisor's platform above. Werkstatt darunter Putz und Schmiermaterial Lager—Workshop with Store below for Oil and Lubricants. Bureau des Dirigenten darunter Magazin—Manager's Office with Stores below.

ordinary extent. During the periods of greatest consumption, the third engine would work directly on the distributing system, while the fourth engine could remain entirely in reserve. The accumulators alone would supply the demand at other times. The space required for the whole business of working 10,000 installed lamps, including offices, workshops, and stores, according to this plan, is only 370 square metres. By locating the offices, &c., elsewhere and providing a third storey for accommodating the accumulators, a still smaller area of land would suffice. From information we have received, it seems that 150-horse power double-cylinder gas-engines will be ready probably next year; then four engines and two accumulators will be able to supply 10,500 burning lights, or about 14,000 installed lamps.

As a matter of course, we do not go so far—and we emphasize this—as to recommend gas-engine power for central electric stations on the above plan under all circumstances. But it, appears to us that the experiences and results above described, of a statistical and accurately conducted practice of nearly five years, can at least lead (1) to setting aside the impression that gas-engines are useless for central electric stations, after thousands of such engines have proved so excellent for working electrical plant; (2) to making rational comparisons with steam-engine installations—that is, taking into consideration the various points herein indicated; and (3) to keeping in view the development of gas-engine construction up to the present. These motors have, as already shown, doubled in size within five years; and therefore subsequent developments will in all probability result in even larger gas-engines, exhibiting considerably greater economy as regards gas consumption.

The well-known prognostication of the late Sir William Siemens, "It is only a question of time when solid fuel must be replaced by the gaseous—viz., coal gas—in order to arrest the present enormous dissipation of fuel," and also ultimately to commence the abolition of the smoke nuisance, may well be kept in view when considering the question of central electric stations. According to the most recent researches on the theory of heat, the utilization of fuel is as follows:—

	In Steam-Engines.	In Coal Gas-Engines.
Sealy (<i>Jour. für Gasbel.</i> , 1883, pp. 552, 567.)	8.0 per cent.	16.5 per cent.
Clerk ("The Gas-Engine," 1886, pp. 263, 267)	11.1 " "	21.0 " "

Perhaps the conversion of many municipal corporations and societies to the idea of central electric stations will become easier when they have proved working with gas-engines to be more advantageous than working with steam-engines, by an exact test carried out under their own supervision. This will be the case with others, when new gas-works are near or have to be built which could supply the central station with gas without any considerable extra expenditure of capital.

In all cases, the working of gas and electrical plant under the same management is to be recommended, whether gas or steam engines are adopted, in order that, on the one hand, the commercial and technical operations may be conducted more in unison and more cheaply, and, on the other, that the public requiring heat, light, and power will be in a position to use both gas and electricity in the most satisfactory manner without any mutual competitive struggles.

Death of Sir G. B. Airy.—Early on the second day of the present year, and six months after the celebration of the 90th anniversary of his birthday, Sir George Biddell Airy, the seventh Astronomer-Royal, passed to his rest at his residence in Greenwich. He had a fall in the summer, and received an injury which involved a surgical operation. This seemed successful at the time; but he gradually succumbed to resultant weakness. Some years ago his services were utilized in connection with the settlement of the conditions under which sales of gas should take place; and he was Chairman of the Commission appointed to consider the general question of standards, also of that entrusted with the superintendence of the new standards of length and weight, after the destruction of the Houses of Parliament by fire in 1834. Sir George was President of the Royal Society from 1871 to 1873; he was made a C.B. in 1871, and a K.C.B. in 1872. He was medallist of the French Institute, of the Royal Society, of the Royal Astronomical Society, and of the Institution of Civil Engineers. He retired on a pension in 1881.

The Work of the Patent Office in the Past Year.—During the year 1891, the number of applications for patents was 22,872, or 1565 more than in the preceding twelve months. The work of the office in 1890 resulted in a surplus which exceeded £100,000; and as the various operations were carried on in a practically identical manner, it is presumed (the absolute figures not being yet available) that there will be an even greater surplus arising from last year's business. Questions have from time to time arisen as to how the surplus revenues should be employed. One suggestion is that the fees should be reduced; while another is that certainly a portion of the excess should be applied to the completion of the work of abridging and indexing specifications accepted prior to 1884—a work which has been for some time in arrear, the persons engaged thereon having been temporarily suspended. A noteworthy incident in connection with the affairs of the Patent Office in the past year is the conferring upon the Comptroller-General—Mr. (now Sir) Henry Reader Lack—the dignity of knighthood by the Queen, in recognition of his public services.

THE STRUCTURE AND CHEMISTRY OF FLAMES.

At a recent Meeting of the Chemical Society, a communication on the above subject was presented by Messrs. A. SMITHELLS and H. INGLE, of the Yorkshire College, Leeds. The following extracts therefrom are taken from the report of the Society's proceedings in the *Chemical News*.

The authors have been engaged for a twelvemonth in investigating the chemistry of flames produced by burning known hydrocarbons; and the publication of their results in the present form is consequent upon the appearance of a paper by Herr N. Teclu in the *Journ. Prakt. Chemie* (Vol. XLIV., p. 246), who describes the phenomenon which served as a starting-point in the author's inquiry. If a long glass tube be fitted, by means of a cork, over the metal tube of a Bunsen burner, so as to form a wider continuation of it, the flame can be caused to burn at the top of the glass tube. When the gas is turned off slowly, the flame becomes smaller, and develops a sharply-defined inner cone of a greenish colour, which ultimately becomes almost a flat disc of flame, and enters the glass tube. As a rule, it will descend at a rapid rate for some distance, then begin to oscillate, and finally either detonate and light the gas at the bottom of the metal tube, or else go out. If the gas supply be very carefully regulated, the flame may be brought into such a state that it will descend the tube for a short distance, and then re-ascend; and in this condition it is very easy to see that, while the lower cone is moving, there remains at the top of the tube a steady cone of flame of a pale lilac colour. By heating the glass tube at one point, so as to increase there the rate of inflammation, it is possible to fix the oscillating inner cone—that is, to prevent its re-ascend. It is also possible to effect this by narrowing the bore of the glass tube at one point, so as to diminish the rate of inflammation—i.e., to prevent the descent of the inner cone past that point. In this way it is practicable to separate the two hollow cones of combustion which constitute the Bunsen flame, and to keep them any distance apart for any length of time. This permits of the aspiration of the gases from the space between the cones without any chance of admixture of outside air, or of products of combustion from the upper cone.

The apparatus used by the authors in most of their experiments consisted of two glass tubes, one of which slides very easily within the other. The inner tube, which is the longer one, is united to the outer one by an india-rubber collar, through which it slides freely; and the two tubes are kept coaxial by a ring of asbestos packing. The projecting end of the inner tube may be fitted to a Bunsen burner; but the authors have usually led separate supplies of gas and air into the apparatus by a T-tube, instead of using a Bunsen burner, in order to have a better control of the flame. With this apparatus a non-luminous flame is easily obtained; and the two cones can be separated in two ways. If the apparatus is arranged so that the flame is formed at the orifice of the wider tube, and the orifice of the narrower one is 8 or 10 centimetres below it, on increasing the air supply the inner cone of flame will ultimately descend and rest upon the orifice of the inner tube. If, on the other hand, the inner tube be made to project beyond the outer one, and the non-luminous flame be formed on it, then, if there be a sufficient air supply, on sliding up the outer tube, it will, as it passes the flame, cleanly detach and carry up the outer cone; leaving the inner one still burning on the inner tube.

The authors have made similar experiments with flames of liquid hydrocarbons by charging air with the vapour of the liquid by passing it through a "saturator," such as is used for producing the ether-oxygen lime-light. The vapour-charged air is afterwards mixed with more air; and, by suitably regulating the proportions, a non-luminous flame is obtained, and divided into two cones. In the case of liquid hydrocarbons, the lower cone of flame usually appears to be divided by dark spaces into several petal-like divisions, which are in rapid rotation. In the case of benzene vapour, the following sequence of appearances is presented: Starting with the orifice of the inner tube 8 or 10 centimetres below that of the outer one, a luminous smoky flame is first obtained at the latter. As air is gradually added, the flame becomes less and less luminous, and an inner cone begins to develop; but before this has become non-luminous, it descends to the inner tube. More air makes both it and the other cone non-luminous; and this state may be maintained. If now somewhat less air is supplied, a luminous streak appears at the tip of the inner cone, and passes right up and through the tip of the upper cone. If more air is supplied, the upper cone of the flame begins to disappear, and only the upper part of it remains. This also gradually fades away, and then there is only the lower cone left. Still more air produces a visible effect on the inner cone; the colour changing, and the combustion becoming less intense, until the cone rises from its seat, passes upwards, and disappears. There is thus a gradual transition from the richly-luminous flame to one consisting of a simple pale blue cone just on the point of extinction through excess of air.

The hydrocarbons examined by the authors were ethylene, methane, pentane, heptane, and benzene. Coal gas was also used. The gases from the regions between the two cones of flame were analyzed in all cases volumetrically or gravimetrically. The results obtained (which were tabulated by the authors) show that the products of combustion of the first cone

are essentially CO_2 , H_2O , CO , and H_2 ; and that the second cone is due to the combustion of the CO and H_2 with the external air. The results are in harmony with the conclusions of Blochmann, obtained indirectly, and with the not generally known work of Dalton on the explosion of methane and ethylene with oxygen in quantities insufficient for complete combustion, which was repeated in 1861 by Kersten.

The authors point out: (1) That carbon, according to Baker's experiments, even in excess of oxygen, burns preferentially to CO , and not to CO_2 ; (2) that the heat of combustion of gaseous carbon to CO is probably greater than that of hydrogen to H_2O ; (3) that, according to Dalton, CH_4 , when burnt with its own volume of oxygen, gives products represented in the equation— $\text{CH}_4 + \text{O}_2 = \text{CO} + \text{H}_2\text{O} + \text{H}_2$;

and they conclude that this equation represents the character of the change first taking place in the inner cone. But as the two substances CO and H_2O act upon one another, the case is one of reversible change; and four products will result—viz., CO_2 , H_2O , CO , and H_2 .

The conditions of equilibrium of this system, according to Dixon, are expressed by the coefficient—

$$(\text{CO} \times \text{H}_2\text{O}) \div (\text{CO}_2 \times \text{H}_2) 4.$$

This is subject to certain conditions of temperature and dilution. The authors in their most reliable experiments—viz., the gravimetric ones—with ethylene and coal gas, get numbers not greatly differing from 4; but they are still engaged in studying this question.

The authors have succeeded in dividing into two cones flames produced by the admixture of air with cyanogen, sulphuretted hydrogen, carbon bisulphide, and decomposed ammonia—i.e., $\text{N}_2 + 3\text{H}_2$. The products of the inner cone in the case of cyanogen were found in one experiment to consist of carbon monoxide and carbon dioxide, in the proportion of two volumes of the former to one volume of the latter.

Professor Smithells is continuing the experiments with a view of elucidating the following points: (1) The influence of differences of diameter of the tubes and rates of efflux on the fractional combustion. (2) The exact composition of the interconal gases in the case of hydrocarbons, and also of mixtures of $\text{CO} + \text{H}_2$, so as to ascertain it, and in what way the above coefficient varies with the composition of the gases and other conditions. (3) The composition of the interconal gases from hydrocarbon flames while carbon is being liberated, so as to ascertain whether the luminosity of flame is due to simple decomposition of hydrocarbons by heat, to preferential combustion of hydrogen, to partial decomposition, or to other change. (4) The exact nature of the flame of cyanogen, so as to ascertain what governs the proportions of carbon monoxide and carbon dioxide formed in the inner cone. (5) The manner in which the partition of oxygen takes place in the inner cone between hydrogen and sulphur, and carbon and sulphur, and so as to obtain information as to the affinities of carbon, hydrogen, and sulphur for oxygen. (6) The spectroscopic appearances of the flames.

At a subsequent period of the meeting, Professor SMITHELLS submitted a note on the same subject, of which the following is an abstract:—

The author began by giving a brief summary of the various views that have been held on the subject. With one or two exceptions, there has been general agreement, since the time of Berzelius, that an ordinary candle-flame, or the flame of coal gas escaping from a circular hole, is divisible into four chief regions: (1) The dark inner part; (2) the luminous part; (3) a small bright blue part at the base of the flame, thinning off rapidly as it extends upwards; and (4) a dim, scarcely visible, faintly luminous mantle surrounding the whole flame.

The explanation which the author would give of these regions is as follows: The gas or vaporized wax, on issuing from the orifice or wick, becomes mixed with air and burns. Whether or not the flame is luminous, depends on the rate at which the combustible is supplied. If slowly, sufficient air is admixed with the gas for non-luminous combustion. Thus a very small gas-flame is non-luminous; and so also is the flame of a candle with the wick cropped close to the wax. It is conventionally said that coal gas burns with a luminous flame. It is just as true to say that it burns with a non-luminous flame. The small non-luminous flame of coal gas, or of a short-wick candle, is seen to have the same structure as a Bunsen burner—viz., a bright blue inner cone, and a pale lilac cone superposed upon it. The author supposes that we have here the same chemical changes occurring as are dealt with in the previous paper—viz., that the first combustion in the inner cone is mainly to CO_2 , H_2O , CO , and H_2 ; and the final one in the outer cone is mainly that of CO and H_2 to CO_2 and H_2O . This is made more probable by the fact that, if the gas supply be increased, the luminous tip shows just at the point where it appears in the experiment with benzene; and that, even after it is considerably developed, the shape of the flame betrays the persistence of the inner cone. As the gas supply is further increased, the luminous area becomes increasingly great; the relics of the two original cones being very small.

The author's view is further enforced by the simple experiment of taking a flame about 5 centimetres high from a Bunsen burner with the air-holes stopped; noting the blue region at the base of the flame, and the dim mantle outside it, and then

slowly turning on the air. The gradual transition shows unmistakably that the blue part and the mantle are the "rudiments" of the two cones of a Bunsen flame.

With regard to the luminous part, everything goes to show that it is mainly a region where hydrocarbons are decomposed by the heat of the outer parts of the flame; and the precise nature of the change is being studied by the author. The dark inner cone contains mainly unburned gas, mixed with some products of combustion from surrounding regions.

A commonly-held view, that the mantle of a luminous flame is due to heated air and products of combustion, is inconsistent with the above explanation, and also with the fact that, in recent experiments, it has been found impossible to render air luminous at the highest attainable temperatures.

The view that carbon is separated in a flame owing to the preferential combination of oxygen with hydrogen, is opposed, the author thinks, to all experimental evidence, which he is of opinion goes to show that, if the oxygen supply be limited, carbon will burn before hydrogen.

The author would describe a luminous flame as follows: (1) An outer sheath or mantle, with (2) an inner bright blue portion visible at the base of the flame. These two parts correspond respectively to the outer and inner flame cones of a Bunsen flame, and mark the region where the coal gas or candle gas is burning with a large quantity of air. (3) The yellow luminous part, marking the region where the heat of the parts (1) and (2) is decomposing hydrocarbons, setting free carbon, which rapidly glows and burns. (4) The dark inner region, consisting of unburned gas, mixed with products of combustion of the surrounding parts.

Novelty is not claimed for the foregoing description; but the author considers that the experiments described in the preceding paper put the matter in a somewhat new light.

Sudden Death of Mr. Leslie Cloudsley.—A large section of our readers, especially those in the southern districts of England, will learn with deep regret of the sudden death of Mr. Leslie Cloudsley, brother of the Mr. John L. Cloudsley who has for some years been a member of the firm of Messrs. W. and B. Cowan, and has had charge of the London branch of the business since its establishment. The sad event occurred, with scarcely a moment's warning, on Monday evening last week. For a few days previously, Mr. Cloudsley had complained of a slight cold; but he did not attach any importance to it, as it did not interfere in any way with his business or social engagements. At about half-past eight on the evening named, while joining in conversation with friends, he was observed to take an unusually deep breath, and immediately afterwards life was found to be extinct—death resulting from a sudden failure of the heart's action. Mr. Cloudsley was only in his 42nd year, and was unmarried. He had for many years resided at Willesden with his brother, with whom, as our readers know, he was associated in business. Those who were in the habit of meeting the late Mr. Cloudsley would never have suspected that one who always displayed so much energy and activity could have a constitutional defect of so serious a nature as that which brought his useful life to so melancholy a close. His characteristic activity was frequently displayed in the cricket-field and in the moderate indulgence of athletics. He was Vice-President of the Willesden Cricket Club. In the social circle in which he moved, his loss will be very greatly felt, for he was a man of many strongly-attached friends. Not less will it be felt by his associates in business, who will, we are sure, extend to his relatives the sympathy of which, in their sudden bereavement, they stand so much in need. The funeral took place last Friday.

The Rose Fuel-Gas Process.—According to the *American Manufacturer*, a gas-making process, called after its designer (Mr. Rose), is being exploited by the National Heat and Power Company. This process is practically a combination of a gas-producer with a water and oil gas manufacturing apparatus. The so-called Rose gas has been analyzed by Dr. E. G. Love, of New York, who finds it to be composed of about 40 per cent. of hydrogen, 15 to 20 per cent. of marsh gas, 10 to 15 per cent. of carbonic oxide, and some 20 per cent. of nitrogen, with about 10 per cent. of "heavy hydrocarbons." It is claimed that, while this is a gas of high heating power, it also has good illuminating properties. The performances of the Rose gas, when used as an illuminant, are also vaunted by the same well-informed organ, which gives a list of ostensible tests of this gas with several well-known types of incandescent gas-burners, the net result of which is *nil* in the estimation of an expert; not one of the published determinations containing the data necessary in an accurate statement of this kind. Seeing the large amount of nitrogen contained in the gas, and the equally high proportion of heavy hydrocarbons, it can only be concluded that the effect of the former is to kill the latter, and that the Rose gas would be all the better without the contribution of the "producer" section of the apparatus. In this case, the remaining plant would be simply a carburetted water-gas apparatus—probably no better, if not worse, than other forms of this kind of plant. It seems only too likely that Mr. Rose has failed, as others have done before him, in the attempt to make, by the cupola method, a fuel gas that shall be both good and bulky. The protest of the experienced Yankee gas consumer—that "he did not want any nitrogen in his gas"—yet covers the field occupied by inventors of the Rose order.

ANTISEPTICS AND MEDICAMENTS DERIVED FROM COAL TAR.

In the current number of the *Moniteur Scientifique-Quesneville*, the principal original contribution is an article by M. Trillat upon the medicinal and sanitary value of coal-tar derivatives. The writer remarks, in introducing his subject, that among the innumerable derivatives of coal tar, most of which have been worked out with a view to the colour industry, there are many which can be utilized in general therapeutics and antiseptics, among which he enumerates phenol, resorcine, salicylic acid, acetaniline, &c. It is curious how the study of antiseptics and medicaments derived from coal tar has been allied with that of the colouring matters obtainable from the same source; but the fact remains, and the industry of the one class of derivatives is similar to that of the other. As with the colouring matters, the chemistry of the antiseptics and drugs has its history. It only developed slowly—being attended with its promises and failures; and if the list of this class of commodities is not so long as that of the dyes, they nevertheless form the basis of important and very lucrative industries, principally in Germany. The reason for this latter fact M. Trillat finds in “the prodigious activity of the German workers, not only in the Universities, but also, and above all, in the numerous laboratories and dye factories.” In this way, chemistry has been enriched with a crowd of new bodies; thus verifying at the same time the influence of theory upon practice, and the reciprocal influence, so that all that the one has gained has contributed to the development of the second. The isolation of phenol dates, according to M. Trillat, from the distillation of tar; and therapeutics soon made use of it. So that as from 1856 phenic acid replaced in *Materia Medica* the preparations of coal tar which were only useful on account of their containing a small proportion of phenol. Of course, as a French author, M. Trillat ascribes the development of antiseptics to the influence of M. Pasteur, altogether ignoring Lister; and he goes on to say that new outlets for antiseptic methods were found in tanning, in the paper industry, in the preservation of wood, as well as in that of diverse organic substances. So that apparently M. Pasteur had something to do with the practice of creosoting, which was an important industry before he was ever heard of. In the search after antiseptic or medicinal applications, two great obstacles were met with—toxicity and insolubility. The latter inconvenience has been remedied by forming soluble salts; but unfortunately the latter device has sometimes proved detrimental to the antiseptic qualities of the product. M. Trillat then proceeds to discuss salicylic acid and its derivatives the salols. He shows how, in the amido series, therapeutics utilizes antifebrine, exalgine, and phenacetine. But it is to the pyridic series that the attention of chemists has been above all attracted. Pyridine was first obtained by Anderson in 1846 from the dry distillation of bones. Runge detected the presence in coal tar of quinoline, the relation of which with Anderson's pyridic bases was soon established. M. Trillat points out how these relations favoured the hope that the important alkaloids of the cinchona group might be derived in their turn from the pyridic series of coal tar. Antipyrine was obtained by Knorr, and has proved a most valuable product, in the commercial sense. The fatty series of coal-tar derivatives have also produced valuable medicaments, among which may be cited chloral, sulphonal, &c. Finally, attempts have been made to use coal tar directly as an antiseptic. By combining tar with a fatty oil in presence of an alkali, we get lysol. Treating it under certain conditions with sulphuric acid yields creoline. The treatment of the paraffin of tar with sulphur gave a product which was sold under the name of thiole; the same method being also applied to certain mineral and animal oils. The remainder of the article gives detailed explanations as to the preparation and nature of the compounds named, and forms a useful report upon the general subject.

THE DISTILLATION OF COAL TAR.

At the last Meeting of the Bavarian Association of Gas and Water Works Managers, Dr. Windmann, of Munich, presented a paper, in which he described the distillation of coal tar as conducted at the Pasing Works in Bavaria. The full text of the communication was given in the report of the proceedings contained in the *Journal für Gasbeleuchtung*; and the following particulars are taken from an abstract translation in the *Journal of the Society of Chemical Industry*.

The distillation of the tar is effected in large wrought-iron stills, heated by means of a furnace placed beneath the still. At the commencement, a gentle heat is applied; and the distillation is performed at the ordinary pressure—the water in the condensing apparatus being kept cold. The distillate consists of light oil and water. After all the water has come over, the heat is gradually increased, the atmospheric pressure diminished, and the temperature of the water in the condenser raised; the products of distillation being medium oil, heavy oil, and anthracene oil. The distillation at the stage at which the latter comes over is aided by the injection of steam and the application of an exhaust air-pump. The residue of distillation is pitch, which is run out from the bottom of the still.

The products are worked up in the following manner: The light oils having a specific gravity below 1, and consisting of benzene and its homologues (phenol, pyridine, and naphthalene), are subjected to fractional distillation. The crude benzene thus obtained is, in the first place, washed with a weak solution of caustic soda, in order to remove all phenols; then treated with dilute sulphuric acid, which extracts the pyridine bases; and finally washed with concentrated sulphuric acid, which separates all tarry substances. The product is then subjected to distillation by means of steam; the following fractions being obtained:—

Benzene I.—Boiling from 80° to 100°; used in the preparation of aniline.

Benzene III.—Boiling from 100° to 120°;
Benzene IV.—Boiling from 110° to 140°; } used in the preparation of toluene, xylene, &c.

Benzene VI.—Boiling from 140° to 175°;
Benzene VII.—Boiling from 175° to 195°; } used in the manufacture of india-rubber.

The residue is added to and worked up with the medium oils. The soda solution, partially charged with phenols, is completely saturated therewith by mixing it with oil rich in phenols, separating the solution from the undissolved oily portion, and decomposing by means of an acid. Crude carbolic acid is thus obtained; and this is subsequently worked up into the pure crystallized acid. The acid solution, charged with pyridine, is neutralized with ammonia; and the crude pyridine thus liberated is subjected to fractional distillation. The product is now largely used for the denaturation of alcohol. The tarry acid liquor, after being washed with water and neutralized, yields on distillation a further portion of crude benzene; the residue being employed for fuel purposes. The medium oil, having a specific gravity of about 1, is subjected to fractional distillation. The first distillate represents crude naphtha, and is worked up with the light oil. The second distillate contains naphthalene and phenol. The former crystallizes out on cooling, and is separated by draining the oil and subjecting the residue to hydraulic pressure. The drained oil is then submitted to fractional distillation; the first portions, which are highly charged with phenol, being used for the preparation of carbolic acid, while the higher-boiling fractions are employed as creosote oils. The heavy oils, having a specific gravity of about 1, contain phenol, naphthalene, and neutral oils. On re-distillation, an oil highly charged with naphthalene is obtained, the lower boiling fractions of which contain large quantities of phenol. This oil is worked up like the second oil obtained by the re-distillation of the medium oil. On cooling, the last product of the distillation of coal tar—anthracene—mixed with other high-boiling hydrocarbons, crystallizes out. This is collected in filter-presses, and the mass subjected to hydraulic pressure. The filtered oil is re-distilled—the first fractions being added to the creosote oils; while from the higher-boiling portions a further quantity of crude anthracene is obtained, which, is, however, inferior in quality and percentage strength to the anthracene separated from the original oil. The water which comes over with the light oil in the early part of the process of distillation, being saturated with ammonia, is converted into ammonium sulphate along with the gas liquor which has been separated from the tar before it is submitted to distillation.

Death of Mr. T. J. Evans, of Merthyr Tydfil.—The Chairman of the Merthyr Tydfil Gas Company, Mr. Thomas John Evans, J.P. for the counties of Glamorgan and Brecon, died suddenly on Saturday, the 2nd inst., at his residence, Glyncelyn, near Brecon, aged 60 years. Mr. Evans had been a Director of the Company since 1860, and Chairman from 1880.

Death of Mr. T. Moore.—The ranks of the gas managers of the Manchester district have sustained a loss by the death, on Tuesday last, in his 57th year, of Mr. Thomas Moore, who for nearly 15 years occupied the post of Gas Engineer of the Macclesfield Corporation. Mr. Moore was born at Stretford, near Manchester; his father being a plumber and gas-fitter in the town. He was educated at the Manchester Grammar School; and, on leaving that establishment, assisted for a short time in the management of his father's business. Subsequently he was articled to the Engineer of the Liverpool Gas Company, where he qualified himself for entering the gas engineering profession. From Liverpool he went to Stafford, to take the position of Deputy-Manager of the gas-works; leaving that town in 1877 to assume more responsible duties at Macclesfield. His first work on arriving there was to prepare plans for a thorough reorganization of the works; and this was effectually carried out during the period of his supervision of them. Mr. Moore's health began to show signs of failing several years ago; but this did not interfere with the proper discharge of his duties till within the last 18 months. An extended leave of absence having failed to produce any appreciable benefit, he sent in his resignation, and was succeeded by Mr. H. H. Ford, who had charge of the works during his chief's illness. Mr. Moore was a member of the Manchester District Institution of Gas Engineers, and occupied the presidency in 1887. He was also a prominent Mason—joining the craft when at Stafford, where he was P.M.; and he held similar rank in the Combermere Lodge, No. 295, at Macclesfield.

REGISTER OF PATENTS.

Governing the Speed of Gas-Engines.—Carling, J., of Middlesbrough. No. 110; Jan. 3, 1891. [6d.]

To regulate the speed of gas-engines as ordinarily constructed, says the patentee, the valve which admits the gas to the cylinder has a spindle projecting downwards; and immediately below the end of this spindle is an oscillating finger mounted on a lever actuated every alternate stroke of the piston by a cam in such a way that, when the engine is running slow, the finger catches the end of the valve-spindle and opens the valve. The finger, however, is capable of oscillating on a fixed centre; and its oscillation is then caused by the rise and fall of the governor balls. Thus, when the engine is running too fast, the action of the governor pushes the point of the finger on one side, so as to cause it to miss the end of the projecting spindle; and consequently, during one or more strokes, the gas-valve is closed until the speed has slackened off. By this method, therefore, the supply of gas is an intermittent one. According to the present invention, however, the supply of gas is not intermittent, but continuous—that is, the cylinder receives a portion of gas at every alternate stroke; but in larger or smaller quantities, regulated by the speed of the engine.

To accomplish this, instead of an oscillating finger, an oscillating quadrant is employed, the outer edge of which is eccentric to the centre of oscillation. Thus, when the engine is running slow, and the governor balls are down, the highest point of the quadrant comes immediately under the valve-spindle, and by the action of the cam on the lever, the valve obtains the highest lift. But when the speed increases, a lower part of the quadrant comes in contact with the spindle, and the lift of the valve is diminished. Thus, the cylinder receives more or less gas at every alternate stroke, but in regulated quantities according to the speed of the engine.

Slow-Speed Condensers.—Clapham, T., of Keighley. No. 1563; Jan. 28, 1891. [6d.]

This invention relates to that class of condenser which consists of a vessel of cylindrical shape in cross section, having partition-plates placed near each of its outer ends so as to form an upper, a lower, and an intermediate cavity therein; the upper cavity being opened or joined to the lower cavity by a series of intervening pipes or tubes extending through the intermediate cavity, so that water may freely pass from the lower to the upper cavity without actually entering the intermediate one. The invention consists of so constructing these pipes or tubes and the upper partition-plate that any of the pipes or tubes may be detached for repairs, or for the substitution of new ones, without interfering with any other.

This object is attained by forming a flange or collar near one end of each pipe, so that when the outer end of a pipe is inserted into one or other of the openings made in the lower partition-plate, this flange will fit over it, so as to cover any interstices that may exist between the pipe and the plate. In the upper plate a downwardly projecting flange is formed to surround each opening; and on the lower interior edge of this flange is formed a rim, which projects laterally, but affords sufficient space for the insertion of the pipe and for the flange on it to pass through. Thus when the pipe is passed through the opening, and a washer is fitted over the upwardly projecting end, and made to rest upon the laterally projecting rim above described, a suitable cavity or box is formed for packing or stuffing material to render the joint water-tight. In the walls of the downwardly projecting flange are formed recesses for T-headed bolts, which are mounted therein so that the nuts thereon may be employed for forcing in or tightening up the stuffing or packing by means of an annular wedge-piece, which fits over and partly within the cavity surrounding the pipe.

Wet Gas-Meters.—Clarke, A. H.; communicated from W. Gay, of Rosario de Santa Fé, Argentine Republic. No. 15,054; Sept. 5, 1891. [6d.]

This invention has for its object to prevent the extraction of the water, by syphoning or other means, through the water supply pipe of wet gas-meters, when placed in position on consumers' premises.

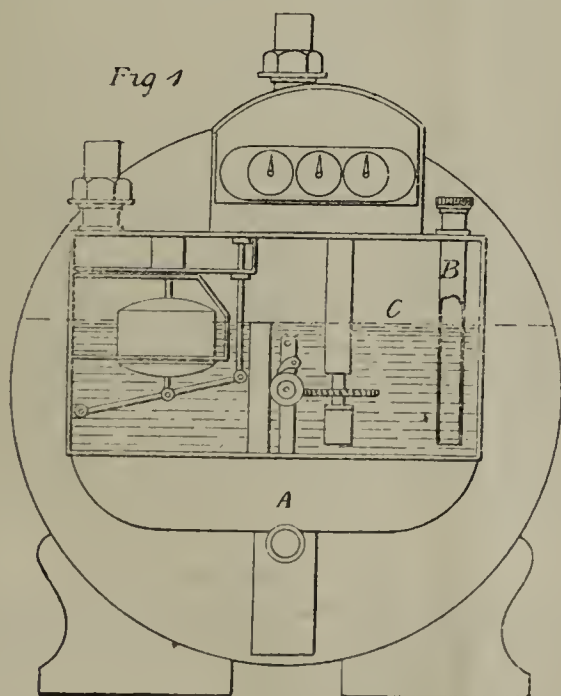
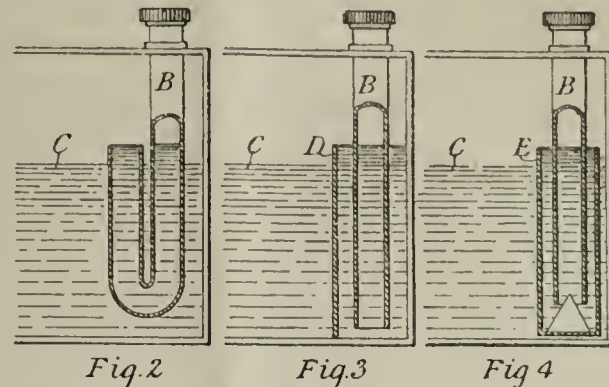


Fig. 1 shows a type of gas-meter to which this invention applies; and figs. 2, 3, and 4 are views, of various examples of the manner of carrying the invention into practice.

A is the meter, which is of any wet-type construction; and B is the pipe through which water C is introduced into the meter, and which is usually provided with a screwed plug. From fig. 1 it will be seen that,

by removing this plug, and applying a syphon pump or equivalent apparatus, nearly all the liquid may be withdrawn from the meter—that is to say, all the liquid above the level of the lower end of the

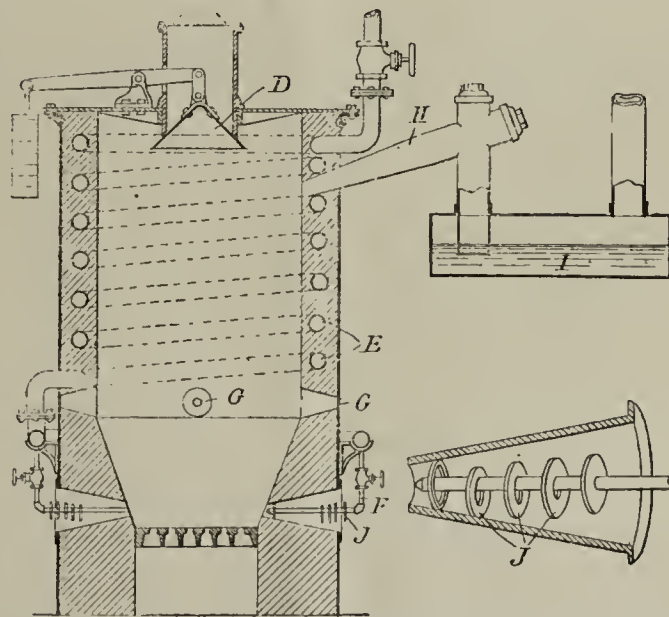


tube B. But figs. 2, 3, and 4 illustrate three different examples of the manner of carrying the present invention into practice. According to fig. 2, the tube B is bent so that the upper end of its leg projects above the normal level of the liquid C; or, as in fig. 3, the tube B is caused to dip down into a case or box D, the upper end of which is above the normal level of the liquid. It will be seen that, in either of these examples, when the liquid is poured into the meter through the pipe B, it will flow over what virtually constitutes the effective end of the tube, which will remain full of liquid, as shown. Should there be any attempt to withdraw the liquid from the meter, it would only result in the emptying of the end tube; the main body of the liquid in the meter remaining unaffected.

In fig. 4 the pipe B is shown as dipping down into a moveable or floating vessel or case E, the bottom of which carries a conical valve, adapted to close the lower end of the pipe when there is any attempt to withdraw the liquid through it. When liquid is poured into the meter through the pipe B of fig. 4, it fills the vessel E, and flows into the meter body over the upper edge of E, which edge virtually constitutes the effective end of the pipe; and when the supply ceases, the vessel E will remain full. If an attempt to withdraw the liquid through B is made, only a comparatively insignificant quantity will be removed; because, as soon as the quantity of liquid in E is sufficiently reduced, the vessel will float and raise the cone against the end of the pipe B, so as to prevent both the further extraction of liquid and the escape of gas.

Manufacture of Gas and Ammonia.—Lake, W. R.; communicated from A. Hernim, of Springfield, U.S.A. No. 15,249; Sept. 8, 1891. [8d.]

The object of this invention is to simultaneously and continuously generate gas and ammonia from bituminous coal, shale, or other suitable fuel; and (stated broadly) this result is accomplished by introducing air and steam, or oxygen and steam—the steam being preferably, though not necessarily, superheated—into the incandescent portion of a body of fuel contained in any suitable vessel or generator. The amount of air or oxygen is regulated so as to maintain a zone of incandescence, or body of fire, of sufficient size and temperature to decompose steam and reduce carbon dioxide to carbonic oxide, while also maintaining a sufficient body of fuel at a lower temperature, beyond such zone of combustion, to allow of the formation of ammonia, and causing the gases to pass off at a temperature sufficiently low to prevent the disassociation of the ammonia.



The illustration shows one form of apparatus which may be used to carry out the process—a vertical section of the generator, and an enlarged view of the injector and washers.

The generator is made in any desired shape, preferably round, and of refractory material. It is provided with the well-known bell and hopper D, through which the fuel is fed; and holes G, through which the fuel may be stirred and broken up as desired. At a point preferably a short distance above the grate, there are a number of radial tuyers F; and into these, steam-injectors are inserted (as shown), provided with cocks or valves to control the admission of the steam. Steam is supplied to these injectors from any boiler by means of a pipe E, preferably coiled within the walls of the generator (as shown), in order to superheat the steam by means of the radiant heat. A pipe H is provided to carry off the gases produced, and to conduct them to a hydraulic main I.

If air is to be used with the steam, it is drawn in through the tuyers by means of the injectors; and the same method is employed with a steam and oxygen blast—the tuyers in this case being connected with any suitable oxygen supply. By placing the injecting tuyers just above

the grate, the patentee claims to be enabled to introduce the air or oxygen and steam to the hottest part of the fire, and to insure a more uniform distribution and complete decomposition of the steam. The necessity for shutting off the blast when cleaning the grate and removing ashes is also avoided, as must be done when the blast is introduced into the ash-pit, unless the inconvenient plan of a water seal is adopted.

Upon the injectors there are adjustable washers formed with holes of different sizes; and when it is desired to control the amount of air or oxygen admitted, one of the washers is pushed inwards, and only so much air as can pass between the injector and the washer is admitted. If it be desired to lessen this amount, another washer having a smaller hole is pushed inwards; and so on.

The apparatus being constructed as described, the process is carried out in the following manner: Bituminous coal, shale, or other suitable fuel is introduced through the hopper and ignited, and allowed to burn until a bed of incandescent fuel 5 or 6 feet in thickness is formed. At about the same time a blast of air or oxygen and superheated steam is admitted through the tuyers. The producer is then gradually filled up, until the coal reaches a depth of from 10 to 12 feet; the upper portion of this charge consisting of green coal drying and partially distilling. In this portion, or "black zone," the temperature is not allowed to rise above 350° C. (being regulated by feeding in fresh fuel as required); and most of the liquid hydrocarbons of the fuel are here driven off. Immediately below this zone lies a zone of a higher temperature, in which the volatile matters of the coal are distilled. The temperature of this zone of distillation varies from 350° to 700° C. Here, practically, all the volatile matters are distilled; and a percentage of ammonia is formed equivalent to about 20 lbs. of sulphate per ton of coal consumed. Any steam arriving at this zone of distillation is decomposed, forming carbonic oxide, carbon dioxide, and hydrogen; and the nascent hydrogen unites with the nitrogen of the coal to form an additional amount of ammonia. The amount of carbonic oxide produced in this zone is below 50 per cent. of the amount of carbon dioxide, since the temperature, although sufficiently high to decompose steam, is too low to convert all of the CO₂ into CO, which reaction commences at 550° C., and is only complete at a temperature of 1000° C. Below this zone of distillation lies a still hotter zone, the temperature of which is 700° to 1000° C.—the "zone of combustion." It is into this zone that the steam or oxygen or air are introduced as above stated. In this zone, a large amount of steam is decomposed; half of the fixed carbon of the coal being thus oxidized, setting free an equivalent amount of hydrogen, and by then properly regulating the supply of air or oxygen the remainder of the carbon is oxidized, raising the temperature to the point proper for the reduction of the CO₂ to CO. All the nitrogen of the fuel is, by contact with the nascent hydrogen, set free from the fuel, and converted into ammonia. The hot zone in which these reactions occur does not exceed, say, a few inches; and the ammonia formed there is instantly removed by the action of the exhauster, along with any steam remaining undecomposed, to a region already cooled by the reduction of CO₂ into CO, and mostly secured in the upper zone, where decomposition of ammonia cannot occur, owing to the low temperature, and where all the steam remaining is decomposed.

The patentee claims that he has, by means of this process, with very crude and imperfect means of separating the ammonia from the gas, obtained ammonia equivalent to about half the nitrogen contained in the coal, and simultaneously therewith obtained a fuel gas of the following composition:—

CO ₂	6.50
CO	29.00
CH ₄	2.25
H.	43.00

(Experiments at the time showed that still more ammonia was formed but escaped, owing to the imperfect condensation.) This gas is practically free from undecomposed steam; and it possesses the proper qualities of a high grade of gas for heating and metallurgical purposes—one of the main points of the process.

In alluding generally to his proposal, the inventor says: "As far as I am aware, I am the first to accomplish the conversion of 50 per cent. or more of the nitrogen of the coal into ammonia, under conditions which would allow of the reactions which take place in my process, especially the conversion of the CO₂ produced in the zone of combustion into CO, and thus enabling me to produce simultaneously with the ammonia a gas very low in carbonic acid (CO₂) and high in carbonic oxide (CO). The greatest care must be taken to regulate the temperature of the various zones. If the temperature rises too high, no ammonia will be formed; or if formed, will be immediately disassociated by the heat. The ammonia and gases are allowed to pass off at a temperature low enough to prevent the disassociation of the ammonia. They flow through the pipe H into the hydraulic main, from whence they are drawn into any of the well-known apparatus for separating the ammonia, removing the tar and other impurities. I am aware that in previous gas processes, air has been used to blow up the fire; and that, after a sufficient bed of incandescent fuel has been formed, the air has been shut off and steam admitted to the fire and decomposed. Furthermore, that air and steam have been simultaneously admitted to the fire. But in these processes the gases that first pass off from the fuel are generally burned, or used to heat a separate chamber, to which the gases created by the decomposition of steam, &c., are to be admitted, for the purpose of fixing or permanently combining them through intense heat. As this is precisely what I desire to avoid, I use no superheating or fixing chamber; nor do I consume the gases first coming off the coal, since I desire to preserve and utilize these gases, which are among the most useful products of the distillation. I am thus able to secure all the gases contained in the coal for fuel purposes; and hence my process will produce more gas per ton of coal than any other now known. The object of the former process has been to obtain a fixed combined gas for illuminating and other purposes, and in order to do this, intense heat has been necessary both in the generator and in the retort or fixing chamber: whereas, my object being to simultaneously produce ammonia and gas, I dispense with any retort or fixing chamber, and, using merely the simple generator, I so control the temperature at different points thereof as first to decompose the steam and reduce the carbon dioxide (CO₂), second to allow the ammonia to form, and lastly prevent its disassociation. If any ammonia has been made in the former processes, for the

production of gas other than the retort or illuminating gas process, it has been a bye-product produced unintentionally and almost accidentally, and has been at once destroyed by the heat that was necessarily used to accomplish the purpose of the inventions. Its formation was a thing rather to be avoided than sought; and, if formed, it must at once be destroyed. In the majority of prior gas processes, ammonia could never be formed at all, and if formed, it would last but an instant, and then be destroyed as above stated, so that the operator would be in ignorance of its formation, and no advantage could be taken of it. In the ordinary process of making illuminating gas in closed retorts, a certain percentage of the nitrogen of the coal combines with hydrogen and forms ammonia, which is collected in the scrubbers and purifiers, but the larger portion of the nitrogen still remains in the coke and is lost. In all previous fuel gas processes, the ammonia has been neglected, if not altogether lost sight of. As stated before, it has either never been formed or at once destroyed. I have, however, discovered, after careful investigation and experiment, the possibility of so controlling the operation of the generator that ammonia can not only be made simultaneously with the fuel gas and separated from it without detriment to the quality of the gas, but that the nascent hydrogen of the decomposed steam unites with most of the nitrogen, which would be lost in the coke of the retort gas process. I am thus able to secure as a bye-product from three to four times as much ammonia per ton of coal consumed as is secured by the retort gas process. The low temperature which I maintain in the coolest zone of the generator, where the gases escape, also enables me to secure, at the same time with the ammoniacal liquors, a considerable quantity of tar of a superior quality; thus adding still further to the value of my bye-products."

Gas-Motor Engines.—Evers, M., of Leeds. No. 17,364; Oct. 12, 1891. [8d.]

This invention relates to the construction of an automatic or self-acting admission-valve for controlling the supply of explosive fluids into the cylinder of a gas-motor engine, and for thoroughly mixing such fluids so as to ensure perfect homogeneity during the admission into the cylinder prior to compression and ignition in the ordinary manner, whereby it is claimed that "great certainty of ignition and explosion is secured, combined with perfect combustion of the entire explosive compound."

In conjunction with the automatic valve, a deflecting-plate (rather less in diameter than the cylinder) is applied, fixed over the admission-valve, for limiting the distance that the valve will open, and for the special purpose of deflecting the explosive gases, during admission, so as to clear away from the bottom or rear end of the cylinder the residuum of previous explosions, and for ensuring the presence of an ignitable compound when compressed up the ignition-tube, which is located about the level of, or in the same plane as, the deflecting-plate. The action of the valve is automatic, and will fulfil the above conditions whether the engine be running quickly or slowly; and it may be applied either to a vertical or horizontal engine.

The engine, when fitted with this valve, may be governed by a bell-crank or T lever hit-or-miss arrangement. Or where great steadiness and uniformity of motion are essential, a revolving governor arrangement can be applied for increasing or diminishing the quantity of air per explosion admitted into the cylinder and producing a correspondingly more or less powerful explosion. Thus, while giving an explosion every alternate revolution, such explosions are of varying power responding to the variations in the air supply, which (as already stated) can be controlled by the governor.

APPLICATIONS FOR LETTERS PATENT.

- 22,292.—YEADON, J. A., and ADGIE, W., "Heating retorts or furnaces for the distillation of coal or other analogous purposes." Dec. 21.
 22,325.—MILLS, B. J. B., "Meters for liquids or gases under pressure." A communication from T. Blein and E. Béraud. Dec. 21.
 22,347.—ROWLAND, W. L., "Recovering cyanides from coal gas." Dec. 22.
 22,405.—JOHNSON, G. W., "Gas connections for use in theatres." Dec. 22.
 22,451.—CHRISTMAS, E. C., and WARREN, A. G., "Increasing light given by gas-burners." Dec. 23.
 22,530.—WALMSLEY, W. E., "System of hot water heating by gas or oil." Dec. 24.
 22,539.—BRADLEY, H. W., and CROSSLEY, F. W., "Gas and oil motor engines." Dec. 24.
 22,549.—FRITZ, F., "Workmen's and other gas-lamps." Dec. 24.
 22,559.—LEIGH, H. H., "Gas and petroleum engines." A communication from P. F. Forest and G. Gallice. Dec. 24.
 22,591.—PHYTHIAN, A. T., "Gas-taps." Dec. 28.
 22,612.—PADGHAM, G. H., "Gas and petroleum engines." Dec. 28.
 22,615.—BARCLAY, A., "Gas-engines." Dec. 28.
 22,662.—ANDERSON, T. R., "Gas-fittings." Dec. 29.
 22,737.—COWAN, W., "Gas governors, and means for enabling them to vary their load and pressure to suit changes in the demand for gas." Dec. 29.
 22,819.—COOPER, W. C., "A reflecting and ventilating gas-lamp." Dec. 31.
 22,828.—MELDRUM, J. J. and T., "Supply of liquor to ammonia stills." Dec. 31.
 22,834.—SECK, W., "Gas and hydrocarbon engines." Dec. 31.

A Guaranteed Dividend of Ten per Cent. for an Electric Lighting Company.—The *South Wales Daily News* says: "A Company, having for its object the lighting of the town of Pontypool by electricity, is being formed. As the Local Board cannot obtain the necessary powers for nearly two years, the Company will at first be a private one, to be eventually transferred to the Board at the original cost; and the profits made will then be spent on improvements in the town. The most gratifying feature is that the Directors are in a position to guarantee a dividend of not less than 10 per cent.; the project having been most warmly received, and the promises of support already given more than sufficient to ensure this desirable result."

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

"Though Lost to Sight, to Memory Dear."

SIR,—At the close of a year, one naturally takes stock of anything left undone or still obscured. In the latter alternative, there are two matters which some time ago had considerable prominence in the JOURNAL, but which have gone latterly out of sight, while apparently in a state of embryo. We are now approaching the season when we must begin to "put our house in order;" and we naturally wish to be informed of all accomplished beneficial facts, and what we may expect in the way of enlightenment from the various suns and stars that have hitherto enlightened our mental darkness.

From the foregoing prologue, may I ask, What has become of the Dinsmore process? There have been gossips of trials of it, large and small, being made in several localities subsequent to the grand results of it which you published three years ago; but authenticated reports of the results obtained, I do not remember to have seen. Also what has become of that secondary planet that struck off, and so brilliantly shone in your pages, a year ago, and was to eclipse its parent sun—I mean the offshoot from The Gas Institute. Like its prototype "that rules the night," it was to make its orbit in a much shorter time than its dull parent; and we were to have had the benefit of its mental refulgence at much shorter intervals of darkness, which gave us great hope that all erratic sparks (which like earthquakes create much rumbling noise, but give little light) had been peacefully composed into separate and regular motions, in which previous collisions would be avoided, and the two orbs as they passed each other, at a respectable and safe distance, would be able to say "good day" to each other as they passed, with at most a stiff sataric bow to each other occasionally.

I have thought for some time that a physical law which some say rules the motion of our earth round the sun, may also rule the future of The Gas Institute and its planet. It is said that the centripetal will overcome the centrifugal force; and our world will go dash into the arms of its parent (if it has arms) after the untellable millions of years of its wanderings, and be again reunited into one homogeneous mass. Should a mental centripetal force be now acting on the wanderer in this instance, I can vouch that the parent has arms—strong arms—and will doubtless hold them out wide enough, and like some carnivorous plants we read of, absorb it into its very midst.

35A, Great George Street, S.W., Jan. 8, 1892.

GEORGE ANDERSON.

Photometry and the Standard of Light.

SIR,—I am glad you have thrown open your columns, to all whom it may concern, for the discussion of the above questions. I may at once admit that I never was an admirer of the present system of photometry. The photometer is far too scientific an apparatus to be fully appreciated; and I think I may venture to say that in nearly three cases out of every four where gas companies, corporations, local authorities, or private individuals are compelled to have photometers, either by their Acts of Parliament or Provisional Orders, the instrument is more ornament than use. It may be all very well for large gas companies, who are able to employ a thoroughly good man, well acquainted with photometry. But, in my opinion, the photometer ought to be an instrument as easy to be understood by the novice as by the scientist, just as a yard measure is to the great town merchant and to the village shopkeeper; and until this is done, it is nothing but red-tapeism for the Board of Trade to grant Provisional Orders to small gas companies, and compel them to purchase and keep up an instrument of which the manager has neither time nor talent to make use. I have never used pentane, and therefore I cannot speak upon its merits as compared with candles; and as the latter are a questionable standard, as shown by the correspondence which has already taken place in your columns, why should I be compelled to employ them?

It is strange if, among all the clever men in the gas profession who have studied photometry, they cannot devise a simple instrument, which, by turning on a tap, enables the quantity of light to be registered. Mr. W. Sugg once brought out a meter photometer which was exceedingly simple. I suppose it had its defects; but it was admired for its simplicity. It is an appliance of this nature that is wanted to satisfy—shall we say "the submerged truth?" If an instrument could be so designed as to dispense with candle standards, and substitute numbers—the light to have a certain penetrating power—it would be an advantage. Let us suppose a standard burner, consuming 5 cubic feet of gas per hour, burning within a case (say) 8 or 10 inches in diameter, with sufficient air admitted from the bottom, and a tube to take away the products of combustion from the top. Let there be at the side an opening, and a tube (say) the same size as the ordinary disc, and in the tube slit holes to admit of discs, each disc representing 1 candle, $\frac{1}{2}$ candle, or $\frac{1}{4}$ candle, which could be added one by one until the light was totally obscured. Let anyone take sheets of writing-paper, and place one between himself and the light, and then add sheet after sheet until he found the light totally obscured, and he will get a rough notion of my idea.

At any rate, I throw out the above suggestion, hoping that someone may improve upon it, and that it may lead to the introduction of a much more perfect and a simpler instrument than the present one.

Penmaenmaur, North Wales, Jan. 7, 1892.

R. DEMPSTER.

A Water Supply Scheme for Bath.—The Town Council of Bath are considering an important scheme for increasing the supply of water, which at dry seasons is found insufficient to meet the growing needs of the city. The Water Committee have presented an exhaustive report, in which they recommend the purchase, at an estimate of £17,650, of springs at Marshfield; an alternative proposal being the construction of an immense storage reservoir at Monkswood, capable of furnishing a supplemental yield of about 400,000 gallons a day for 120 days. The Council, by a substantial majority, have favoured the acquisition of the springs, on the grounds of the certainty in the actual increase of supply, the quality of the water obtained, and the ease with which it could be delivered to the higher levels.

MISCELLANEOUS NEWS.

MR. T. CANNING'S LECTURES ON COAL GAS.

The Domestic and Industrial Applications of Coal Gas.

The last of the course of lectures by Mr. T. Canning, Engineer and Manager of the Newport (Mon.) Gas-Works, to the members of the Young Men's Friendly Society in that town, was given on the 28th ult.; the above being the subject selected. The previous lectures were reported in the JOURNALS for the 22nd ult. and the 5th inst.

The lecturer commenced by describing the application of coal gas as an illuminant; dealing first with the question of domestic and street lighting. For illustrating his remarks, he had arranged before him, on a wrought-iron horizontal tube, a series of burners of nearly every general shape and character, from the antiquated iron fishtail up to the most highly-developed modern burner. Several handsome meters were attached, in order to show the quantity of gas consumed; thus giving the audience full opportunity of judging of the value of each burner, and bringing into very bold relief the importance of using proper ones, in order to obtain the highest amount of lighting power possible from a given volume of gas. The difference between a burner having a governor, and one not furnished with this appliance, was also well demonstrated; and the capability of gas to effectually yield as brilliant a light as could be desired, was also illustrated by the Argand and high-power burners exhibited—Mr. Canning briefly explaining the construction and adaptability of each type.

The lecturer next referred to the competition between gas and electricity. This competition might, he said, be summed up in two words—cost and convenience. The cost of electricity could not in reality be known with any certainty at present, as no two electricians were agreed upon it. With respect to measurement, the Board of Trade unit was the measure for electrical energy. This was 1000 watts. Now, 746 watts represented in energy 1-horse power; therefore the Board of Trade unit was equal to $1\frac{1}{3}$ -horse power. In respect of the generation of electrical energy, one electrician would state that it required only 8 lbs. of coal per unit; while another would go as high as 22 lbs. per unit. Of course, this difference might arise mainly from the quality and arrangement of the machinery, particularly the boiler plant used in the work of generating electricity. In regard to the distribution of electrical energy, there were two systems, which the lecturer explained—the low-pressure direct current, and the high-pressure alternate-current system; and he asked if electricians were really agreed as to which of these was the better. Could any electrician tell the cost of maintenance with the latter system, the wear and tear of transformers, and the preservation of insulation? For the Board of Trade unit a charge of 8d., and in one case 7½d., was generally made. Was this too much or too little? Mr. Canning said he would not venture to answer the question, but would simply observe that no great profit seemed to result from this price. Electricians, however, particularly Mr. Preece, would say the light was still nearly as cheap as gas, as it gives a higher candle power. He would follow Mr. Preece, and take a shilling's worth of gas and a shilling's worth of electricity, and compare the two. At Newport a large proportion of the gas was sold at as low as 2s. 10d.; but, for convenience, he would take 3s. per 1000 cubic feet. For 1s. at Newport there were obtainable 333½ cubic feet of 16½-candle gas, yielding, in round numbers, the light of 1000 candles when properly consumed. Taking Mr. Preece's own statement, that the Board of Trade unit yields 333 candles, then at 8d. per unit this would be 495 candles for 1s., or less than half the number of candles' light given by the Gas Company for the same money. He (the lecturer) wished it to be understood that he did not accept, save for argument's sake, the statement that the Board of Trade unit would give 333 effective candles per hour; and instead of considering that electrical energy cost for lighting purposes only twice that of gas, he thought it was about 2½ times as much. For a 16-candle light a gas company charged about 0·2d. per hour; while for the same light electricians charged 0·5d. He introduced Mr. Preece's name particularly because, first, he was an eminent electrician; and, secondly, because, notwithstanding his advocacy of the electric light, he was a large, and avowedly firm, gas shareholder. Electric lighting was used in the Pullman cars, but not in the third-class carriages on our railways; in the state cabins of ocean mail steamers, but not in the sorting department; in the drawing-room, but not in the shop. It was, in short, a light of luxury and novelty.

Mr. Canning then referred to the use of gas as fuel, and its application for purposes of cooking. He illustrated his remarks on this subject by a gas-fire at work in the room, consuming about 11 cubic feet of gas per hour. This would, in the first hour, raise the temperature of an ordinary sitting-room 11° Fahr., or 1° for each cubic foot of gas consumed. In regard to cooking, he explained that five joints of 8 lbs. each might be cooked for 3d. worth of gas; and a joint of 8 lbs., for about 0·6d. Another use of gas for fuel was, he said, in regenerative furnaces, which had been applied to glass-works, gas-works, steel and iron works, and in various other industries. Gas was the light of the nineteenth century; and everything showed that it would be the light and fuel of the twentieth. The lecturer also alluded to the great use made of compressed gas for lighting buoys; instancing as examples the buoys on the Suez Canal, and those employed by the Trinity House. The latter were spherical, 9 feet in diameter, carrying a little wrought-iron frame on the top of which was a small lantern. Gas was compressed to about five or six atmospheres, and lasted something like 100 days, when the buoy would be charged afresh. The value of gas in illuminating light-houses, and its power to penetrate fogs, were well known. One ingenious application of gas—viz., that of lighting railway carriages—was first adopted in 1871 on the Lower Silesian Railway, and introduced on the Metropolitan Railway, London, in 1876. It had since been adopted on many other lines. The small gasholders are attached either to the roof or to the under framework of the carriage; the pressure being from 6 to 8 atmospheres. From these holders the gas is passed through regulators to the burners. On the London and North-Western Railway, two small holders, of the combined capacity

of 27½ cubic feet, light a six-wheeled first-class carriage by means of seven burners, each consuming 0.4 feet per hour. These two holders, charged at Euston, at a pressure of eight atmospheres, do not require re-charging until they return thence from Aberdeen; the whole distance covered being 1080 miles. Generally speaking, there is a pressure of 20 lbs. on the square inch left on their return.

Mr. Canning closed his remarks by stating that one of the greatest industrial applications of coal gas was for motive power in the gas-engine; and for the production of energy, it was, so far as it had gone, in no way behind any other motor in efficiency.

During the evening the lecturer, assisted as before by Mr. J. H. Canning, performed a large number of interesting experiments. It may be mentioned that the gas appliances exhibited were manufactured by Messrs. W. Sugg and Co., Messrs. T. Fletcher and Co., Messrs. J. Wright and Co., the Gas-Meter Company, Messrs. W. Parkinson and Co., Messrs. W. and B. Cowan, and some other well-known makers.

A hearty vote of thanks was accorded to Mr. Canning for his lectures.

BIRMINGHAM CORPORATION GAS SUPPLY.

The Sale of Coke—The Fittings Department.

At the Meeting of the Birmingham County Council last Tuesday—the Mayor (Mr. Lawley Parker) presiding—the Gas Committee's report, of which we gave the principal portions in last week's JOURNAL, was submitted.

Alderman POLLARD, in moving the adoption of the report, said the Committee had made a concession to the workmen in their employ by reducing their hours from 54 to 53 per week, by allowing them to terminate their work at twelve o'clock on Saturdays, instead of one. In doing this, they were following the example set by many large manufacturers in Birmingham. Some minor concessions had also been granted, which had given great satisfaction to the men. The cost of these changes would amount to about £700 per annum; but the Committee had consulted the other principal Committees employing labour—such as the Water, Public Works, and Health Committees—and had found that the concessions made would not interfere with them, as the conditions under which their labour was employed were different from those which obtained in the Gas Department. The Committee, he went on to remark, had provided prepayment meters in the houses of terraces where gas had been provided, with the result that there was now a far larger number of consumers, and the amount of gas burned by each had been considerably less than in former times—thus showing that greater economy was studied where the prepayment meters were used. With regard to the storage of coke, there had been a great accumulation. In May and July last, he called attention to the fact that the Committee would have to accumulate a larger stock of coke than usual, because of the failure of some of the trades to take the quantity of coke they had been accustomed to purchase. The amount in stock, however, was but a very small proportion of the quantity they manufactured in the course of the year. The sales of coke in Birmingham had not decreased—in fact, they were selling more in the city than previously. There had been a reduction of 2s. per ton in the price, because of the fact that some manufacturers of gas found it convenient to send their coke into Birmingham, and sell it at almost any price to get rid of it. He did not think there would be any necessity to further reduce the price at present; and they would be able to dispose of the present stock as well as the winter-made coke. The revenue from coke fluctuated considerably. In 1885 the revenue was £39,000; in 1886, it fell to £34,000; in 1887, it was the same; in 1888, when trade improved, it rose to £44,000; in 1889, it increased to £60,000; and during the last financial year, from March, 1890, to March, 1891, the revenue was £91,400, or nearly three times as much as in 1885. Between April 1, 1890, and March 31, 1891, they made about 245,000 tons of coke, of which quantity they used 55,000 tons at the works, and had for sale 195,000 tons. This year they would probably have for sale 220,000 tons. He wished to point out that a reduction of 1s. per ton in the sale of coke meant a decrease in their revenue of £11,000, or about 1d. per 1000 cubic feet in the price of gas. The question of coke was a matter of great anxiety to the Committee; for they relied upon the revenue from coke to meet the additional expenditure for coal and wages. If they could not rely upon it, it would be necessary to increase the price of gas; but the Committee would endeavour not to be obliged to follow the example of other gas companies, and raise the price of gas. The price of gas in part of London, for instance, at present was 3s. 1d., against an average of 2s. 3½d. in Birmingham; and in Liverpool it had been increased from 2s. 8d. to 3s. There was an increase in the consumption of gas during the six summer months; and in October and November, there was also a slight increase. But December proved an unprofitable month, because they had to compare the mild weather of 1891 with the very severe cold of 1890. The falling off was considerable before and after Christmas; but there was one week during which the consumption was 3,250,000 cubic feet more than in any week in 1890. On Christmas Eve the consumption was very large, owing to the fog and cold weather which prevailed. It was almost too great for their production; and they had to rely on the indulgence of the public in being compelled to reduce the pressure, in order that they might not be without gas in the evening. They would not have been placed in this predicament if the additional works authorized by the Council at the last meeting had been completed; but, unfortunately, they were not quite finished.

Mr. WILKINSON thought if the Committee could bring the price of coke within the means of artisans, the demand for it would soon be equal to the quantity produced. He had heard of coke being purchased from outsiders at 7s. 9d. per ton; whereas in the city the price was about 14s. a ton. This seemed most unreasonable. Four firms within half a mile of the Saltley Gas-Works used something like 5500 tons of coke every year, which was imported from different gas-works; and there were other firms in Saltley which used 2000 tons a year. These firms would use Saltley coke if they could get it as cheaply as they could away from Birmingham.

Mr. BARCLAY said he noticed that the Sutton Coldfield Corporation were promoting a Bill to enable them to supply their own gas. He would like to know what effect this would have on the Birmingham Gas Committee.

Mr. JACOBS protested against the fittings department being continued as a competitor with other traders.

Mr. BLOOR, having thanked the Committee for the concessions they had made to the gas workers, said he had heard that some firms were supplied with coke by the Gas Committee at contract prices of 8s., 8s. 6d., and 7s. 9d. per ton. If the Committee could supply large firms at these rates, surely they could reduce the price to householders.

Alderman ASH complained of the dirt which was allowed to accumulate with the coke, and pointed out that, in stacking the coke to such a large extent, it was badly crushed, and therefore not so profitable. The consequence was there was a waste of money in permitting such an extensive accumulation of the coke. In his opinion, it would be far better to sell it at a cheaper rate than allow it to perish in stock.

Alderman KENRICK, in reply to Mr. Jacobs, said the fittings department was not so much a competitor with other traders as a museum for the instruction and convenience of ratepayers and consumers. He hoped the fittings department would never be given up.

Mr. GREEN said the matters referred to by Alderman Ash had been considered by the Committee; but they were obliged to stock a certain quantity of the coke for the winter.

Mr. BEALE said that, if there was a strong feeling on the part of the ratepayers that the fittings department ought not to exist, they could shut it up. It could not exist unless it was found to be a convenience. There were something like 13,000 or 14,000 small accounts in the department, say, averaging a pound apiece; and this fact showed that the department was regarded as a convenience.

Alderman POLLACK, in reply, said that the Committee had not sold less coke to the inhabitants than last year—rather more, in fact. They were compelled to follow the price of coal to some extent. No doubt the man who took great quantities of coke during the year had it at a cheaper rate than the very small consumer. Of course, the price of coke could be reduced if the Council desired it; but this would mean an increase in the price of gas. It was a mistake for Mr. Jacobs to say that the fittings department of the Corporation should be abolished. The Sutton Coldfield Corporation were trying to acquire the gas supply in their district. The Gas Committee would not oppose the application to Parliament; but the interests of the city in the present supply of gas to Sutton would have to be purchased out. A certain sum had already been mentioned as the value of those interests; but the Committee did not consider it at all an adequate amount.

The report was then adopted.

EXTENSION AT THE WEST BROMWICH GAS-WORKS.

At the Monthly Meeting of the West Bromwich Town Council last Wednesday—the Mayor (Mr. G. Salter) presiding—the Gas Committee presented the following report: "In consequence of the difficulties in obtaining the plot of land on the Mill Farm estate, adjoining the gas-works, for the erection of a gasholder thereon, the Committee have, after due consideration, made certain modifications in the scheme of extensions as submitted for approval to the Council in May last. As reported to the Council at the last meeting, it has now been decided to erect a gasholder in the gas-works yard, of a smaller capacity than that which was intended to have been put upon the land above referred to. It has also been decided to make certain alterations and enlargements to the existing retorts, recommended by the Manager (Mr. Littlewood), and so defer building an additional retort-house. The Manager estimates that these enlargements will have the effect of increasing the productive power of the retort-house by 11 per cent., and will therefore place the Committee in a position to meet the demand for gas for several years to come. The cost of the retort-house alterations will for the most part be chargeable to revenue; only a small proportion being chargeable to capital. The modified scheme of extensions as now recommended to the Council for approval is as follows: Proposed new gasholder, £8000; additional purifiers, £2640; additional scrubber, £600; stoking machinery, £2500; additional boiler, £320; additional condensers, £500; additional meter, £1050; sulphate of ammonia plant, £1000; alterations to retorts (proportion chargeable to capital), £100; and coal-testing apparatus, &c., £200—total, £16,910. Adding to this £3090 for contingencies and further outlay, makes £20,000. The Committee therefore recommend the Council to apply to the Local Government Board, under the Provisional Orders Confirmation Act, 1886, for sanction to borrow the sum of £20,000, instead of £33,310, as submitted by the Committee at the meeting of the Council in May last." Alderman Farley, in moving the adoption of the report, explained that the Committee did not intend to expend all the £20,000 at once; but to spend it from time to time as the circumstances require it. Mr. Keys seconded the motion, which was carried.

Fatal Accident at the Huddersfield Gas-Works.—On Christmas Day, Christopher Kenny (aged 30), a labourer, met with an accident at the Leeds Road Gas-Works of the Huddersfield Corporation, which resulted in his death. It appeared that the deceased was engaged in wheeling ashes from the retort-house into the yard. Beside the doorway of the retort-house was a lift, about 6 feet square, and 9 ft. 6 in. deep. On the morning in question, there was ice near the lift, caused probably by the water dropping from the barrows; and it is supposed that Kenny slipped on the ice, and fell down the lift, where he was found badly injured by a stoker. Death occurred at the Infirmary on the following Monday, from peritonitis, arising from abdominal injuries. At the inquest, it was stated that the lift was only guarded on the side facing the retort-house; but experiments were about to be tried, and, if found practicable, an automatic guard would be put all round. A verdict of "Accidental death" was returned.

BOLTON CORPORATION GAS AND WATER SUPPLY.

In reviewing the operations of the various departments of the Bolton Corporation during the past year, a local paper says that, under the constant care of the Gas Committee, the high standard of efficiency which has so long been maintained in connection with the gas-works, continues to be sustained; and wherever improvements can be introduced to facilitate the production of the "lighting medium" in a manner both efficient and economical, they are adopted. Two or three changes have been recently made at the Lum Street Gas-Works. In the retort-house were originally four benches of retorts. Nos. 1 and 2 have been pulled down; and in their place a new bench upon the generative principle has been erected, embracing 288 mouthpieces. The condensers at these works have been doubled in height to meet the requirements of the extra production by the adoption of the new system. The connections to the scrubbers have also been re-arranged, and their diameter increased; and the scrubbers are now doing their work very effectively. At the Gas Street works a large new tar and liquor tank has been completed in a satisfactory manner. It will perhaps be of interest to mention here, as illustrating the producing power of the works, that during the 24 hours from six o'clock on Thursday morning, Dec. 24, 5,493,000 cubic feet of gas were consumed; this being considerably more than the highest previous record for 24 hours—4,800,000 feet—a few weeks ago. Rather more than a year since, the Corporation commenced to supply gas by prepayment meters, and a large number of these are now in use. There are also at the present time 684 gas cooking-stoves, 403 gas-fires, and 129 breakfast grillers out on hire.

Dealing with the affairs of the Water Department, it is mentioned that the new reservoir at High Rid, Heaton, is now on the eve of completion. It has a capacity of about 100 million gallons of water; and it is expected that it will be ready for use within the next three months. Another important feature in connection with this department is the extension of the water supply to the township of Atherton, which has been hitherto provided from the Manchester Corporation Water-Works, but has now been undertaken by the Bolton Corporation at the request of the Local Board. The arrangement between the Corporation and the Local Board provides for a supply of water in perpetuity; the minimum being 50,000 gallons per day, and the maximum 100,000 gallons. The Heaton and Sharples drifts are now both completed; and by their agency an enormous supply of excellent water is regularly obtained from the Horwich and Belmont hills. Another big piece of work is the repair of the waste-water channel in connection with the Wayoh Reservoir, and which is now in progress, about 6000 square yards of new paving having to be done, and nearly 4000 cubic feet of ashlar sill stones to be put in, besides the renewing of the concrete work. The present stock of water in the whole of the reservoirs amounts to nearly 1030 million gallons.

HEYWOOD CORPORATION GAS AND WATER SUPPLY.**Extensions at the Gas-Works—The Position of the Water Supply.**

In the course of a review of the municipal affairs of the borough during the past year, the *Heywood Advertiser*, referring to the Gas Department, remarks that it is pleasing to find that there has been an increased consumption of gas both for motive power and for cooking purposes. To meet this demand, and the increased consumption created by the growth of manufactures, there have been various alterations and extensions at the gas-works. These include the taking out of two old steam-boilers and two exhausters, and replacing them with new ones, which are larger and better adapted for their work in every respect. A portion of the old engine-house has been taken down, and a larger engine-house substituted; and a new boiler-house and stokers' kitchen have been erected. To meet the deficiency of capacity which has been experienced, a new holder has been constructed; and an old tank has been repaired and utilized for this purpose. The work was much retarded by the extremely wet weather which prevailed during the whole of the summer and autumn; but the holder has been brought into active use during the past few weeks. This increased holding capacity has not been provided one whit too soon—in fact, the wet weather prevented its completion soon enough; for during the intensely dark and foggy days a month ago, the supply of gas at the works was on one evening practically exhausted, and extra men had to be called on from the other "shifts," and special efforts made to manufacture gas as quickly as possible regardless of quality, the supply for some hours being literally from hand to mouth. The new holder will prevent any such risk in future, even when the mills now in course of construction are at work, because their demand does not last for many hours each day. The profits during the year on the Gas Department were reported at £901.

As regards the Water Department, the annual report of the Engineer (Mr. James Diggle, C.E.) shows that there is now at Clay Lane and Naden an increased storage capacity of a million gallons per day, or sufficient water to meet the requirements of 50,000 people during the greatest drought on record. The increased supply of water is one of the great features of the year; because, although there have been complaints of the excessive rainfall of the latter part of the year, the early months were decidedly dry—so much so that, while the people in Heywood were revelling in an abundant supply of beautiful soft water early in the spring, Bury and some other neighbouring towns were being put on "short commons" in regard to that necessary of life. The receipts for water sold during the municipal year amounted to £15,129, or more than those for the corresponding year by £384.

The Water Supply of West Bridgford.—A Syndicate of owners and ratepayers of West Bridgford has been formed for the purpose of boring for water; and they have engaged Mr. W. H. Radford, C.E., of Nottingham, to advise them. This step has been taken in opposition to the proposal that the district should be taken within the limits of the Nottingham Corporation water supply.

THE ELECTRIC LIGHTING SCHEME FOR CAMBRIDGE.

An inquiry has recently been held at Cambridge by Colonel J. O. Hasted, R. E., one of the Inspectors of the Local Government Board into an application by the Corporation for power to borrow money for purposes of electric lighting. The Town Clerk (Mr. J. E. L. Whitehead) opened the proceedings by stating that the Corporation asked permission to borrow £35,000 for the scheme. The present indebtedness of the Corporation was between £56,000 and £60,000; and although they might have a sewerage project looming in the distance, which might cost £150,000, he did not think the Local Government Board would prevent them obtaining the loan for electric lighting if they thought desirable. Professor Garnett proceeded to give details of the scheme proposed to be adopted. He explained that the generator which they intended to use was a Parsons steam turbine, driving alternate currents of 2000 volts; and also that a complete system of secondary mains would be laid down throughout the entire length of the route covered by the primary mains with, for the present, a few exceptions. His estimate for immediate expenditure was £24,300; but he had recommended that borrowing powers should be obtained to the extent of £35,000, because that would enable the system of conductors to be extended if the demand arose. Mr. Mollison said that Professor Garnett had estimated the net profit on a capital expenditure of £30,000 to be £1700; but it would seem that the Newcastle Company only obtained a gross profit of about £1500 on a capital expenditure of £22,000. He asked Professor Garnett if he could explain this great difference. Professor Garnett replied that there were two partial explanations of it. One was that the Newcastle Company had been rapidly developing, and started the year with not nearly so many lamps as they had now. But the main explanation was that the Company sold their energy at the rate of 5.05d. per unit; and in Cambridge it was proposed to charge 8d. per unit. The Master of Peterhouse spoke in opposition to the scheme. He was of opinion that the matter should be taken up by an independent company, and not by the Corporation. The Colleges would not for a long time use the electric light except for the halls and chapels; and he saw no possibility of making a profit. He hoped that should the Local Government Board decide to grant the application, opportunity would be given to consider whether the direct-current system would not be the most economical to adopt. Professor Ewing, referring to this last remark, said there was no doubt at all, from the figures which had been published by the various electric lighting companies, that for the continuous current system, the consumption of coal was only about one-half of that required for the alternating system. He would like to ask Professor Garnett whether it was not his opinion that the continuous current system was better adapted than the alternating system for the supply of the compulsory area of Cambridge. Professor Garnett replied that he was quite prepared to admit that given a central station, with a proper water supply, the compulsory district could be supplied with the direct current system under very favourable circumstances, and perhaps at a somewhat less cost than with the alternating system; but the advantages of the continuous current system were not so great as at first sight appeared. Alderman Balls, the Chairman of the Cambridge Gas Company, speaking as a ratepayer, said that at the present time the amount of loan on which the ratepayers had to pay interest was £64,318. The sewage scheme he had put down at £120,000, which, he thought, was very moderate, and then the electric light he estimated at £40,000. The total was £224,318. He would like to know whether the ratepayers were aware of the position in which they stood, and whether they would agree to support a scheme of this kind, which he must designate as an unlimited company, with power to call upon the ratepayers from time to time. He could not conceive how the scheme should meet with the approval of the ratepayers when they were told the Corporation were only about to light the centre of the town, and the ratepayers in the suburbs must wait an indefinite time before they reaped the benefit of this luxury. He did not object to a company coming in and speculating; but he protested against the money of the town being used for the purpose. The inquiry shortly afterwards concluded.

THE LONDON WATER SUPPLY.

At the Meeting of the Balloon Society, at St. James's Hall, Piccadilly, last Friday evening, Mr. HARRY WILKINS, the Vestry Clerk of St. James's, Westminster, delivered an address on the above subject. Mr. W. H. LE FEVRE occupied the chair.

After a few introductory remarks from the Chairman,

Mr. WILKINS commenced his address by observing that few people, except possibly shareholders in the Water Companies, would regard the present position of the London Water Supply as satisfactory. Complaints were pretty frequent of arbitrary requirements, of over-charge, of insufficient supply, and of inferior quality; and yet at no period in the history of London had there been so copious, so convenient, and speaking generally, and with some reservation, so excellent a supply as now. Although he had no serious complaint to make against the Companies, he was strongly impressed with the idea that the inhabitants would be better served if the undertakings were in the hands of a public authority. Having taken a hasty glance at the history of the Water Supply of London from 1225, when a conduit for Tyburn water was erected in West Cheap, down to the inauguration of Sir Hugh Myddleton's scheme—the New River—in 1613, Mr. Wilkins said he believed the precise original cost of this work had never been published; but in the New River Company's Act of 1852, it was stated that £1,519,958 and upwards had been expended on the undertaking. This had since been increased by about 2 millions; so that the capital outlay had been greater within the last 40 years than during the previous 250 years. Next in point of date was the East London Water-Works Company, which originated in 1669. The present Company was incorporated in 1807; and the capital authorized was £380,000. It was now upwards of £1,250,000. The Chelsea Company was established in 1723, with a capital of £40,000, since increased to £1,192,645. The Southwark and Vauxhall Company had

existed in some form or other since the year 1771, but was not incorporated under its present name until 1845. The Lambeth Company was established in 1785; and the Grand Junction Water Company was an offshoot of the Grand Junction Canal Company, which obtained power in 1793 to supply water to the inhabitants of Paddington and the parts adjacent. The power to supply water was transferred to a separate Company in 1811. The West Middlesex Company was incorporated in 1806, with a share capital of £30,000, and borrowing powers to the amount of £50,000. The present capital of the Company was £1,354,916. The last of the eight Metropolitan Companies—the Kent—was incorporated in 1809, and was authorized to acquire the works and privileges of the Ravensbourne Water-Works, which had been in existence since 1701. This Company was the only one drawing a supply solely from deep-wells sunk in the chalk.

Having quoted some of the statistics given in the report for October last of the Water Examiner as to the amount of water drawn from the various sources, Mr. Wilkins referred to the quality of the water. In touching upon this question, he said he felt that he was treading upon delicate ground. At the same time, when they found that the largest community in the world had a smaller death-rate than communities much more favourably situated for health, and supplied with a theoretically purer quality of water, what conclusion could they draw, except that the water supplied to London contained nothing very detrimental to health? He wished to guard himself, however, against being supposed to assert that the supply of water from the Thames could not be improved; it was excellent, but might be better. Much of the impurity complained of resulted from the neglect of the householder to have his water receptacle cleansed from one year's end to another. Even a constant supply did not remove the necessity of periodically cleansing the cistern, if such a receptacle was used. This reference to constant supply led him to observe that the Water Companies deserved every credit for giving a constant service in large parts of their districts without any legal obligation to do so. At the present time as much as 93 per cent. of the house supplies were on the constant system in the East London Company's district; while in the Chelsea Company's area, only 23 per cent. of the houses were supplied in that manner.

The speaker then passed on to consider some of the general legislation affecting the question. The Metropolis Water Act, 1852, was first referred to; and he gave a synopsis of its principal provisions. The Water-Works Clauses Acts of 1847 and 1871 next received attention, and then the provisions of the Water-Rate Definition Act were dwelt upon. In connection with the last-named Act, he said that, in the past five years, the average increase in the rateable value of London, arising from new buildings, had been about £250,000 a year; but the increase by the recent revaluation was nearly £1,500,000, after deducting the average annual addition for new buildings (£250,000), and making due allowance for the rateable value of property not supplied with water at all, or on other terms—such as railways, tramways, docks, warehouses, factories, &c. He thought that, upon a low estimate, the Companies derived an additional income of £37,000, or an average of nearly £5000 each, solely from the increased assessment of existing buildings without coming under any additional obligation; and capitalized at 4 per cent., this represented £943,000. It would thus be seen that, if purchase of the existing undertakings was contemplated, each quinquennial assessment added a considerable sum to the capital value of the Companies' undertakings.

At some length, Mr. Wilkins proceeded to refer to the terms for the purchase of the Water Companies proposed by Lord Cross in 1880, which, he said, were open to three very grave objections—(1) Excessive price; (2) payment of annuities, instead of by redeemable stock; and (3) unsatisfactory constitution of the water authority. He then passed on to the attempt which was made to grapple with the water question last session, referring especially to the provisions of the Vestries' Bill. As he was largely concerned in constructing the scheme of this Bill, he might perhaps be pardoned for expressing an opinion that the Bill dealt equitably with the complex question, having regard, as far as possible, to the various conflicting interests. Standing in the relation that he did to the Bill, it would, he said, be unbecoming in him to criticize the action which the City Corporation and London County Council deemed it right to take in opposing it. He could not, however, refrain from saying that the course they adopted seemed to him incomprehensible and inconsistent. The Engineer of the County Council, for instance, admitted that, to undertake the supply of water without acquiring the undertakings of the Companies was not only without precedent but suicidal, and yet the Council were not willing to come under an obligation to purchase on arbitration terms, bound as the arbitrators would have been to disregard causes for inflating the value of the undertakings, while taking into account causes for depreciation. The attitude of the Water Companies on the point of arbitration was intelligible; and he did not think it was a breach of confidence to mention that an intimation was conveyed to him that, unless they accepted arbitration under the Lands Clauses Act pure and simple, the Companies would fight the clause in the Bill strenuously, if, as at one time appeared probable, the Committee found the preamble of the Bill proved.

Regarding the Bills to be presented to Parliament this year, Mr. Wilkins remarked that there were nominally three. Two of them, however, were duplicate measures; so that only two proposals would be before Parliament. As to the Bill promoted jointly by the City Corporation and the County Council, at the sole expense of the former, it so closely resembled the rejected City Bill of last year that he could not regard it as a serious attempt to settle the question, especially as in points of difference it was rather worse. As a freeman and liveryman of London, he deplored the fact that a historic Corporation should step down to the position of (he was about to say) servility—and did not know any better word to express his meaning—to a body which, he ventured to think, did not, as at present constituted, command the complete confidence of its constituents; and he deeply regretted that the Corporation of a commercial community should assist the Council in its attempts to set aside, too lightly, vested rights based upon parliamentary bargains.

Dealing with the question of purchase, he said that the profits divided by the Companies last year, including interest on debentures,

was about £1,120,000; the total nominal capital, £14,500,000; and the present market value of the capital, about £33,500,000. This capital included the value of landed estates chiefly belonging to the New River Company, which were in no way essential to the water undertakings, and probably represented an asset of something like £4,000,000. Deducting this asset, the water undertakings should be acquired for less than £30,000,000. This amount in 3 per cent. stock would represent an annual charge for interest of £900,000, leaving a large margin every year to be applied to the redemption of the debt and to the unification of charges for water throughout the area of supply. But in estimating the purchase price of the undertakings, it must be remembered that they did not all stand on the same footing. One or two—such as the Chelsea Company—had already provided for all probable requirements of their district; while others were likely to come under heavy capital commitments in a very short period, with the prospect of falling dividends. Another important consideration was the fact that within 15 or 20 years existing sources of supply must be supplemented; and the cost of this was highly problematical. This fact seemed to him to be the strongest reason of all why the undertakings should be acquired by a public authority without delay.

Mr. Wilkins next commented on the various new sources of supply which have been suggested, summing up in favour of the conclusions arrived at by Sir Robert Rawlinson that adequate storage reservoirs in the basin of the Thames would afford the best, and by far the cheapest, solution of the difficulty. With regard to the constitution of the authority to be entrusted with the water supply, he said he should prefer a representative authority elected by the Town and County Councils throughout the area; and he regretted that the Corporation of London had not seen their way to place themselves at the head of the federated municipal and county councils of greater London. Such an opportunity presented itself last year; but unfortunately it was thrown away.

At the close of the address,

Mr. BONTROM, of the St. James's Vestry, proposed—"That in the public interest the undertakings of the eight Metropolitan Water Companies should be transferred to a public authority, on equitable terms, with the least possible delay, as the first step towards vesting the supply of water in such authority."

Mr. TRINER, of the Holborn District Board, seconded the resolution which was carried.

A vote of thanks to Mr. Wilkins concluded the proceedings.

THE WATER SUPPLY OF FLORENCE.

Our readers are aware that some months ago the Municipality of Florence commissioned Sir Douglas Galton, K.C.B., to inquire into the sanitary condition of the city, which had given rise to a certain amount of alarm. In the course of his report, which was presented last month, he gives the following description of the portion of the water supply that is obtained from outside the municipal boundary:—

There are two sources of extraneous supply—one from the Monte Reggi, from the gravel and sand beds, in which the River Mugnone runs (a tributary of the Arno), which was originally provided by the Medici, and supplied the Pitti Palace and other places on its way. This was extended about twenty years ago by one of the family of the Canta-Galli at his own expense. It is delivered by gravitation into a reservoir 60 metres above the level of the quay at Florence; but since its extension it has occasionally become turbid in times of much rain. Last year it was alleged that the contamination of this source had caused the typhoid epidemic in the city; and it was cut off. The analysis of the water made at the time did not bear out this contention. The other extraneous source of supply was constructed between 1873 and 1876. It consists of two galleries carried at a depth of some 12 feet or 14 feet below the bottom of the Arno. They start from the water-works, which are situated on the quay on the south side of the river near the Via dei Bardi. One is carried under the river bed to the opposite side, and receives water from a well situated near the Campo di Marte. The other is carried up the valley parallel to, and about 70 metres distant from, the river. Both are in the gravels and sands in which the river bed is situated. The galleries are of masonry. Water is admitted through openings in the bottom and through holes in the sides; the latter at distances of about 5 feet apart, and about 2 feet from the bottom. The part of the gallery which passes under the town has been recently made impermeable; and water is now collected only from that part, 60 metres in length, which lies under open fields above Florence. The water is pumped out by turbines, driven by the water of the Arno, into three reservoirs, at heights of 60 and 40 metres above the level of the quay, and thence distributed by gravitation. These reservoirs are capable of holding 36,000 cubic metres (about 8 million gallons). This water is always clear and good. The quantity may be said to vary from 1 to 2 million gallons per 24 hours, according to the season. At the present time, out of 12,000 houses in Florence, about 3200 receive the town supply, and there are, moreover, 180 public fountains or stand-pipes. It is proposed to extend the gallery from 300 to 400 metres up the valley, as may be necessary to bring up the supply to the present required quantity of about 5½ million gallons a day, and to protect the surface in the vicinity from any pollution for a considerable distance. The Municipality have recently bought springs in the mountains near Lucca, which are equal to the supply of about 13½ million gallons per 24 hours at a high level. But these springs are 70 miles from Florence; and it will require three years at least to get the water into the town. Meanwhile, the gallery, when extended, will supply all that is required.

Accident on the Manchester Water-Works near Kendal.—Yesterday week a serious accident happened on the line of the Manchester Water-Works near Kendal. A gang of men were employed clearing away some earth, when one of them struck his pick into an unexploded cartridge. The result was that an explosion occurred; and two of the men were blinded and otherwise very severely injured.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

The illuminating power of the Edinburgh gas has been very much discussed within the last year or two; and appearances point to the likelihood of a continuation of the practice until something shall result from it. That something must be the only possible development out of the commercial situation in which the gas industry at present stands in Scotland in consequence of the high price of cannel; it can only be the lowering of the illuminating power of the gas, and an attendant reduction of price. There is no other escape from the present position of the Edinburgh and Leith Gas Commission. The charge of 4s. 6d. per 1000 cubic feet for gas of from 26 to 28 candle power is too high, in face of the competition from cheaper illuminants. The public will not stand it—that is, they do not care to pay the price, and would fain have it lowered. It is there, however, that the wrinkle comes in which disturbs the evenness of the public contemplation, for they would have the price reduced without any reduction in the lighting power of the gas. It takes a long time to convince the community that if they will have the one, they must have the other also. Even in high quarters, there is an ignorance of matters pertaining to gas supply which is positively disappointing. Take, for instance, the remark of Lord Provost Russell, of Edinburgh, at the meeting of the Town Council on Tuesday, that "he was sure there was not a place in Britain with a higher candle power" (than Edinburgh). Such a remark is arrant nonsense; and is particularly to be regretted in the mouth of the gentleman who is Chairman of the Edinburgh and Leith Gas Commission. Edinburgh is no better off in the matter of illuminating power than is Perth or Forfar, and until recently, Aberdeen; while it is positively lower than at some very much smaller places, such as Dunbar and Broughty Ferry. Ignorance upon such a simple matter of fact presupposes incapability to grasp the situation when more important issues are under consideration; and when a person in the position of the Lord Provost shows a primitive mind, what is to be expected of the general community? The subject came before the Town Council by a complaint made by Treasurer M'Crae to the effect that "the gas was very smoky," to which the Lord Provost replied that "gas of such power must be very smoky unless burned with very special burners." The Treasurer's retort was that it was "since the quality was reduced that the complaints had been made;" and then followed the Lord Provost's remark commented on above. Mr. Mackenzie suggested the lowering of the illuminating power of the gas with a view to escaping the people who made them pay a high price for coal, a sentiment which did not meet with the approval of Mr. Kinloch Anderson, the Convener of the Works Committee of the Gas Commission. Mr. Mitchell Thomson, who has retired from the Gas Commission, hoped it would not go abroad that it was the opinion of the Council that the quality of the gas should be reduced. There the matter ended. There was not much in the discussion; but it will help on the movement for cheaper gas.

The above remarks obtain point from what transpired at a meeting of the Edinburgh Merchants' Association on Wednesday. This is a body of commercial men who look at matters from a business point of view. Mr. Orrock, one of their number, told them that he had a gas-engine; and that to work it with gas at 4s. 6d. per 1000 cubic feet was a very costly affair indeed—in fact, it was a real tax upon industry. He advocated the reduction of the illuminating power. The speaker was generally supported by his brethren; and a Committee was appointed to consider the whole question and to report. This is an important step; and if the inquiry be gone intelligently about, it should help in the enlightenment of the people on a matter in which they require education. The Gas Commissioners generally will be glad to have any assistance in that direction. A year ago, it will be remembered, they endeavoured to lower the illuminating power; but in deference to clamour by West-end Edinburgh, they again raised it. The fallacy which then took hold of the public mind was that gas of low-candle power was less pure than that to which they had been accustomed. That has not yet been dispelled; and it lies with the Gas Commissioners to dispel it, by experiment or otherwise. There is a field in Edinburgh and Leith, in connection with the gas supply, for the making of a reputation, if the man were forthcoming who had a sufficient grip of the subject. Such trifling with it as was shown in the Town Council, illustrates how much such a man is wanted.

The Dundee Gas Commission at its monthly meeting on Wednesday, accepted offers for 8000 tons of coal to replace the 10,000 tons which was recently rejected on the advice of their analyst. Of this, 5000 tons are obtained from the Fife Coal Company at the price of 21s. per ton; and the remaining 3000 tons have been purchased at prices ranging downwards to 12s. 6d. per ton. In reply to a question, Mr. M'Crae, the Manager, stated that the 5000 tons were expected to produce gas of 31-candle power; and he thought the average would now be right. That is all very good; but why were the public not informed of the real state of matters? Do the Commissioners mean to take credit for supplying better gas than they have been doing without informing the public that they are making them pay for it? The average contract price as fixed last spring was 17s. 2½d. per ton; whereas the coal now contracted for is of an average price of not less than 17s. 10d. per ton, which should make a considerable difference on the resulting gas product. It is probable that the contractors who have been discarded would have supplied coal of the quality now contracted for, if they had been paid the price.

This has been a busy week in Inverness upon the subject of lighting. In the first place, the Sub-Committee of the Town Council which was appointed some time ago to consider the question of procuring water power for an electric light installation, issued their report; and in the second place, the Gas Committee of the Council met and considered the report of Mr. Thomson, the Gas Manager, upon the necessity for extending the gas-works. The Electric Lighting Committee's report should, if the public men of the place are wise, be the last of the proposal. Confining themselves to the question of procuring water power, they have ranged over the district, from the town supply to the Falls of Foyers, 18½ miles from Inverness, reporting upon no fewer than eleven sources of supply. One after another of these sources,

they find to be unsuitable; and they settle down upon one which would involve the taking of water from the Caledonian Canal at its Inverness end about a mile from the town, for the driving of two turbines. The cost of the works they estimate at £7200; and if steam power were provided as an alternative in the event of a break-down of the water power, £3000 more would be required. This, it is to be observed, does not include the cost of conveying the electric current to the town, or its distribution. The Gas-Works Visiting Sub-Committee met on Wednesday to consider Mr. Thomson's report upon the proposal to expend about £10,000 upon the extension of the gas-works. Mr. Kenneth Fraser, the Convener, stated that the gas-works were barely able to supply the community with the present consumption of gas; and as this was increasing at the rate of half-a-million cubic feet a year, they would not be able to meet the demand next year. The gas-works were now being strained, which entailed great loss. For instance, retorts which should last two seasons, were being used up in two or three months; and the purifiers were being overworked. The extension proposed would, it was estimated, result in a saving of £7 per week. Provost Ross pointed out that the 400-horse power which it was proposed to apply to the production of electric light, would only give light equivalent to one year's increase of the gas consumption, and they would require to extend the gas-works irrespective of the introduction of electricity. The Sub-Committee unanimously recommended that the extensions should be proceeded with, and that to meet them £9000 should be borrowed. Next day, the Water and Gas Committee of the Town Council had this recommendation submitted to them; but they, in view of the electric lighting proposals, instead of adopting the Sub-Committee's recommendations, resolved to delay the matter and to ask Mr. Thomson to prepare a modified scheme. Thus the gas supply of the town is being humbugged by an impossible electric lighting scheme. The time is short in which to proceed with the extensions at the gas-works; and one would think that even the most ordinary intelligence would see the advantage of expending £10,000 upon the perfecting of the gas supply, compared with the expenditure of probably £30,000 upon the introduction of an electric lighting installation, with the knowledge that they will also require to expend the £10,000 upon the gas-works.

At Thursday's monthly meeting of the Town Council of Glasgow, a discussion arose on the minutes of the Gas and Electric Lighting Committee, which was limited, however, to the item bearing upon the contract for the big gasholder which it has been resolved to erect at the Temple Farm gas-works. It may be remembered that I made mention, a couple of weeks since, of the contract having been placed with Messrs. R. Laidlaw and Son, of the Barrowfield Iron-Works, Glasgow. It was stated in the minutes that the amount of the accepted tender was £41,000; but it transpired in the course of the discussion that an offer to do the work for £1200 less had been received from Messrs. Hanna, Donald, and Wilson. The questions put by inquisitive members brought out the important fact that in the specification on which the tenders were based it was distinctly stated that early completion of the holder, as well as the price, would be taken into consideration in the placing of the contract. Now, it so happens that the Glasgow firm offered to give delivery in July, 1893; whereas October was mentioned by the Paisley firm. Of course, the prospect of getting delivery of the holder three months earlier in the one case than in the other, naturally had some influence with the Sub-Committee on Contracts in causing them to come to the decision they did. But the fact, or alleged fact, that the Council were throwing away £1200, if the minutes were adopted, did not fail to raise objections; and one member actually went the length of entering his dissent, which was duly recorded. He went on the principle, he said, that, all things being equal, the lowest offer should be accepted. Another strict municipal moralist was concerned to know if everything had been done fairly and above-board when the matter was before the Contract Committee, and if every firm that sent in a tender was treated on the same footing. He was assured by a member of the Committee that such was the case. With the one instance of dissent referred to, the minutes were adopted.

There was also a minute in reference to the acquisition of the electric lighting stations, machinery, business, &c., of Messrs. Muir, Mavor, and Coulson by the Corporation, at the price of £15,000. It seemed, however, that the minute, as to the terms of the agreement, had still to be revised; and consequently the Committee were authorized to take it back. I may say, however, that the bargain between the buyers and sellers has been practically concluded; and that the officials of the Gas and Electric Lighting Committee are preparing to take over the two generating stations, &c., which have enabled Messrs. Muir, Mavor, and Coulson to supply the electric light in the central area of the city. It has been practically concluded that on and after March 1 next, what was the Glasgow Gas Trust pure and simple, will be engaged in supplying electricity for lighting purposes as well as coal gas. It will be many months before the Corporation Electric lighting station, fully half a mile to the west, and which is being designed by Professor A. W. W. Kennedy, will be ready to supply current to the west central area and the West-end proper. Indeed, it is scarcely probable that the new station will be in working order by August, when the two years allowed for active operations by the Electric Lighting Provisional Order will have expired.

While dealing with electric lighting matters, I may state that a letter has been received by the Electric Lighting Sub-Committee from the Board of Trade, intimating that, in the event of the Corporation acquiring the undertaking of Messrs. Muir, Mavor, and Coulson, and provided that the Board are satisfied as to the safety of the system in other respects, they will not object to the temporary use of the existing overhead wires, pending the completion of the installation about to be acquired by the Corporation.

This week's Glasgow pig-iron market has been quiet, in consequence of the occurrence of the holidays. The ironmasters' returns for the past year, which were published on Tuesday, were regarded by the trade as being very unsatisfactory, as they showed a reduction for the year, on home consumption and exports, of fully 500,000 tons. Prices remain but very slightly changed. Scotch is still quoted at 47s. per ton cash—the Syndicate's price. Carron No. 1 has come down 6d. per ton, to 56s. 6d.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, Jan. 9.

Sulphate of Ammonia.—The complete metamorphosis of the market, although it was to a great extent unforeseen at this early period of the season, cannot altogether come as a surprise. It has been pointed out over and over again in these columns, and it has been shown by the stubborn facts of undeniable figures, that sulphate was much too low down in the scale of values, and that whichever way the position was viewed, only by a complete error of judgment could consumers refrain from buying sulphate, it being the cheapest source of ammonia. Still this does not account for the extremely sudden change; for, at the present moment, dealers, speculators, and consumers vie with each other to secure everything available. Is it then correct to assume that it required but a key-note to start the thing into life? It has been given; and mark the change! What is happening now is that dealers and speculators are scrambling for January contracts, to cover previous sales; while consumers, though annoyed at having been misled, and having missed so many favourable opportunities, still are making hot haste to repair the mischief. No wonder, therefore, that there is an advance of about 5s. per ton on the week; and though some consider that the market is moving a little too rapidly, others think it is not so when delayed requirements and short sales are taken into account. The movement in the spot market is bringing with it a considerable inquiry for futures; and 10s. to 15s. per ton advance on the lowest December quotations is reported as having been paid for spring delivery and delivery up to June next. Nitrate has improved, and 9s. 4½d. to 9s. 6d. has been paid for cargoes, while spot price is now 9s. 4½d. per cwt.

LONDON, Jan. 9.

Tar Products.—This market continues as flat and uninteresting as it can possibly be; and there are no buyers of anything excepting pitch—the result being that all products, with the exception named, are decreasing in value. It is beginning to have its effect on tar, as an important contract was booked during the week of a very good quality at 19s. 6d. per ton. Curiously, pitch continues fairly strong; large shipments are taking place, and one or two important contracts forward are reported at a shade below to-day's quotation. Nominal quotations are: Tar, 19s. 6d. Pitch, 34s. Benzol, 90s., 1s. 11d. to 2s. 1d.; 50's., 1s. 7d. to 1s. 7½d. Toluol, 1s. 2d. Solvent naphtha, 1s. 1d. Naphtha, 30 per cent., 11d. Creosote, ¾d. to 1d. Crude carbolic, 60's., 1s. 1d.; crystals, 5d. Cresol, 8d. Anthracene, "A" quality, 1s. to 1s. 11d.; "B," 8d. to 9½d.

Sulphate of Ammonia.—There seems to be more activity in this market; and important sales are reported at prices ranging from £10 7s. 6d. to £10 12s. 6d., less 3½ per cent. There is a good deal of inquiry; and the price is likely to improve. Gas liquor (10-oz.) is quoted at 6s. to 7s. 6d. per ton, according to position.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Except that the ordinary course of business has been recently considerably disorganized by the usual holiday stoppages of collieries and works throughout this district, there is no material change to notice in the condition of the coal trade here. House-fire qualities are in fairly good demand at late rates—best Wigan Arley averaging 12s. 6d.; Pemberton 4-feet, and second qualities of Arley, 10s. 6d. to 11s.; and common house-fire coals, 9s. to 10s. per ton. With regard to the lower qualities of round coal, the stoppage of works has to some extent counterbalanced the cessation of the output at the collieries; and there has been no scarcity of supplies, while prices still show a weakening tendency. For inland requirements, 8s. to 8s. 6d. remain the average quotations at the pit mouth; but for shipment buyers are holding out for lower figures, and there has been very little business doing, with Lancashire steam coal not averaging more than 9s. 6d. to 10s. per ton delivered at the ports on the Mersey. Engine classes of fuel have been in generally brisk demand, as with few exceptions mills have only very limited accommodation for stocking purposes; and all descriptions of slack have been moving freely away, with prices showing more firmness than recently, although there is no really quoted advance upon late rates. At the pit mouth ordinary classes of burgy do not average more than 6s. to 6s. 6d.; best qualities of slack, 5s. to 5s. 6d.; good ordinary descriptions, 4s. to 4s. 6d.; and common sorts, 3s. to 3s. 6d. per ton at the pit—these figures representing the maximum prices obtainable.

Northern Coal Trade.—There is considerable activity in the northern coal trade after the holidays; and as stocks of some kinds of coal had been considerably reduced, there was a full demand experienced. Best Northumberland gas coals vary in price from 10s. to 10s. 6d. per ton, free on board; and most of the collieries have very fair orders on their books. Second-class coals are weaker in position; the price varying from 9s. to 9s. 9d. per ton, free on board. Small steam coals are plentiful, at prices averaging about 4s. 3d. per ton. For gas coals, the demand is still extremely heavy; and as the work was not at its fullest for the first fortnight after the holidays, stocks have needed to be replenished. The price varies; but from 9s. to 9s. 6d. per ton, free on board, may be taken as the general average figures. In coke, best blast-furnace qualities are firm; and 16s. per ton, free on board, is the general rate. Gas coke seems more difficult of sale just now; and contracts are believed to have been placed at lower prices than have of late been quoted—about 9s. per ton having been rumoured as the price for a recent contract.

The Storage Capacity at the Ripon Gas-Works.—The question of the necessity of increased storage for gas at the Ripon Corporation Gas-Works was brought before the Gas Committee last Thursday night by the Manager (Mr. F. Shepherd). It appears that during the month of December the total manufacture of gas was 4,161,000 cubic feet; and on Christmas Eve, the amount of gas in the holders was reduced 4000 feet—the retorts at the same time being charged to their full capacity. It was decided to specially bring the subject of an enlarged storage capacity before the Council.

The Proposed Purchase of the Bideford Gas-Works by the Corporation.—The Bideford Town Council last Thursday had a further discussion on the question of acquiring the gas-works; and in the end they passed the following resolution: "That, subject to all necessary consents being obtained thereto and to the sanction of the Local Government Board, the Gas Company be informed that the Town Council are desirous of negotiating with them for the purchase of their undertaking upon the basis of clause 2 of the Electric Lighting Act of 1882; but before committing themselves to this, they desire to consult the ratepayers of the borough on the subject, and will take an early opportunity of doing so. And, further, that the Secretary of the Company be requested to submit to the Directors for consideration the question of suspending, until the session of 1893, their application for the Provisional Order, so that negotiations may be proceeded with."

Birmingham Corporation Water Scheme.—At the next meeting of the Severn Fishery Board, the Chairman (Mr. J. W. Willis Bund) will submit for consideration a letter on the subject of Water Bills, which he has addressed to the Chief Inspector of Fisheries. In his communication, Mr. Bund states that the Severn Fishery Board have come to the conclusion that the time has arrived for the Board of Trade or some Government Department or for Parliament by Standing Order to lay down some general rules that should apply in all cases, defining the terms and conditions under which an outside authority is to be entitled to abstract water from a watershed. The Liverpool Act of 1880, which will doubtless be referred to as the great precedent for the Birmingham scheme, to some extent recognized the rights of towns and persons affected in the elaborate provisions made in it for compensation water. But those provisions were (he points out) obtained at the instance of individual bodies; and it is most desirable that matters of such national importance should not be left to individual action.

Distribution of Gifts at the York Gas-Works.—It will be remembered that, owing to the great pressure put upon the York Gas Company by the extremely cold and foggy weather of Christmas week, all the workmen could not be present when Mr. C. Sellers, the Company's Secretary and Manager, gave his usual address, reproduced in the JOURNAL for the 29th ult.; and, in consequence of this, the distribution of the Christmas gifts for their children was postponed until the 2nd inst. On the assembling of the men, Mr. Sellers briefly congratulated them upon the brave and loyal manner in which they had worked shoulder to shoulder to meet the unprecedented strain put upon the Company by the extraordinary weather; and expressed his especial pleasure in the fact that they had had only one fool in the entire staff who had, during the Christmas week, tarnished their reputation and disgraced himself by drinking. The distribution of articles of dress, books, and toys then took place; and after the men had thanked the Directors of the Company, who contributed to the gift fund, and also Mr. Sellers, they heartily joined in recognizing this gentleman's mother in musical cheers, and then went to their respective homes.

The Gas Supply of Hornsey.—At the meeting of the Hornsey Local Board on Monday last week, the Surveyor (Mr. T. De Courcy Meade) brought up a report on the question of the gas supply of the district. He stated that he had received a notice from The Gaslight and Coke Company to the effect that the price of gas supplied by meter would be increased from 2s. 9d. to 3s. 1d. per 1000 cubic feet after the Christmas quarter. He wrote to the General Manager of the Company (Mr. J. Orwell Phillips), asking if the increase applied in any way to the gas supplied to the public lamps, and had received a reply in the negative. The Manager of the Hornsey Gas Company had written stating that, notwithstanding the large sum which had been expended on the extension of the works (much of which must remain unproductive for some years), and that the cost of coal and labour had largely increased, he hoped his Directors would be able to continue to sell gas at the present price, and that, with this object in view, they had not paid the 1¼ per cent. additional dividend which they were entitled to do under the sliding scale. He also added that contracts had recently been let for further extensions, amounting to £10,000, and that they were now contemplating expending about £26,000 for the same purpose during the present year. Colonel Bird remarked that the quantity of gas supplied by the latter Company was not sufficient, and recently the district was in darkness. Many complaints had been received in regard to it; and the tradesmen of Crouch End were preparing a petition on the subject to present to the Board. The report was ordered to be entered on the minutes; and the subject dropped.

The New Public Health Act for London and the Smoke Nuisance.—At the meeting of the Balloon Society on the 1st inst., Mr. H. G. Assiter, President of the Association of Sanitary Inspectors, read a paper on "The Public Health (London) Act, 1891," which came into operation on that day, in the course of which he dealt with the clauses relating to smoke consumption. He said that the chief alteration had been to remove the duty of executing the law on the subject from the shoulders of the police, and to place it on the sanitary authority. Every chimney whatsoever, except those of private dwelling-houses, was now subject to the provisions of the Act. With this slight strengthening of the law, and the duty of the sanitary authority to execute it being made imperative, we might hope to benefit by the change. The lecturer expressed the opinion that there is no excuse, seeing the many excellent inventions for ensuring the consumption of smoke, for anyone who breaks this law. Mr. Assiter said it was to be regretted that some legislation was not effected with regard to the chimneys of private houses, which were very great offenders. He was in a position to say that it would not be a difficult matter to consume the smoke arising from domestic fireplaces; and he hoped in a few years to see the law amended in this respect, when he predicted that we should have less of the dreadful fogs which afflict people at this season, although we might never hope to entirely get rid of them. At the close of the paper, a resolution was passed expressing the hope that the smoke abatement clauses would be thoroughly carried out, and in future be extended to the chimneys of all domestic fireplaces. A vote of thanks was accorded to Mr. Assiter.

Serious Fire at a Compressed Fuel Factory.—Last Thursday, a fire broke out at the perforated block fuel factory of Messrs. Forbes, Abbott, and Lennard, on the banks of the Thames at Greenwich, and developed into a conflagration which was not extinguished until late in the evening. It originated in a building 80 feet long and 70 feet wide, utilized in the manufacture of the blocks; and at the time of the outbreak it contained several hundred tons of very small coal. The place was used, in fact, as a coal bunker; and it lead into a corrugated iron building, measuring 100 feet long by 90 feet wide, and about 50 feet high, employed as a manufactory and store. This was filled with materials of a most inflammable character, and was surrounded, in the large yard attached to the premises, by tar pits and casks containing large quantities of combustible material. Work was proceeding in the usual course when the alarm was raised that the big coal bunker was on fire; and directly afterwards great clouds of smoke, followed by enormous tongues of flame, were seen issuing from the extensive building nearest to the river. The workmen at once began to attach a hose to two private hydrants which were fitted on an adjoining building, and started pumping water on the flames. Soon the Fire Brigade arrived; and they worked with tremendous energy. The result of their labours, which were carried on under great difficulty, owing to the risk run by the men of falling into the river, was that the fire was effectually quelled, and the adjacent property saved from destruction.

City of Norwich Water-Works Company.—The half-yearly general meeting of this Company was held on the 23rd ult.—Mr. H. S. Patteson in the chair. The Secretary (Mr. R. Cooper) read the balance-sheets of receipts and expenditure of capital and revenue of the Company to Sept. 29 last, which were submitted for the inspection of the shareholders; and he subsequently read the Directors' report. It was stated therein that, after payment of the working expenses, debenture interest, and preferential dividend, and including the balance carried over from the previous half year, there remained a sum sufficient to pay a dividend on the ordinary shares at the rate of 6 per cent. per annum, deducting income-tax; leaving a balance of £736 to the credit of the next half-year's account. The Directors therefore declared a dividend at this rate. The Chairman moved the adoption of the report; and the motion was carried unanimously. He also read a long statement as to the recent offer made, on behalf of the Corporation of Norwich, to purchase the Company's undertaking; and explained the views of the Directors thereon. (It may be remembered that the price offered was 10 per cent. premium upon the market value of the shares; and as the Directors declined to lay this before the proprietors, the project fell through.) The business of the meeting having terminated, a resolution was passed expressing the shareholders' confidence in the Chairman and Directors, as well as the Manager of the Company (Mr. J. Ayris, M. Inst. C.E.), and thanking them for the prudence and forethought they have exercised in the interests of the Company.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 62.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon invest-ment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	15 Oct.	10½	Alliance & Dublin 10 p. c.	10	16-17	+½	6 3 6
100,000	10		7½	Do. 7 p. c.	10	11½-12½	+½	6 0 0
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105-107*	..	4 13 5
100,000	20	27 Nov.	8	Bahia, Limited	20	12-14	..	11 8 5
200,000	5	12 Nov.	7½	Bombay, Limited	5	6½-7	+½	5 7 1
40,000	5		7½	Do. New	4	4½-5½	+½	5 14 1
380,000	Stock.	13 Aug.	12½	Brentford Consolidated . . .	100	210-220	..	5 11 4
125,000	"		9½	Do. New	100	157-162	..	5 14 2
220,000	20	16 Sept	11½	Brighton & Hove Original .	20	40-42	..	5 9 6
888,500	Stock.	16 Sept.	5	Bristol	100	98-103	..	4 17 1
320,000	20	15 Oct.	11½	British	20	42-44	..	5 2 3
50,000	10	28 Aug.	11½	Bromley, Ordinary 10 p. c.	10	18-20	..	5 15 0
50,380	10	"	8½	Do. 7 p. c.	10	13-15	..	5 13 4
328,750	10		—	Buenos Ayres (New) Limited	10	52-6½	..	—
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	90-95*	..	6 6 4
150,000	20	13 Aug.	8	Cagliari, Lmited	20	24-26	..	6 3 1
550,000	Stock.	15 Oct.	13½	Commercial, Old Stock . . .	100	240-250	..	5 10 0
165,000	"		10½	Do. New do.	100	185-195	..	5 10 3
130,000	"	30 Dec.	4½	Do. 4½ p. c. Deb. do.	100	117-122*	..	3 13 9
800,000	Stock.	30 Dec.	13	Continental Union, Limited.	100	220-230*	+5	5 13 0
200,000	"		10	Do. 7 p. c. Pref	100	185-195*	..	5 2 7
75,000	Stock.	16 Sept.	10	Crystal Palace District . . .	100	190-200	..	5 0 0
486,090	10	15 July	10	European, Limited	10	19-20	..	5 0 0
354,060	10		10	Do. Partly paid	7½	14-15	..	5 0 0
5,470,640	Stock.	13 Aug.	13	Gaslight & Coke, A, Ordinary	100	223-227	+1½	5 14 6
100,000	"	"	10	Do. B, 4 p. c. max.	100	94-97	..	4 2 5
665,000	"	"	4	Do. C, D, & E, 10 p. c. Pf.	100	248-253	..	3 19 1
30,000	"	"	5	Do. F, 5 p. c. Pri.	100	118-123	..	4 1 4
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	172-177	..	4 4 9
1,300,000	"	"	7	Do. H, 7 p. c. max	100	153-158	..	4 8 7
463,000	"	"	10	Do. J, 10 p. c. Pri.	100	245-250	..	4 0 0
476,000	"	"	—	Do. K, 6 p. c. Prf.	100	145-150	..	4 0 0
1,061,150	"	11 Dec.	4	Do. 4 p. c. Deb. Stk.	100	110-114	..	3 10 2
294,850	"	"	4½	Do. 4½ p. c. do.	100	118-123	..	3 13 2
908,000	"	"	6	Do. 6 p. c. do	100	160-165	..	3 12 9
3,800,000	Stock.	12 Nov.	12	Imperial Continental	100	221-226	+2	5 6 2
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4-4½	..	6 13 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5p. c. Deb.	100	109-111	..	4 10 1
541,920	20	27 Nov.	6½	Monte Video, Limited. . . .	20	15-16	..	8 2 6
150,000	5	27 Nov.	10	Oriental, Limited	5	8½-9	..	5 11 1
60,000	5	30 Sept.	7	Ottoman, Limited	5	4-5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited.	10	2½-3½	..	—
				People's Gas of Chicago—				
420,000	100	3 Nov.	6	1st Mtg. Bds.	100	94-99	..	6 1 3
500,000	100	1 Dec.	6	2nd Do.	100	93-98	..	6 2 5
150,000	10	15 Oct.	10	San Paulo, Limited	10	11-12	..	8 6 8
500,000	Stock.	28 Aug.	15½	South Metropolitan, A Stock	100	265-275	..	5 12 9
1,350,000	"	"	12	Do. B do.	100	222-227	+2	5 5 8
200,000	"	"	13	Do. C do.	100	225-235	..	5 10 8
700,000	"	30 Dec.	5	Do. 5 p. c. Deb. Stk. . . .	100	138-143*	..	3 10 0
600,000	Stock.	16 Sept.	11½	Tottenham & Edm'nton, Orgl.	100	—	..	—
							</	

Fatal Explosion at the Windsor Street Gas-Works at Birmingham.

—An explosion involving fatal injuries to a stoker named James Merrill (aged 56), occurred about midnight on Thursday at the Windsor Street Gas-Works of the Birmingham Corporation. Merrill, after ceasing work at twelve, joined a number of fellow-workmen in the mess-room. The apartment is provided with a cooking-range; and the man had an idea that the fire did not draw as well as it might, owing to the choking of the flue. With the view of remedying the defect, he took a can of naphtha, and poured it down one of the flues; evidently thinking that the blaze would ascend in sufficient force to remove any obstacle. An explosion of an alarming character immediately followed this act. The kitchen was in a moment filled with smoke and dust, and the men made their escape with all promptitude. Merrill, however, appears to have been overcome by the fumes; and his comrades, on discovering that he had failed to escape, returned to his rescue. The poor fellow was then enveloped in flames. The fire having been extinguished, oil and wool were applied to the injured man with all haste prior to his removal to the General Hospital. He was so terribly burnt that he succumbed during Friday afternoon.

Bilston Gas Company.—The annual meeting of this Company was held yesterday week. The Secretary (Mr. J. S. Reeves) read the notice convening the meeting; and then the Chairman (Mr. T. Holcroft, J.P.) moved the adoption of the report and statement of accounts, which were summarized in the JOURNAL for Dec. 29. He first referred to the

point mentioned in the report, that the profits of the year had not been sufficient to pay the usual dividends, but the difference (£450) had been taken from the unappropriated profits of previous years. He considered that, as the past year had borne the full brunt of the higher prices of coal, the results might be deemed very satisfactory. Owing mainly to the severe weather of last winter, there had been an increase in the sale of gas of about 6½ per cent. He, however, did not expect much increase in the consumption during the current year. With a view to the greater economy in the manufacture of gas, he said, they had spent a considerable sum in improving their carbonizing plant; but as the benefits of these improvements would extend over a number of years, they had charged the cost to a "suspense account," which it was proposed to wipe off gradually. With regard to the reference in the report to the proposed amalgamation of the Willenhall Gas Company with their own Company, the principal advantages of such an amalgamation would have been to the consumers of gas, particularly those in Willenhall, who would immediately have benefited by a reduction of 3d. per 1000 cubic feet. As, however, the local authorities of both Willenhall and Bilston were opposed to any such amalgamation, and had resolved to carry their opposition to the Board of Trade, the Directors of the Bilston Company decided not to proceed further with the application. The report was adopted; and the usual dividends of 10 per cent. and 7 per cent. on the "A" and "B" shares respectively were declared.

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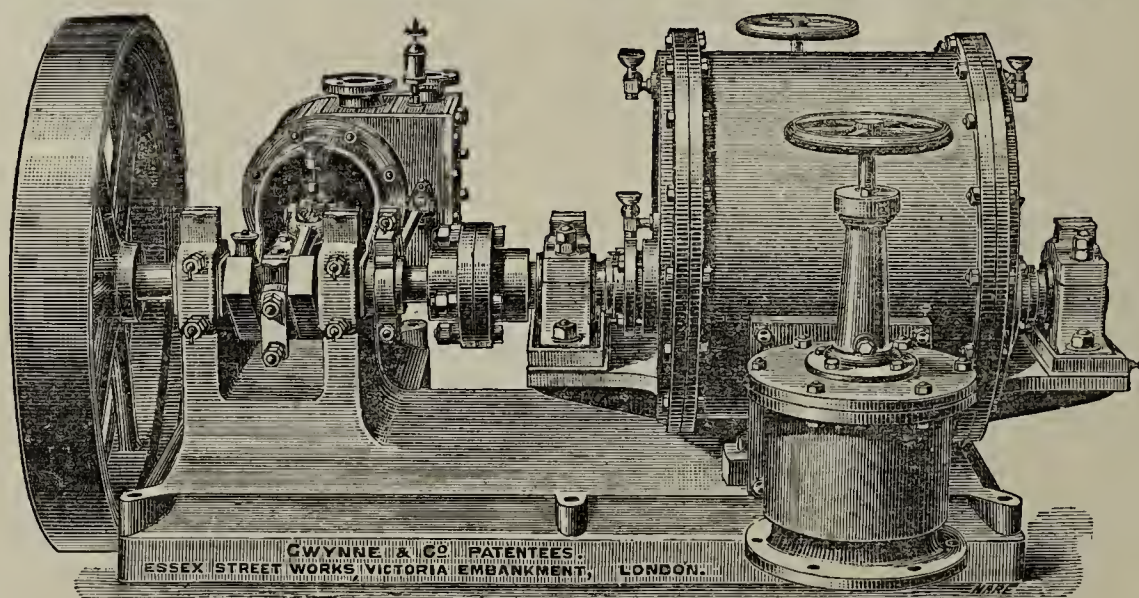
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By order,
THOS. A. JACKSON,
Town Clerk.

Town Hall, Chorley.

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THE Chorley Corporation invite Tenders for the supply and fixing of the following at their Gas-Works, Water Street, Chorley, viz.—

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Further information can be obtained from Mr. Wm. Blackledge, Gas Manager, Chorley.

The Corporation do not bind themselves to accept the lowest or any tender.

Tenders, endorsed "Exhauster" or "Condensers" as the case may be, to be sent to me before Noon, on Wednesday, the 20th of January, 1892.

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THE Directors of the Cirencester Gas Company, Limited, give notice that 300 £15 NEW ORDINARY SHARES, bearing a maximum Dividend of 7 per cent., of and in the Cirencester Gas Company, Limited, being a portion of the additional Capital authorized to be raised under the provisions of the Cirencester Gas Order, 1891, will be offered FOR SALE by auction by Messrs. Moore and Hill, at the King's Head Hotel, Cirencester, on Monday, the 18th day of January, 1892, at Four o'clock in the afternoon precisely, in lots of Five each, and will be issued to each purchaser as paid-up Shares after full payment of the purchase-money.

Further particulars and Conditions of Sale may be obtained from the Auctioneers, Corn Hall Buildings, Cirencester; Messrs. Mullings, Ellett, and Co., Solicitors, Cirencester; or of

J. P. BENCHAM,
Secretary.12, Silver Street, Cirencester,
Dec. 23, 1891.

THE Gas Committee of the Corporation of Heywood are prepared to receive TENDERS for the supply of RETORTS and FIRE-BRICKS. Tenders, endorsed "Retorts and Fire-Bricks," must be delivered to me not later than Tuesday, the 19th day of January, 1892. Specification, Quantities, and Form of Tender may be obtained upon application to the Manager, Mr. W. Whatmough. The Committee do not bind themselves to accept the lowest or any tender.

By order,
ALFRED WALLIS,
Town Clerk.Municipal Buildings,
Heywood, Jan. 1, 1892.BOROUGH OF WEST BROMWICH.
(GAS DEPARTMENT.)

THE Gas Committee are prepared to receive TENDERS for the construction of a BRICK GASHOLDER TANK, 124 feet diameter, at their Gas-Works, Albion, West Bromwich. Drawings and Specifications may be seen, and all information obtained, upon application to the Manager (Mr. Littlewood), at the Works, as above. Tenders, properly endorsed, to be sent to me at the Town Hall, West Bromwich, not later than the 28th inst. The Gas Committee do not bind themselves to accept the lowest or any tender.

By order,
THOS. HUDSON,
Secretary.Town Hall, West Bromwich.
Jan. 9, 1892.

SHEFFIELD UNITED GASLIGHT COMPANY.

GRIMSTHORPE STATION.

CONTRACT No. 4.

TO IRONFOUNDERS.

THE Directors of this Company invite TENDERS for the supply of CAST-IRON STANDARDS and other IRONWORK required for a Framing in the No. 1 Gasholder Tank at their Grimesthorpe Station.

Bill of Quantities may be obtained, and the Drawings may be seen at the Company's Offices upon application to the Engineer, Mr. Fletcher W. Stevenson.

The Directors do not bind themselves to accept the lowest or any tender.

Sealed tenders, marked "Tender for Ironwork for Tank Framing," and addressed to the undersigned, must be delivered at the Company's Offices, by post, not later than Saturday, Jan. 30, 1892.

HANBURY THOMAS,
General Manager.Commercial Street, Sheffield,
Jan. 9, 1892.

SHEFFIELD UNITED GASLIGHT COMPANY.

GRIMSTHORPE STATION.

CONTRACT No. 5.

TO JOINERS AND GENERAL BUILDERS.

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Bill of quantities may be obtained, and the Drawings may be seen, at the Company's Offices, upon application to the Engineer, Mr. Fletcher W. Stevenson.

The Directors do not bind themselves to accept the lowest or any tender.

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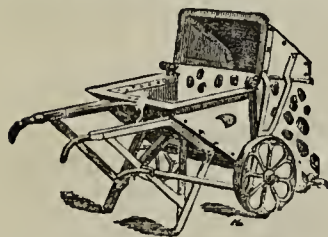
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TUESDAY, JANUARY 19, 1892.

First Meeting of the Board of Trade Commission.

THE first meeting of the Board of Trade Commission on Standards of Light was held on Friday last, when Dr. Odling, one of the nominees of the Department, was unanimously elected Chairman. The Commission as finally constituted is rather more numerous than can be called in strictness necessary for the proper performance of the work in hand; but when once the principle of representation had been admitted, it was obviously impossible to draw the line closer. There are enough members on the Commission now to ensure the full presentment of the subject in all its issues before a body strong enough to neutralize any sectional feeling within itself, and authoritative enough to impose its judgment

upon the gas industry at large. There was no opening, in the constitution of the Commission, for any representative of either the provincial gas interest or that of electric lighting. We are not sure whether the latter would have *locus standi* before the Commission, notwithstanding the plain fact that candle power means almost as much to electric lighting companies as it does to gas manufacturers. With respect to the non-Metropolitan gas undertakings, however, there can hardly be a doubt that the Commission would deal in good part with any representations that these may desire to make before the close of the present proceedings. The undertakings in question are not immediately concerned with the subject-matter of the labours of the Commission; but if they were to organize themselves with a view to secure attention for any special points upon which they might desire to offer some observations, they would not lose their pains. It is well known that the ways of gas testing in and out of London are different; and it would be as well for the Commission to take account of these differences. Common gas in London, to mention only one matter, means 16-candle gas. The same term has different meanings in various parts of the kingdom—the distinguishing adjective being indeed usually dropped, and "gas" meaning just what the local taste, regulated to some extent by local law, prefers to have it. Strictly speaking, all this has nothing to do with the Commission; but it would nevertheless be as well for their report to rest upon as wide a basis as can be obtained for it. In the meanwhile, nothing but good can come of the free discussion of the subject in the "Correspondence" columns of the JOURNAL. Here is no limitation, on the score of place of origin or any other, to shut out pertinent suggestions or sound criticism. We accordingly welcome Mr. H. Leicester Greville's letter, which appears to-day, and offer the additional suggestion that intending correspondents should pay particular attention to the principal points of his five recommendations. These are all important, and ought to be well threshed out before the Commission.

The Punishment of a Demagogue.

ON Friday last, Mr. Justice Denman and a special jury determined the action of *Higgins v. Ward*, to which reference has once or twice been made in these columns. This was the suit for damages for slander, brought by a stoker in the employ of the South Metropolitan Gas Company against the Assistant-Secretary of the Gas-Workers' Union, which has been the subject of wilful misrepresentation by the organs of Trade Unionism, wherein it has been described as brought by Mr. Livesey against a praiseworthy official of the Union—of course, for personal reasons. The misrepresentation went forward as briskly as this kind of business usually does; being, it may be supposed, carefully attended to by the Father of Lies. At any rate, it found its way into the *Echo*, and furnished the Editor of that respectable print, which has devoted some attention to gas matters of late, with occasion for an expression of wonder that Mr. Livesey should have deemed it worth his while to set the law in motion against a Trade Union official. This stupid story has now been exposed; and we may, it is to be hoped, consider that we have heard the last of it. The substratum of facts, without which no misrepresentation could endure for an instant, was supplied in this instance by the circumstance that the Directors of the South Metropolitan Gas Company, with Mr. Livesey, as Chairman, at their head, allowed it to be known to all and sundry whom it might concern, that they are prepared, at all times and by all proper methods, to afford the fullest protection to their servants when molested in the discharge of their duty. The energetic Ward, in the course of his operations against the Company and their loyal workmen—between whom and his party there is, and must be, war to the death—forgot the truth that the arm of the law is long enough and strong enough to reach an orator even through a mass meeting. The policeman on the edge of such a gathering is there to keep the peace. But brickbats are not the only means of offence against which the law has a remedy; and Ward has lived to learn, in the fashion reported in another column, that even a non-unionist stoker has rights which it behoves a stump-orator to respect. In truth, enthusiastic Trade Unionists, Socialists, and Anarchists—for the parts appear to be interchangeable—have had several "heavy

"blows and great discouragements" of late. This order of gentry have a vague notion that "old Father Antic, the Law," ought to stand aside and let them exercise what they are fond of calling a "free hand." It is very noticeable how catch-words of this sort continually pass current in the newspapers and among the mass-meeting spouters of this particular stamp. The newspaper scribes, safe in their anonymity, fulminate in grandiose language about the "sacred right of insurrection," and are always prating of the urgent necessity of "mending or ending" something. These scraps of incendiary journalism are caught up by the professional agitators, and by them and their following translated into all sorts of fantastic actions. The net result of all the writing, and speaking, and processionizing is, that some feather-brained folks fall into the mistake of imagining that they can do as they please, even to the extent of directing Parliament to pass such laws as they deem to be desirable, while they reserve full licence to set at naught any law of which they disapprove. Alas for the fancy! The fervid denunciations, the frantic vilifications that go down so well with the unwashed multitude, which affects to believe that the question of liberty of speech is bound up with the tolerance of obstruction of some particular thoroughfare, and likes its Trade Unionism served up hot with personalities, do not avail to turn aside the cold rigour with which the law visits slander and incitement to violence. It is all very well for a Ward to point with personalities his interested onslaughts upon stokers who refuse to support the Union which made such miserable failures in Salford and South London—he does so at his peril. It is very bold for a Clem Edwards to attempt to terrorize over a firm that defies him and his colleagues—he has to look to himself when the latter "stand from under." It is unnecessary to multiply instances. If the Trade Unionists and the Social Democrats who lead and live upon them could make their own Parliament, appoint their own Judges and Magistrates, pack the juries, and govern the police, then, as they put it, they would receive justice—which is as much as to say that then only would they get their own way in everything. Meanwhile, they must abide by the law as it stands, like other people.

An Experience Confirmed.

THE reflection that "the wise old world is mostly right," is one that those who endeavour to strike out, and live by, strange rules of their own devising, sooner or later have borne in upon them by force of circumstances. Purveyors of commodities under any system of constant delivery, such as gas distributed through pipes leading into the consumers' premises, have repeatedly tried to do without meters, and to determine their charges by apparently simpler and cheaper means. But all such devices fail in turn; and the meter asserts its superiority to any "rental" system, however artfully devised. It has been so with the supply of electricity for lighting; and also with the natural-gas Companies of certain of the United States. The experience of the latter is particularly instructive. The system of charging at first adopted by the latter Companies was after a fixed monthly rate per cooking-stove, fire-grate, or other apparatus connected to the service, without any reference to size or to the quantity of gas required. This plan did not give satisfaction to anybody. People who had small stoves or fire-places objected to pay as much as others with larger grates; and paying for the service, whether the gas was used or not, was regarded as a grievance. On the other hand, the system led to very great waste. There was no inducement to economize; and it was less trouble to keep the gas burning day and night than to turn it off and light it whenever wanted. An attempt was next made to meet some of the objections by rating the stoves and grates proportionately to the size of the house. But the trouble was not removed thereby, for allegations of unfair reckoning became rife; and when gas ran short, the consumers complained that the Companies made no corresponding deduction from their charges. Yet another system tried was the supply by means of "mixers" of different sizes, which it was supposed would deliver gas in quantities proportionate to their capacity. But here again there was no inducement to economize, except in the size of the mixer; and the result was that apparatus very wasteful of gas, and yet too small to be of any real use for its intended purpose, caught the consumer's fancy. At last a suitable meter made its appearance; and although at first the consumers looked upon

these appliances for teaching economy in the use of gas as devices of the Companies for increasing their revenues, their use has spread, until at the present time most of the natural gas supplied to houses in the neighbourhood of Pittsburgh is paid for by meter. So experiences repeat themselves.

The Home Coal Trade of 1891.

AN interesting article upon the "Home Coal Industry in 1891" has appeared in *The Times*. It commences with the statement that, "after enjoying for about two years 'a period of unusual prosperity, the coal trade of the United Kingdom has suffered a relapse to its former 'and more normal condition of keen competition and low 'prices.'" This observation, being supported by sufficient evidence, will sound like good tidings in the ears of gas managers, who probably consider that they have suffered a great deal more than they deserved at the hands of the coal people during the "period of unusual prosperity" in question. The writer in *The Times* explains the relapse in the coal trade by referring to the contraction of demand in the iron and steel, engineering, and other industries; and also to the fact that the resources of production have been greatly increased within the last two or three years. Between 1886 and 1890 there was an increase of more than 17 million tons in the home consumption of coal, which was far too great an expansion of trade to continue. The demands for coal for household use, for railway consumption, and for gas making are all expected to show an increase for 1891; but for other purposes there was an "unmistakeable and pretty general" falling off in the latter part of the year. This is a striking corroboration of the views expressed upon the same subject in our "Retrospect" of the year just ended. The extent of the revival of the coal trade referred to in the article now under notice is marked by the increased value of the coal exports, which rose from 8.32s. per ton in 1887, which was the lowest recorded for a very long time, to 10.21s. in 1889, 12.62s. in 1890, and 12.2s. in 1891. The result of this rise in values has been that "the coal industry has 'had between 30 and 40 millions sterling more to dis-'tribute during each of the last two years, in the form of 'either profits or wages, than it had in 1887.'" It is computed that at least one-half of this additional money went in the shape of advanced wages; but this does not imply that all the rest was increased profit for the owners, because, among other heightened sources of expense which they had to bear at the time, the shorter hours worked by the miners figured for something considerable. All these things are now settling down to something like the old level; so that, if they only display the most ordinary capacity for business, gas manufacturers may reasonably expect to be able to buy their coals at low rates once more. Of course, those who buy in a panic, and arrange their contracts in a way that invites hostile combination among the coal-owners, will have to pay the usual premium on mismanagement. Some buyers seem to regard it as the height of prudence to give 1s. a ton more for their coal than anybody else. But the last year or two has hit several of these oddly-constituted gentry pretty hard; and they may do better for the future. It may seem like brutality to the coal-owners that gas-coal buyers should openly rejoice at the collapse of the market, which cuts off all, or nearly all the profit margin from their new contracts; and we can well understand representatives of the coal interest asking, "more in sorrow than in anger," how gas manufacturers would like to work for nothing. Well, the position needs some explanation, perhaps; and it does seem hard if, as is said, the coal-owners' share of profit upon the output of his pits is only about 9d. per ton, that he should not be able to depend upon realizing this modest proportion of the gross value of the commodity. As a question of principle, it is hardly to be imagined that gas manufacturers or any other buyers of coal entertain the slightest objection to the owner getting his normal 9d. per ton profit; but the worst of it is that there is "neither 'rhyme nor reason' in the various fluctuations of the coal market. Why, for example, should gas makers, whose requirements are perfectly regular and their money good, be asked to pay 50 per cent. more for the same coal in 1890 than they could get it for in 1887? "Please, Sir, it 'isn't me!" cries the innocent owner. So says the miner; and so says everybody concerned. All the buyer knows is that he has to pay "through the nose" for the coal he requires; and be thankful for what he gets. It

is the "state of the market" which is responsible for the consumers' sufferings; and it is hardly to be wondered at that, when he understands that this formless but very real oppressor of his has collapsed, he should rejoice with exceeding joy, and refuse to pity the long-faced sellers, groan they never so touchingly.

Some American Topics.

It is understood that the great American press and the greater American people suit one another in at least one regard—that the former is never weary of publishing, nor the latter of reading, any sort of printed matter that can be described as being "mainly about people." It does not greatly signify who the people are, nor what is said about them. The point is that personal chatter *per se* ranks above everything else, and that no sense of intrinsic values with regard to matter, nor of grace of style, nor of clearness of expression, interferes with the pre-eminence of the "personal paragraph" in American journalism. If this is the correct view, the "gas men" of the United States ought to be happy just now, for they have several first-class eruptions of personalities in full blast. To begin with, there is the squabble in the membership of the American Gaslight Association regarding the knotty point whether President Harbison was or was not justified in saying unkind things of a journalistic critic who is apparently not without backers in the Association. Then there is a good bit of shuffling going on in respect of the management of one of the New York gas undertakings; and prominent names are being shifted about from one place to another, after a fashion that gives colour to the suspicion that, even across the Atlantic, gas management is still far from being "all beer and skittles." The efforts of the native gas industry to secure "bold advertisement" at what, in the perverse Yankee tongue, is called the Chicago "Exposition," and the discouragement which these efforts continue to receive, also furnish many piquant paragraphs to the newspapers. The Chicago Gas Companies—or some of them—were patriotic, or prudent, enough to contribute the handsome sum of \$50,000 to the funds of the Exhibition Executive; but when, in return, some authoritative acknowledgment of the gas industry was asked for, the same Executive became impracticable. We alluded a short time since to some of these troubles of our American cousins, and ventured to condole with the many good, practical, straightforward, and common-sense men whom we know to be engaged in the gas industry of the United States, upon the garbled way in which, through the inveterate striving of American journalists after the "picturesque" style of reporting, news of their doings reaches the world at large. Our gentle criticism has been taken in good part. To our request for reports in plain English, one journal devoting itself to the American gas interests proudly rejoins that this is its special care. In its very next page, however, our contemporary, desiring to be plain, tells how "the American Gaslight Association sailed close to the reefs" on Thursday, Oct. 22, 1891, and that it did not scrape "some of the copper from its bottom, or meet even worse disaster, is not to the credit of the men elected to handle the helm on that day." We have heard a corporation defined as having neither a soul to be—condemned, nor a body to be kicked; but this particular Corporation is here described as not only possessing a bottom, but also as having that bottom coppered! And then, if it was "not to the credit" of certain men that disaster did not happen to this curiously-built Association, are we to understand that it would have been greatly to their credit if the mysterious injury already mentioned had accrued? Really, unless it is seen to before it is too late, writing plain English will become as impossible for an American journalist as it well-nigh is already for a plain Englishman to understand American. All the same, we gather, from the reports that reach us from time to time, that our American cousins have a few little troubles of their own just now, from all of which we sincerely wish them safe and speedy deliverance.

Title and Index to Volume LVIII.—The title and index for last half-year's volume of the JOURNAL is in course of preparation, and will be ready for issue next week.

Books Received.—"Methods of Gas Analysis," by Dr. W. Hempel, translated by L. M. Dennis (London: Macmillan and Co.). "The Strange History of a Dynamo," by T. E. Gatehouse (London: Alabaster, Gatehouse, and Co.).

WATER AND SANITARY AFFAIRS.

THE Imperial power has at last interposed, to place the Metropolitan Water Question upon the footing which its importance demands. It is announced that Her Majesty's Government have resolved to advise the appointment of a Royal Commission to inquire as to the adequacy of the present water supply of London; and, if inadequate, the means of increasing the supply. This at once effects an essential change in the situation. The "Agreed Bill" of the County Council and the Corporation (we name the County Council first as having the master-hand) should now be laid aside, after making perhaps a brief appearance in the House of Commons, supposing the opposition on Standing Orders to be ineffectual. The protracted and strategic agitation which has been so long maintained respecting the water supply of London, must of necessity be suspended while the subject is being investigated by the high authority about to be appointed. From no quarter can a single voice of complaint be raised concerning the arrangement now pending. A full year ago, the County Council asked for a Government inquiry to be instituted—a request based on a unanimous resolution. Later on, when the Select Committee of which Sir Matthew White Ridley was appointed Chairman declared it to be "the duty of the London County Council" to conduct a "complete inquiry" into the subject of the Metropolitan Water Supply, the Council demurred to the proposal on the ground that they had no power whatever to call for evidence or information, but would be entirely dependent on voluntary witnesses. Under such conditions, it was observed that the result of any inquiry the Council might make would fail to be final and conclusive. As for the report of the Select Committee, that suffers no slight. The Committee found the subject which they had to deal with was too big for their grasp, and required more time for its consideration than they were able to command. Having rejected the Water Bills of the Corporation and the Vestries, the Committee left the main task altogether unfinished, and practically untouched. A power adequate to the purpose is at length coming forward; and the people of London have every reason to be satisfied that a question in which they are so vitally interested is to be inquired into by an authority which they can trust. The conclusion to be arrived at by the County Council was obvious beforehand; and yet, in the absence of a Royal Commission, it was inevitable for the subject to fall into the hands of that body.

The full instructions to be embodied in the Royal Commission are not yet known. All we are told is that the inquiry will have reference to the "adequacy of the present water supply of London." If the present supply is considered inadequate, then comes the question as to the means of increasing it. There is no allusion to the quality of the water, though this will inevitably receive consideration. Should quality fail, that, of course, would be as bad as no water at all. But there is no reason to apprehend this. The thoroughly wholesome character of the water sent out from the works by the London Companies is proved by scientific examination and physiological experience. With respect to quantity, there can be no dispute that an average of 31 gallons per day to each member of a population exceeding 5½ millions is adequate. Such is the "present" state of things. But the Commissioners will look into the future. We must understand the problem to be simply this: Can London, over a considerable series of years to come, be adequately supplied with water from the present sources? Or must a supply be drawn from remote watersheds, such as may be found in Wales or Devonshire? The sources now drawn upon yield an average through the year of 175 million gallons of water per day; the actual delivery being very considerably higher on occasions of summer heat. An attempt is made to show that the existing sources of supply are overtaxed. If they are, this must be due to defective works; for there is evidence to prove that an immense volume of water runs to waste in mischievous floods, while a large quantity escapes underground. The Rivers Pollution Commissioners, in their report on the domestic water supply of Great Britain—a document coming down in date to May, 1873—say: "We believe that, within 40 miles of St. Paul's, a sufficient volume of deep-well and spring water can be obtained for the present daily wants of the Metropolis, and that

"the radius of the circle of supply would only require "to be very slowly lengthened to meet the requirements "of an increasing population." Reasons for this opinion are given at some length. Farther on, the Commissioners say: "Certainly no necessity can for a long time arise "for going beyond the 50-mile circle." From this reckoning, the chalk beds in the neighbourhood of Brighton are excluded, as not being within the Thames basin. Now, although it is nineteen or twenty years since these conclusions were arrived at, the interval is not sufficient to destroy their practical value. It is simply a question of going farther afield from time to time within the boundary of the Thames watershed. To disregard all this immense store of water close at hand, and to construct enormously expensive works encroaching on another watershed, would seem to involve a mistake from which London should be delivered by the acumen and impartiality of the Royal Commission about to be constituted. If, indeed, it is thought needful to visit the mountains and moorlands, and to draw from head waters and lakes, the subject then becomes one of national importance, and the right appropriation of watershed areas will have to be provided for. But let the issue from this point of view be what it may, we cannot suppose that a Royal Commission will advise any arbitrary dealings with the London Water Companies, who have maintained an abundant and healthful supply of water for the use of the enormous and rapidly increasing population of London and the far-off suburbs.

The City Commissioners of Sewers have finished their artesian well, and the trust which appertains to the enterprise now dawns upon them. They will be enabled to supply their artisans' dwellings at a cost of £150 per annum, instead of paying £80 per annum to the New River Company. The daily supply will only be at the rate of 20 gallons per head; and the estimated cost makes no allowance for a duplicate engine, or for depreciation of machinery. There will be a surplus volume of water; but the Solicitor to the Commissioners says they can only give it away. How this is to be done is not very clear, for the Commissioners have no power to pull up the streets to lay down water-pipes; and it is scarcely likely that the citizens will go with buckets to the City well, after the manner of a remote ancestry. Neither can we suppose that the Commissioners will send round a free gift of water, in the shape of a barrel on wheels. In the interest of the public and of the ratepayers, the best thing the Commissioners could do would be to make a present of the well to the New River Company, or sell it to the Company cheap. This would be a saving equal to the difference between £80 and £150 per annum.

Mr. John Holliday, Assistant to Mr. Hepworth at the Carlisle Corporation Gas-Works, has been appointed Sub-Manager of the Scarborough Gas-Works—a position for which applications were invited in our advertisement columns early last month.

The London Water Supply.—Her Majesty's Government have resolved to advise the appointment of a Royal Commission to inquire as to the adequacy of the present water supply of London; and, if inadequate, as to the means of increasing the supply.

Dr. S. Rideal, Lecturer on Chemistry at St. George's Hospital, who has from time to time appeared as a contributor to our columns, has just been appointed Gas Examiner to the Bromley (Kent) Local Board. We understand that Dr. Rideal is one of the candidates for the appointment of Gas Examiner to the Corporation of London, rendered vacant by the death of Mr. Charles Heisch.

Death of Mr. J. Douglas.—The death is announced of Mr. John Douglas, C.E., for some years Engineer of the Portsea Island Gas Company, but latterly Manager of the Victor Cement Works at Cowes. Mr. Douglas's health began to fail in 1875; and this caused him, four years afterwards, to relinquish his position with the Portsea Island Gas Company, in which he was succeeded by Mr. S. B. Darwin.

Death of Mr. John Chapman.—We regret to record the death, on the 10th inst., after a few days' illness, of Mr. John Chapman, of Harrow. Mr. Chapman was one of the founders of the Harrow Gas Company, of which he was Deputy-Chairman at the time of his death; and he was among the first members of the Harrow Local Board. He had been for 30 years a Guardian of the Poor of the parish, was one of the Superintendents of the Harrow Baptist Sunday Schools, and took considerable interest in all local institutions. Being so well known in Harrow, Mr. Chapman will be much missed; and great sympathy is expressed by all classes for his widow and family in their bereavement.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 123.)

DURING the past week the Stock Markets have been decidedly dull. At the same time there is no sign of any appreciable degree of weakness; and prices have not suffered any fall worth speaking of. It is difficult to understand exactly why this depression should be; for its source is not apparently among the phenomena which ordinarily furnish the cause of a depression. Money is cheap and abundant; trade and traffic at home are promising; the peace of Europe (always a hazardous thing to speculate upon) really seems ensured for some little time to come; and yet the markets are depressed. Perhaps those are not far wrong who think it is the prevailing sickness which prostrates our minds and unfits us for enterprise. If this be so, a revival of activity cannot be looked for yet awhile. The Gas Market, however, during the past week has been as active as it was in the preceding. Movements are irregular. The turn downwards in Gaslight "A," which was just beginning to show itself, has been more persistent. The opening price was 225. But this was not touched again; and the figures fell away gradually, until on Saturday the lowest point—219—was reached, without any promise at the close of present recovery. Nothing was done in the debenture stocks; but the "K" 6 per cent. preference was pretty active, and the price was well maintained. Of the two limited issues, the "B" 4 per cent. advanced 1, and the "H" 7 per cent. receded to an equal extent. At current prices, the one returns 3s. 8d. per cent. for money more than the other. South Metropolitans have not furnished much business; but the transactions marked in the "A" and "B" were all at good figures, indicative of strength. Nothing was done in Commercial; but a favourable tendency was apparent from buyers offering a higher price for the new stock. Transactions in the Suburban and Provincial Companies were at fair average figures, with the exception of one "special" bargain in Brighton and Hove, which, for some reason or other, was done much under the mark. The Continental undertakings have been doing very well; and perhaps the prospects of the preservation of the peace of Europe had something to do with it. Continental Union made a further advance of 5; and Imperial Continental, 3. Indians were quite steady. Of the South Americans, San Paulo receded $\frac{1}{2}$. The improvement in Water quotations still continues; and further moderate advances have been scored.

The daily operations were: The Gas Market was fairly active on the opening day; and prices generally (with the exception of Gaslight "A," which fell $1\frac{1}{2}$) were good. Continental Union gained 5; and Imperial Continental, 1. In Water, East London and Grand Junction rose 1 each. Tuesday was much quieter; and the only feature was a further fall of 1 in Gaslight "A." Lambeth Water rose 5. On Wednesday, Gaslight "A" was steady. "B" rose 1; and "H" fell 1. In Water, Chelsea improved $2\frac{1}{2}$; and East London, 1. Thursday was very inactive. Commercial new rose $2\frac{1}{2}$; and Imperial Continental, 2. But Gaslight "A" fell 2. Friday's business was almost entirely in Gaslight "A" and Imperial Continental; but neither moved. Saturday developed no fresh feature; and all quotations closed unchanged.

ELECTRIC LIGHTING MEMORANDA.

The Dessau Central Station—Gas-Engines for Central Electric Lighting Stations—Steam-Power Central Stations—The Difficulty of Understanding Electrical Measurements.

THE particulars relating to the central electric lighting station of the German Continental Gas Company at Dessau, which we have recently given in the JOURNAL, form an important contribution to the available stock of information respecting the installation and equipment of establishments of this kind, which will be specially welcome to gas engineers, from the mere fact that the whole thing is the production of distinguished members of the same profession. We have always maintained that if anybody can make a central electric lighting station pay, it will be a gas engineer, simply because he can bring to bear upon this class of business a wealth of practical experience and aptitude in management which no mere electrician possesses. The recent history of the electric lighting industry proves over and over again that its practical, working success has only been rendered possible by the labours of workers who have begun where the electrician, pure and simple, has left off. While it remained in the hands of electricians, the arc lamp was a sort of philosophical instrument; and the same might be said of methods of electrical generation and distribution. Gramme, Brush, Edison, Westinghouse, Ferranti, were all fully employed for years in putting the delicate apparatus of electricians into work-a-day garb. So, likewise, it was only when the ordinary run of mechanical engineers and gas-fittings manufacturers took to the electrical branches of their business, that the small goods of the industry assumed a marketable shape. Hitherto the design of central stations has been left too much to professors of electrical science, and to engineers whose ideas are those of the workshop; and how many of their productions in this line are likely to pay? It is not saying very much to assert that an

experienced gas engineer and manager, with an electrician assistant, would probably make at least as good a job of a central electric lighting station as gentlemen of the orders named. At any rate, no British municipality owning gas-works, and constrained to embark upon an electric lighting speculation, can afford to ignore the Dessau example.

We are as firm as ever in maintaining the position that British statutory gas companies had better have nothing to do with electric lighting; but, of course, we cannot pretend to lay down the law for foreign companies, the managers of which ought to know their own business best. The relations of Continental gas companies, working under the concession system, to the municipalities of the towns they have to serve are very peculiar and complex; and, altogether the position of a concessionary gas company with regard to electric lighting is, in some parts of the Continent, very much more like that of a British municipal gas department than that of a British statutory gas company with respect to the same business. This being understood, it is clear that if the administration of a municipal or sub-municipal gas undertaking think fit to establish an electric lighting branch, it is natural that the possibility of driving the electrical plant by gas, and so "killing two birds with one stone," should appeal to them for particular consideration. This is an idea that would never occur to a college professor, or to any of the well-advertised specialists who are usually consulted in a matter of this kind by a British municipality. Something of the sort has been suggested in Glasgow, however, with the immediate result of hopelessly confusing the ideas of all the eminent electrical specialists engaged to advise the Corporation. The illustration of Dessau is such a potent one, and the difficulty of wrestling with the "load factor" is admittedly so great in the case of steam-power stations, that any gas-supplying municipality who neglect to convey to their electrical consultants a special "Instruction" to consider the question of generation by gas-engines, will be guilty of a gross dereliction of duty.

With reference to the subject of the preceding paragraphs, it is possible to argue that when the equipment of large stations is in question, the comparatively small sizes in which gas-engines are at present made, as compared with steam-engines, bars the former from strict comparison with the latter. It is becoming apparent, however, that cases in which very large steam plant can be profitably employed in electric lighting must be exceedingly rare. In many towns there are small *nuclei* where, for the purposes of either business or amusement, a certain demand for electric lighting can be depended upon. Here is the opportunity for the gas-engine station. Even the steam stations (according to what has come to be regarded as the best and safest English practice) are split up into medium-sized generating units consisting of a high-speed engine coupled to, and driving its own dynamo direct. The notion that there is any special economy, for electric lighting work, in very large steam-engines, is one of the early delusions of electricians, which they are quietly but deliberately dropping. The employment of large engines driving big dynamos for generating alternating currents of high voltage is already seen to be a mistake—not, perhaps, so much from the point of view of the electrical engineer, as on account of other considerations. The question of the provision of transformer stations is by no means a simple matter to settle, having regard to the ordinary conditions of town life; and when Mr. Justice Kekewich forbade the reinstatement of the Grosvenor Gallery transformer station, on the ground that it would be a dangerous nuisance, his Lordship's decision went a long way towards settling the problem of safe and convenient electrical distribution.

The fact that conscientious electricians are at their wits' end to explain electrical phenomena and measurement, is continually being commented upon and deplored in the journals devoted to the industry. Our contemporary the *Electrician* has recently been devoting some attention to this puzzling subject, with special reference to the curious feature of electrical meters that they measure something which has no objective existence. When one measures water by means of a meter upon a pipe discharging into a tank, there is the water to show what the meter has been registering; and if there is any doubt about the indications of the instrument, the water can be measured out as easily as it was measured in. So also with the counting of a crowd of people by means of a turnstile giving access to an enclosure—the people are there, in evidence of what it was that made the "wheels go round." But when it is a case of measuring what is conventionally termed a "current" of electricity, where is it after it has affected the measuring apparatus? It only exists in flowing (if such a lame expression is permissible); and we only know that it is affecting the wire, or whatever the form of apparatus that contains it, not by any disclosure of itself, but by some indication which is really a factor of the wire or the apparatus. The analogy of electricity to flowing water is the only known means of expressing in simple language, not what electricity is, but what it does. It does not carry one far, however, even with dynamical electricity, although it is sought to explain the phenomena of induction by further assuming the water to be infinitely heated. And the "flow of water" analogy fails entirely to explain the most obvious phenomena of magnetism. It is therefore easy to perceive why electrical measurements are so misunderstood, or so seldom understood at all, even by people with a good aptitude for figures.

THE CRYSTAL PALACE ELECTRICAL EXHIBITION.

THE Electrical Exhibition which is now, by a polite fiction, described as being "open" at the Crystal Palace must naturally attract the attention of the gas engineering world; and accordingly we propose to describe the principal exhibits with particular care in the pages of the JOURNAL, in order that our readers may be able to form an opinion as to whether it is or is not worth their while to personally inspect the show at Sydenham, and also that those whom circumstances may prevent from making the necessary pilgrimage may suffer as little as possible from the deprivation. We shall therefore, in all probability, devote several articles to our proposed critical notice of the exhibition; beginning as soon as there is anything ready for examination. When we visited the Crystal Palace last week, however, appearances indicated that, after opening the subject generally, it will be necessary to allow an interval of a week or two to elapse before instituting anything like a critical investigation of the details of the display. Enough may even now be seen, however, to give one an idea of the character and extent of the exhibition, which is the first thing to be considered. For there are exhibitions *and* exhibitions, as it is hardly necessary to prove by citing modern comparative examples which will occur to our readers' recollection. There is the exhibition which is a worthy representation of the condition of the *technique* of an industry, or a group of industries, as existing in a particular nation or in the civilized world; and there is the show which is merely a "catch-penny" concern, and merely caricatures the title which its promoters have chosen to give it. Between these extremes lies a wide range of speculation, which is filled in variously by the large class of exhibitions that are laid out to "combine business with pleasure" in uncertain proportions. It may be said at once that the Crystal Palace Exhibition is a high-class affair, worthy of the reputation of this really national, though actually proprietary, institution. It is supported by the full strength of the electrical engineering interest in this country, and consequently deserves to be esteemed as in every way fittingly representing the present condition of the electrical industries of the United Kingdom. This is no small thing to say; but we do say it without reserve.

The fact that the exhibition has been opened before it is ready or fit to be seen, is only what experience of undertakings of the kind leads one to expect; and the equally obvious fact that this particular example is even more than usually behind-hand must, we suppose, be explained by reference to the nature of the exhibits. For it is no libel to accuse electrical apparatus of a trick of disappointing its friends just when they want it to make the best possible appearance before the world. Let this subject pass with the observation that in the present preliminary notice of the exhibition we shall not bind ourselves to draw the line too strongly between what is to be seen now and what may be hoped to be visible at the Palace before the season closes. Gas engineers, at any rate, will see no reason to grieve over-much because a week after the date of the opening many of the exhibitors may still be seen getting their stalls in order by the light of an ordinary theatrical "T standard" which helps to swell the revenues of the Crystal Palace District Gas Company. We shall not wonder if the show, as a whole, turns out to be as good a thing for this Company as if gas apparatus had been formally included among the exhibits. Last week, at any rate, there was practically as much gas as electric light in evidence at the Palace.

The exhibition will be distinctly national in its scope and character. According to the catalogue, all the best known firms in the English electrical trade are to be found among the 230 or so stall-holders; and no foreigners worth mentioning appear in the list. There are, of course, several firms of foreign origin; but these have all become acclimatized ere this, and their work is accepted as forming part of the English branch of the industry. We have no hesitation in conceding that the general aspect of the interior of the Palace even now bears witness to the distinctiveness of this branch. There is a massiveness about the exhibitors' preparations, an absence of trickery from the setting forth of what they have to show, and a finish about their exhibits which unmistakably stamp their origin. English electrical engineers may not be cunning in the employment of plush and satin hangings in the supposed adornment of a stand of dynamos; and the palm-trees are kept away from the steam-engines, which was not the case at Frankfort. But the apparatus looks like standing wear and tear; and wherever neatness and high polish may reasonably be sought for, there they are to be found.

The critical visitor cannot help comparing the general aspect of the Palace now with its appearance ten years ago; and the difference is easily noted. Where electrical engineering was obviously experimental then, it is not less obviously commercial now. What ten years ago was more of a curiosity than anything else, is now a matter of business. There is no disputing this conclusion. But it is equally plain that the development of electrical science and practice during the past ten years have not been precisely along the lines seemingly laid down at the commencement of this period. It is a significant fact that while the exhibitors in the long naves of the Palace are getting their stands in order, and while the arc lamps belonging to the lighting system of the building are shining all over the place, the

well remembered lines of gas-burners along the springing of the lofty roof are still alight, albeit, as it were, in the background. Is it unfair to compare the gas at the Palace to the garment next the skin, which a man never displays as an ornament, but which he can worst spare?

At any rate, if one had assured the electricians and the public ten years ago that gas would be found at the end of the decennium—not only holding its ground, but with the same old burners to light the Palace in case of emergency—the prediction would have been scouted. It would have been wrong to have met the boastful prophecies of the electricians at that period with a flat denial of their prospects of doing any business at all; but it is not a little remarkable that events have taken their actual course. For the permanence of the old nave gas lighting at the Palace is emblematical. Inasmuch as the design of the electricians of 1882 was to supplant gas, they have utterly failed; but they have as certainly succeeded in building up a business in many kinds alongside, and even in conjunction with, gas. A very great deal of the contents of the present exhibition, even when connected with lighting, speaks of applications with which gas has no concern. Search-lights, projectors, ships lighting of all sorts, and the machinery therefor, fancy lighting for the drawing-rooms of the wealthy, decoration in which tiny lights constitute an element—all these form whole departments of industry, into which gas has never entered. The extensive display of gas-engines applied to the driving of electric lighting machinery, again, is proof of the extent to which the one industry directly helps the other. And by far the most striking portion of the exhibits is composed of electrical apparatus applied to purposes other than lighting, such as telephony, telegraphy, and the accessory industries.

The long line of the naves is fairly filled with the most attractive descriptions of electrical exhibits, conspicuous among which are the stands of the Edison-Swan Company, Messrs. Woodhouse and Rawson, Messrs. Crompton and Co., Siemens, and the Brush Company. Here are also the electric telegraph exhibits from the General Post Office; the large stand of the National Telephone Company; and the cable exhibit of Messrs. Johnson and Phillips. Not all the telegraph and electrical signalling firms are exhibitors; but in exchange for these appear numerous exhibitors of electrical "sundries," whose name and fame are not particularly well known. This is really one of the striking features of the exhibition—the number of new electrical machinery and fittings' manufacturers who, according to the display they make, do a considerable trade in this way. From what may be seen here, it would appear quite unnecessary for anybody intending to make use of the electric light, or any other application of electricity, to go to one of the much-advertised companies or firms who have essayed to usurp pre-eminence in this department of industry. The gas-fitters as well as the ordinary engineering shops have clearly got hold of the "knack" of electrical fitting, and are running the professed electricians very close indeed.

The steam and gas motors required for the exhibitors of lighting, &c., or merely intended to be exhibited on their own account, are collected into a "machine-room" which, thanks to the vastness of the Palace, need not be entered at all by ordinary visitors, and consequently cannot prove a source of annoyance to people who are not interested in machinery in motion. This is the dingy corner immediately to the right of the entrance to the Palace from the High Level Railway Station, in which space is found for 38 exhibitors, who will doubtless all be ready for inspection in the course of a few weeks. At present, while some of the gas-engines are actually at work, a good deal of machinery is lying on the floor precisely as it was dropped from the carriers' carts.

The catalogue of the exhibition constitutes for the present the best guide to an appreciation of the scale upon which the undertaking will eventually be completed. This catalogue is sprinkled with little essays, introductory to the different divisions of the subject matter, by the Editor (Mr. H. J. Dowsing), who begins by telling the world that "Steam has revolutionized the present century; but electricity bids fair to control the destinies of the next." To control destiny is rather a "large order," even for electricity; but one must not be too particular with regard to the style or the matter of a catalogue, which is a kind of publication that always reminds one of the auctioneer. In this case, the Editor is particularly careful that there should be no mistake respecting the main object of the present exhibition. Having regard to the fact that "few towns exist where the subject of electricity has not been discussed," and that deputations from municipalities are "constantly visiting works in progress to see the various systems employed," it is pointed out that "the present exhibition will afford an excellent opportunity for local authorities of every town and village to send their representatives to view, in one well-chosen spot, the latest inventions for commercial use." It seems almost superfluous to add that "the Directors will welcome such deputations, and afford them every facility in their power"—naturally. Besides, is it not perfectly true that "the Crystal Palace, while offering exceptional facilities for the carrying out of an exhibition of this kind, also lends itself to the social enjoyment of its visitors?" Certainly it is; and accordingly there is every reason to hope that "this happy combination of business and pleasure will ensure even a greater success for the present exhibition than that which attended the former one held ten years ago." Let us hope, at any rate, that

there will be no repetition of the company-mongering which attended the last exhibition. The time is not propitious for this sort of thing, which, moreover, is a game that can hardly be played twice. There is likely to be plenty of sport, however, in the netting of orders from local authorities, many of whom must shortly "do something," or see their statutory electric lighting powers lapse; and the exhibition will doubtless form a capital decoy for the electrical fowlers.

The attempt of the Editor of the catalogue to give a popular explanation of the phenomena and laws of electricity, including electrical measurements, is about as futile as such attempts generally are. The writer gets sadly mixed up between "force" and "quantity," and only succeeds in conveying to his reader the impression that Edison is not the only electrician who does not understand Ohm's law, although he may be one of the few who can afford to say as much. Mr. Dowsing goes on to describe in their turns primary and secondary batteries, dynamos, and arrangements for distributing electricity; and it is in connection with the last-named division of the subject that one misses, with a sort of shock, the name of Ferranti. There is no mention of the Ten Thousand Volt System; and if we inquire what has become of the clever Engineer who invented it, Echo makes her customary and unsatisfying response. On the important subject of electro-motors, Mr. Dowsing is diplomatically guarded; and with respect to that of lighting, he is conventionally confident, not to say boastful. He is prudent withal; for, while prophesying the large future extension of electric lighting, he is careful to say little about its present cost. Electric heating takes a superfluous amount of Mr. Dowsing's attention; for, although three pages of the catalogue are occupied with his discussion of the subject, there are only two exhibits in the section, and these not of any great importance. Before dismissing the subject of Mr. Dowsing's really creditable catalogue, we may be permitted to refer to his statement on page 187, that, "on examination of the accounts rendered by the electric supply companies throughout the country, it is found that the average price paid for a lamp of 10-candle power is 12s. per annum, against 10s. for gas." We should like to have his authority for making this statement; but, in any case, it is as well to remind our readers that, even if the assertion is correct (which we do not admit), the gas pays a dividend of 6 or 7 per cent. on the invested capital, while the electric lighting pays nothing at all. When we return to this subject, it will be for the purpose of dealing with the contents of the exhibition in detail.

THE CHANGING CONDITIONS OF GAS SUPPLY.

EACH shortest day, as it comes round in the course of passing years, seems to give less prospect of the realization of a hope that was very general at the time the suppliers of gas first began to push the use of gas cooking-stoves. One of the advantages of securing an extended use of gas for cooking, it was claimed, would be a larger summer consumption, which would enable a greater output to be effected from any given plant; enabling the charge for interest on capital to be spread over a greater quantity of gas—thus affording a prospect of cheaper gas for the public, with a fair proportion of advantage for the proprietors of shares. The endeavours to secure a more extended use of gas cooking-stoves were attended with a fair measure of success, and were doubtless productive of some benefit to all concerned; but, after practical experience, the claim for a larger summer consumption quietly dropped out of sight. It is quite forgotten now. The usual experience is that the gas cooking-stove is at work all the year round, and that, so far from being shut off for the winter, it is, if anything, employed rather more during the cold weather, when a larger demand exists for warm food and drink than during the hot weather. No well-to-do household, for example, would care to sit down to a cold breakfast or lunch, of the kind that is in demand during the sultry days of August or September, during the foggy or frosty weather that we have experienced of late. So that, at best, the gas cooking-stove has only brought a regular all-the-year-round consumption. This, however, although not all that fancy painted it, is by no means to be despised.

With the gas cooking-stoves, gas-fires and warming apparatus have been introduced, and possibly to as large an extent. Some gas companies have not troubled to push their use at all, and do not supply them on hire; others, who are more enterprising, have put them on exactly the same footing as cooking-stoves. Several cheap and attractive patterns of gas-fires have been brought out; and this department has been largely advertised by frequent discussions on the subject of smoke abatement, and the advantage of smokeless fuel. Attention has also been directed to it, no doubt, by the increased price of coal and coke, as in most localities this advance has taken place without anything like a commensurate increase in the price of gas. If any rise at all has been made, it has been too trifling to attract general attention. The gas heating-stove is not likely to be employed during the summer to any extent worth noticing; and its use in the winter half of the year will depend upon atmospheric variations. A considerable fall in the thermometer will lead to a large and instantaneous increase in the consumption; while a low barometer will not be without its effect, as meaning damp and chilly weather.

With the use of gas cooking and heating stoves, there has also come in the adoption of gas-engines, together with the use of gas for special technical purposes. These applications for gas are, speaking generally, entirely independent both of the thermometer and of the barometer; and they are affected only by business considerations, which may necessitate a season either of extra time or of short time. Moreover, they are sufficiently numerous and diversified to give a fairly regular demand, regarded as a whole, throughout the year, with the exception of holiday seasons.

The changed conditions in the supply of gas that have been developed during late years, may be summarized as comprising the addition of a large regular all-the-year-round demand, and also of a comparatively important increased demand during cold or damp weather. The chief thing to be feared, under the former conditions, was fog. But now it seems that the results following a rapid fall of temperature may be even more decisive. It was always observed that cold weather increased the need for gas, as, in shops and various places, the practice of turning on the burners as a means of warming the air has prevailed. But of late years the effect of temperature has become much more important. A sudden spell of fog and cold, setting in simultaneously, will therefore try the resources of the suppliers of gas to a much greater extent now than formerly. And therefore a large reserve of generating, purifying, and storage plant is necessary. The sharp lesson received twelve months ago led to considerable activity, in the way of extensions, during the past summer. But there were some who neglected the considerations just laid down, and comforted themselves with the reflection that the winter of 1890-1 was a phenomenal one, which would be followed, according to all the laws of probability, by a milder season for 1891-2. Yet, as it has turned out, the reserve plant was quite as necessary this season as it was last. For a few days it was even more so.

The great defect of ordinary gas-generating apparatus is its inelasticity. It is, of course, always worked at its maximum productive capacity. Anything less would mean increased working expenses. If more retorts are needed, they cannot be brought into working order at less than 24 hours' notice. The engineer goes to the works (say) on Monday morning, and finds more retorts are required. But these cannot possibly be of service to him as helping to meet the Monday evening demand. Indeed, he will be fortunate if they can be brought in to do anything for even Tuesday evening. Unless there is ample storage, approximating towards the equivalent of 24 hours' consumption, by Tuesday evening the holders will run inconveniently low. The slightest reduction in supply or pressure is sure to be noticed; and, with every care, it may turn out that the distributing plant is not equal to the strain put upon it. So that the engineer cannot see his way clear towards Saturday night, and does not know where he may get to before then. It is scarcely necessary to add that all sorts of inconveniences generally make their appearance at or about the Monday in question. The supply of fresh coal fails; necessitating a falling back upon old stock, which means a dropping off in the rate of production. Some of the best hands in the retort-house are away ill; and the strappers who are put in their places do not like the work. And so a thousand-and-one worries could be enumerated, any of which might come in, just at the hour of extremity, to make matters worse.

The makers of water-gas apparatus have claimed that it is to a great extent free from this defect, which we have called "inelasticity." Whereas a bed of retorts can only be worked, with advantage, to something close to its maximum productive power, it is claimed that a considerable variation may prevail with the water-gas generator, without any practical effect on the cost per 1000 cubic feet of gas made. And instead of requiring 24 hours' notice, it is claimed that the generator may, starting all cold, be at its full producing power in about two hours. A more convenient opportunity of testing the value of such apparatus, in these respects, than that which occurred during the recent Christmas week could scarcely be afforded. It was stated during last summer that The Gaslight and Coke Company had erected water-gas apparatus on a fairly important scale. As compared with the coal-gas plant belonging to this large undertaking, it might possibly only represent a few units per cent of the total demand, and not be large enough to turn the scale, one way or the other, in the case of a sudden additional need for gas. Still it is to be hoped that, in due course, official information will be forthcoming as to whether or not the capabilities of the apparatus as a means of rapidly increasing the rate of production were tested, and to what extent the claims above noticed were realized in practice.

Meanwhile, the question of meeting any sudden variations in demand, at or about the season of maximum consumption, is one that may well receive the attention of gas engineers. It has already been observed that the evils of a short supply extend far beyond the mere loss of gas-rental. It is more than ever necessary that a full and ample supply of gas should be maintained, at all times and under all circumstances, and that this should be done without incurring any extraordinary expenses.

Dr. Tyndall, F.R.S., has resigned his position as one of the Metropolitan Gas Referees; and we understand that the appointment will probably be offered to Professor Rücker, F.R.S., of the Royal College of Science, South Kensington.

NOTES.

A New Industrial Agent.

In a recent issue of *Industries*, a short editorial article appeared drawing attention to what was described as a "new principle" in industrial chemistry—namely, the application of cold in manufacturing processes. The point of the article was strengthened by preliminary comments upon the modern development of the application of localized heat in manufacture, as in the electrical furnace, in which the heat is concentrated by special appliances upon the exact spot where it is wanted. It is asserted that the new idea of employing cold by special means, and for particular purposes in manufacture, constitutes a fresh departure which may lead to many profitable industrial developments. After references to the improvement of the sulphuric acid manufacture by the judicious application of cold at a certain stage, and to the purification of benzene by freezing it, the article proceeds to notice the stoppage of gas-mains by the deposition of naphthalene as one of the standing trials of the gas manager, the removal of which would be hailed with joy by both producer and consumer. It is mentioned that experiments have lately been conducted in Germany in which coal gas was strongly cooled before being allowed to pass into the mains, with the result that "water, benzol, and naphthalene were deposited, and subsequent stoppages thereby avoided." It is also remarked that, contrary to expectation, the illuminating power of the gas was only decreased by about 0.2 of a candle; and even this would be compensated for by the recovery of a larger quantity of bye-products. The general tenor of the suggestion is that the possibilities of the industrial applications of artificial cold, in gas manufacture as in other matters, are well worthy of attention, especially as it is a field in which there are at present only a few pioneers, "but which may be worked in the near future by the main band of explorers with a chance of success that, considering what has already been achieved, appears by no means despicable."

A Lesson in Ventilation.

In a paper on Ventilation and Warming appearing in the *Builder*, an illustration is given of the method of calculating the ventilation required for a public hall 80 feet by 35 feet, and 24 feet average height, seated for 400 persons, and lighted by burners consuming 300 cubic feet of gas per hour. Allowance is made for 3000 cubic feet of air per head hourly, with 1000 cubic feet additional for every cubic foot of gas burnt; making a total in this instance of 1,500,000 cubic feet of fresh air required hourly, or 416 cubic feet per second. This inflow of air requires to be accommodated with channels aggregating 208 feet of superficial area, if the rate of flow is to be kept down to the regulation 2 feet per second. The method of admitting the air is from behind a wooden dado 5 feet high, with suitable perforations at the top. For the removal of the foul air, openings are arranged in the ceiling, the space between which and the roof is converted into a foul-air chamber, divided into two compartments, each discharging into the open air by means of a suitable ventilator of the self-acting type, fitted with valves for the prevention of down-draught. The rate of discharge is 7 feet per second, involving the use of two 6-foot tubes. The fresh air is propelled into the chamber by means of a fan; and the pattern selected is a 48-inch Blackman propeller, driven by a 2-horse power gas-engine. Such a scheme of ventilation would doubtless be sufficient; but it may be questioned whether many examples of ventilation upon such a scale exist.

Magnesium Lighting.

The employment of magnesium as an illuminating agent has for some years been restricted to the production of "flashes" for theatrical and photographic purposes, for which the metal is more conveniently used in the form of powder than in the wire or ribbon prepared for popularly illustrating the brilliancy of its flame. Questions having arisen respecting the duration of the flash obtained by injecting powdered magnesium into a non-luminous flame, Dr. Eder has measured the luminous period by means of a blackened wheel turning with known velocity in the dark, and bearing two brightly-polished reflectors—one on the periphery, the other at the centre. When this arrangement is photographed by the help of the light of a magnesium flash, the result is an arc, long or short in proportion to the duration of the flash. With one-fourth to one-half of a gramme of the metal, the flash lasts from one-quarter to one-third of a second. The explosive mixture formed with 30 parts of perchlorate of potash, 30 parts of chlorate of potash, and 40 parts of magnesium, used in quantities of $\frac{1}{2}$ gramme, gives much shorter flashes, the duration of which may be as brief as 1-80th of a second. The illuminating power of these flashes has not been determined; and nothing has been heard for some time of the magnesium lamp, which it was suggested might be made useful, for signalling and similar purposes, by dropping a stream of magnesium dust into a spirit flame.

A Free-Flame Furnace.

It is claimed that a step in advance in adapting fuel gas to industrial uses is made by the Pettibone-Loomis open-hearth furnace, which has been designed to burn the gas produced by the Loomis down-draught generator. In this furnace, which is suggested as a type of arrangements of the kind required for a variety of metallurgical or industrial purposes, the air and gas

are introduced together through conical ports in the side walls, which enlarge inwards, and being disposed at a tangent to the internal line of the walls, the resultant flame has a swirling movement, which ensures full development of the flame itself, and ample opportunity for radiation. This idea of delivering a heating flame tangentially is noteworthy, as constituting evidence of the practical value of Frederick Siemens's theory that live flame should never touch a solid surface, but should heat it by radiation in the first place; the only contact being with the spent products of combustion. The value of this principle has been proved in connection with open-hearth steel furnaces, and also in gas-retort furnaces; but it is by no means generally understood or applied in regard to industrial furnaces and the large class of ovens.

Institution of Civil Engineers.—At the ordinary meeting of this Institution last Tuesday, the following were elected associate members: Mr. Isaac Carr, Gas-Works, Widnes; Mr. T. Goulden, Gas-Works, Beckton; and Mr. A. Holden, Water Engineers' Office, Bolton. On the same occasion, Mr. Boverton Redwood, F.R.S.E., was elected an associate.

The Dessau Central Electric Lighting Station.—Referring to the translation of Herr von Oechelhäuser's report on the Dessau central electric lighting station of the German Continental Gas Company, given in the last two issues of the JOURNAL, we learn that the 120-horse power "Otto" gas-engine mentioned therein is now at work in direct combination with a Fritsche dynamo; and it has been running since the 25th of October exceedingly well, giving a perfectly steady light. The large engine makes less noise than the two 60-horse power motors did before; and it runs quite cool at 150 revolutions per minute with full load.

The Mixture of Gases of Different Densities.—Dealing recently in the *American Gaslight Journal*, with the subject of the stratification of gases, Professor E. G. Love remarked that the greater the difference between the densities of two gases, the more rapid would be their diffusion. This is contrary to what might naturally be supposed. The same property of gases which causes them to mix readily will prevent them separating again "unless chemical action or some other extraneous cause intervenes." The practice of adding water gas to coal gas commercially has met with some objection on the ground that the greater density of the former would cause it to settle out, and form a lower layer in the holder; or that the mixture having been once effected, it would not continue so. Professor Love says there is not the slightest possibility of this, as the gases will mix readily and remain mixed. He has had frequent occasion to make mixtures of coal and water gases on a small scale; and has found that with coal gas of a density of .480 and water gas of a density of more than .700, when the heavier gas was introduced last into the holder, a space of about two hours was sufficient to effect the perfect admixture.

Boiling with Coal Gas and Water Gas.—Some interesting comparative experiments on boiling with coal gas and water gas have been made by Herr Cogliervina, of Vienna, with various types of apparatus used for cooking purposes in Austria; and his results are epitomized in the *Journal of the Society of Chemical Industry* from the *Journal für Gasbeleuchtung*, in which they were fully reported. The types of apparatus selected were: (1) A vertical boiler in common use, made on a French model, and furnished with two rows of flames; (2) the well-known boiler made by the German Continental Gas Company of Dessau; and (3) an Austrian boiling apparatus with triangular slit opening. The results stated below are for the best of each type. The temperature of the room throughout the experiments was 14° C. (57.2° Fahr.), the gas pressure was equal to 2 centimetres of water, and the amount of water used in each experiment was 1 litre. It was found that the quantity of heat (in calories) generated in each case per minute with coal gas was: French boiler, 16.9; Dessau boiler, 18.8; Austrian boiler, 14.28—mean, 16.66 calories. The quantity generated per cubic metre of coal gas used was: French boiler, 2186; Dessau boiler, 2384.6; Austrian boiler, 2093—mean, 2221.2 calories. Taking the theoretical heating effect of 1 cubic metre of coal gas as 5150 calories, these results show that the best types of apparatus have an efficiency of $(2221.2 \times 100) \div 5150 = 43.13$ per cent. Experiments were next undertaken with the object of investigating the efficiency of the same types of boiling apparatus when used with water gas instead of coal gas. It was found necessary to close the air openings, and to increase the gas pressure up to 6 centimetres of water. Under these circumstances, the results given below were obtained: The quantity of heat (in calories) generated per minute was: French boiler, 12.13; Dessau boiler, 13.14; Austrian boiler, 10—mean, 11.76 calories. The quantity generated per cubic metre of gas was: French boiler, 942; Dessau boiler, 1081.4; Austrian boiler, 1036.4—mean, 1019.9 calories. Taking the theoretical heating effects of 1 cubic metre of water gas as 2813 calories, these results show that the best types of apparatus have an efficiency of $(1019.9 \times 100) \div 2813 = 36.25$ per cent. The author is of opinion that the commonest fault in all types of boiling apparatus (whether for coal gas or water gas) lies in the fact that the flame only plays on parts of the bottom of the boiler. Improvements can best be effected by securing an even spreading-out of the flame,

COMMUNICATED ARTICLE.

LIGHTING.

By W. H. Y. Webber.

PART III.—A CRITICAL EXAMINATION OF MODERN PRACTICE. (Continued from p. 66.)

From what has been already remarked, it follows that if it is impossible, for reasons of economy, to provide much light for a roadway, the smaller the luminous intensity, in reason, of the light-sources employed for the purpose, the more equable the effect. Conversely, the more powerful the sources, the higher must be the scale of lighting over the whole roadway. So that, in a sense, it is true that the more powerful the lights, the more of them we need. Again, if it exceeds a certain range of intensity, a lamp for street lighting must be screened from direct view, or it is worse than useless for its intended purpose. Having in mind, therefore, the accommodating power of the human eye for different degrees of illumination, it may be concluded that artificial lights for streets or roadways may well be of very moderate intensity; and that, this point once defined, multiplication of sources rather than intensification of powers is the simplest way of improvement.

If we take the case of an ordinary suburban road, and consider the problem of lighting it, from the starting-point, the first thing to be settled is the minimum luminous power to be allowed for the individual lamps. If it were only a case of what has been called in these articles "beacon" lighting, the smallest flame that can be relied upon to keep alight would serve the purpose, as is actually the case with some railway signal-lights. A street lamp is, however, required to do more than merely render itself visible. Wayfarers do not require to read newspapers in any part of the roadway; but they often need sufficient light for deciphering a written address on a letter or card, for writing a memorandum, for consulting a watch, &c. These wants are really the most exacting that occur to foot passengers in the ordinary way. Those of drivers of vehicles are similar; and their observations are naturally taken at a height of several feet above the ground level, which favours the light.

Now, observation shows that the requirements just enumerated are satisfied by street lamps exhibiting, at a mean height of 10 feet above the road surface, a gas-flame of not less than 12-candle power effective. This means for all qualities of coal gas up to and including gas of 16-candle power, a 5 cubic feet flat-flame burner in a well-cleaned, neatly-framed lamp. If with thin opal top glasses, so much the better; but the top of the lantern must in no case be opaque. For richer gas, the rate of consumption may, of course, be smaller; but the average luminous effect of the lamp should not be lower than 12 candles, after allowance is made for the glass. Such a lamp gives a good, cheerful effect over a radius of at least 50 feet, which may be taken as the area of what appears to the dilated human eye as bright lighting. At this distance, an address on a letter may be read with ease, which means that a passenger need not cross the road for the purpose when he happens to be opposite a lamp. Such lamps throw a distinct shadow on flags or asphalt at a distance of 100 feet; and if spaced not more than twice this distance, they afford all the light really necessary for purposes of vehicular or foot traffic in suburban roads.

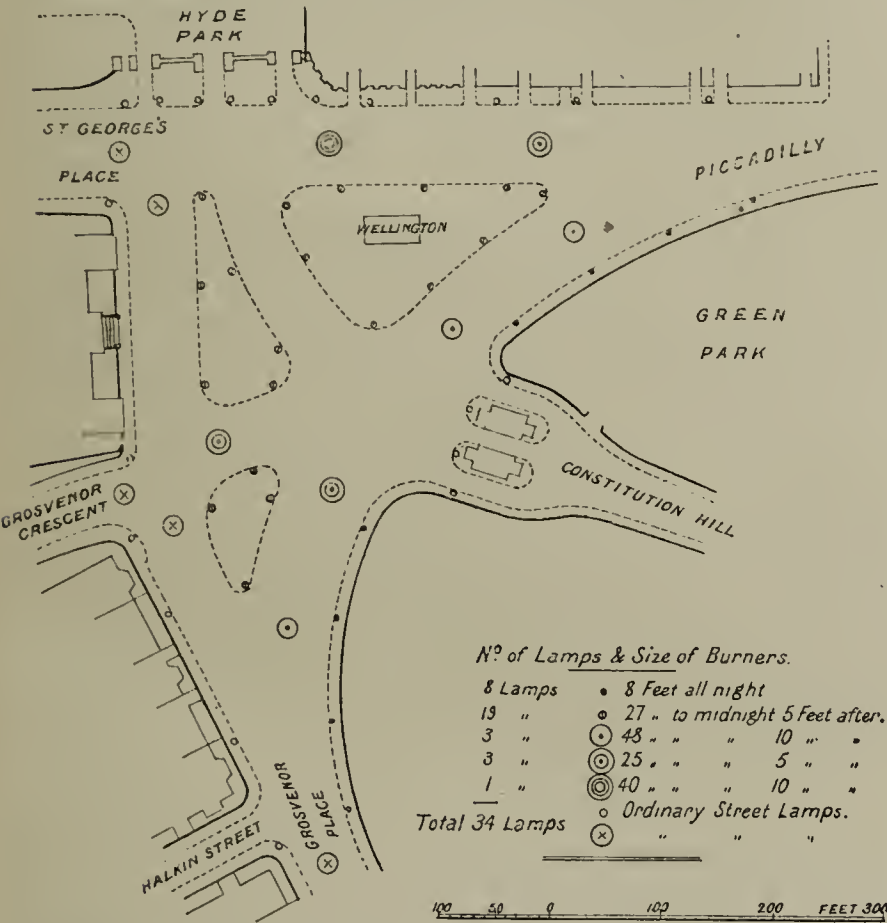
In busier thoroughfares, and especially in streets where there are well-lighted shops, the street lamps must be thicker. For it is an almost paradoxical fact that shop light, although it appears to make the pavements brilliant, affords little or no assistance to the street traffic, as shopkeepers who desire to make their windows attractive recognize, by adding extra lamps on the kerb-line. The reason for this is the same that has already been given with reference to intensification of street lamps—it is the presence of higher *maxima* necessitating the elevation of the *minima*. Spots of roadway that would not appear too dark when a single gas-lamp supplies the brightest point in the field of vision, look impenetrably obscure by contrast with the glare from a brilliantly lighted window. Good street lighting, for central thoroughfares not specially devoted to shops doing an evening trade, would be afforded by 5-foot lamps at (say) 90 feet apart. When more light than this is required, it is preferable to employ 10-foot burners, beyond which it is not necessary to carry the process of intensification for ordinary thoroughfares, with the exception of street refuge lights. But even these may do more harm than good if too brilliant. Powerful lights demand high columns to bear them.

The ordinary 12-candle power street lamp, 10 feet high to the flame, gives on the ground immediately under the lantern an intensity equal to $12 : 1 :: 10^2 : x^2 = 1$ candle at (say) 2 ft. 9 $\frac{3}{4}$ in. distance. According to the formula already stated, a 24-candle, or a 10 cubic feet flame will give the same intensity of light upon the ground immediately beneath it from a height of 13 ft. 10 in., and so on. Since it is desired to increase the intensity of light on the ground, however, lamp-posts are not required to be further heightened in this proportion. It is to be observed, moreover, that street lighting from elevated lamps is, in reality, brighter than is shown by calculations according to the formula given, which show the value on the ground level, because the solid objects, moving and stationary, perceived by the light, stand up more or less from this level, and therefore tend to neutralize the effect of the Law of the Cosinus. This formula consequently gives only the minimum effect.

This part of the subject may fittingly conclude with one or two descriptions of good examples of street lighting by gas in the best modern style.

A MODERN EXAMPLE OF STREET LIGHTING IN LONDON.
The Gaslight and Coke Company have been honourably distinguished for their efforts to raise the standard of gas lighting in the streets of London; and they have from time to time organized displays of so-called "experimental" street lighting in different important thoroughfares of the City and West End. There is reason for thinking that these displays, which were in all cases carried out at the Company's own expense, or in concert with the firm of Messrs. W. Sugg and Co., Limited, were effectual in "putting a damper" on the rage for electric lighting upon the extravagant scale on which it was introduced in Paris. Although the "experimental" lighting arrangements were not finally adopted by the highway authorities, quite enough was done in this way to show the baselessness of the contention which the electric light speculators were anxious to establish—that, if better street lighting was wanted, there was no alternative to the arc lamp. This assertion of the electric lighting interest was so effectually met by the high-power gas-lamps, that to this day electricians never allude to this kind of gas lighting if they can avoid doing so, but always affect to compare arc lamps with 5-foot gas-burners.

The exhibition of these specimens of improved street lighting proved, among other things, that the amount of light which could be obtained for any thoroughfare was purely a question of expense; and so the electricians' attempt to assert a monopoly of brilliant lighting was defeated. At the present time, the pattern display of open-air lighting for London is that of Hyde Park Corner, the quality of which will be understood from the accompanying plan, courteously supplied for the purpose of this series of articles by Mr. G. F. L. Foulger, Distributing Engineer of The Gaslight and Coke Company.



This is luxurious lighting; but the site is one where, of all places in London, street illumination, upon a scale that would elsewhere be regarded as superfluously liberal, is a plain necessity. The rated consumption and the cost of gas are given in the following tabular statement:—

Total Estimated Consumption in Lighting the following Lamps with Cannel Gas (20 candles nominal).

Number of Lamps.	BEFORE MIDNIGHT.		AFTER MIDNIGHT.		Total Consumption.
	Size of Burner.	Consumption per Annum (2160 Hours' Burning).	Size of Burner.	Consumption per Annum (1676 Hours' Burning).	
Refuges . 3	48 ft.	Cubic Feet. 311,040	10 ft.	Cubic Feet. 50,280	Cubic Feet. 361,320
" . 1	40	86,400	10	16,760	103,160
" . 3	25	162,000	5	25,140	187,140
Footways 19	27	1,108,080	5	159,220	1,267,300
" " 8	8	138,240	8	107,264	245,504
Total. . 34	..	1,805,760	..	358,664	2,164,424
Cost at 2s. 8d. per 1000 feet.	..	£240 15s. 4d.	..	£47 16s. 5d.	£288 11s. 9d.

Average consumption of gas per hour: Before midnight, 836 cubic feet; after midnight, 214 cubic feet.

The irregular shape of the area lighted, and the complexity of the traffic that has to be provided for, enhance the brilliancy of the effect, which must be seen to be appreciated. It should be remarked that the lanterns employed here are of special design.
(To be continued.)

TECHNICAL RECORD.

NAPHTHALENE IN ILLUMINATING GAS.

A Paper read by Herr E. Kunath before the German Association of Gas and Water Engineers.
[Translated from the *Journal für Gasbeleuchtung*.]

Naphthalene, a whitish substance, was first obtained from coal tar by Mr. Garden, in 1820. It was found to contain carbon and hydrogen in the proportion of 10 : 8; and the chemical symbol is therefore C₁₀ H₈. It crystallizes in rhombic leaves, which are soluble in alcohol, ether, hot water, &c., but insoluble in cold water. The melting-point is 79° C; the boiling-point, 216° C; and the specific gravity, 1.15.

Having explained what naphthalene is, the next question of importance will be: Where is it formed? Some chemists are of opinion that the naphthalene which occurs in illuminating gas is formed in the retorts; others, however, do not consider that it occurs ready made in the gas, but maintain that it appears occasionally and locally in such places as are favourable for its production. As most gas managers will be aware, it is to be found in the ascension and dip pipes; so that there can be no doubt that the place where it is formed must be the retort.

As to the relations existing between the formation of naphthalene vapours and the heat of the retorts, chemists agree that, by raising the temperature, the quantity of naphthalene is increased. In practice, this supposition is found to be correct, as after the introduction of generator firing for retorts, the naphthalene trouble seems to have become greater than before. For my part, I have not experienced this increase of naphthalene in the gas-pipes; and this fact leads me to conclude that it is to be ascribed to the larger production of gas, at least in those cases where, with an increased make the condensing and scrubbing appliances have not been correspondingly enlarged. When, on the other hand, M. Lucien Brémont, in his valuable paper on "Naphthalene in the Manufacture of Illuminating Gas,"* says that it is not formed in the retort before a high temperature is reached, I cannot agree with him; for in 1857, when I was making some experiments on illuminating gas in Dresden, under the superintendence of Herr Blochmann, the naphthalene trouble was experienced at a time when we had not reached a very elevated temperature.

Before any better hypothesis as to the formation of naphthalene is suggested, we may suppose that the combination of carbon and hydrogen to naphthalene takes place in the retort, and that the naphthalene when formed is in a vaporous state. After leaving the retort, these vapours are condensed and crystallize. As you will be aware, all substances are subject to alteration of their condition by the withdrawal or the addition of heat. Ice, water, and steam, for example, are the different aggregates of one and the same molecular compound of oxygen and hydrogen (water); and it is only by altering the temperature that we change the aggregate. In the retort we have naphthalene vapour, and in the pipes and appliances crystals of the same substance; and we may suppose that there is also fluid naphthalene, since we know the condensing point of this substance to be about 79° C., or close to that of the tar vapours especially benzene (80° C.). Benzene, however, is a very good solvent for tar, as well as for naphthalene. Taking into consideration the fact that the specific gravities of naphthalene and coal tar are almost the same, we find an explanation of the occurrence of the former in the latter, which always contains larger or smaller quantities of it. The separation of fluid naphthalene, dissolved in benzene will therefore, in consequence of deprivation of heat about the mains and the dip-pipes take place to a greater extent the more uniform this deprivation of heat is found to be—in other words, the longer the gas remains in contact with the tar, by the great specific heat of which a rapid cooling is prevented. This has been termed, "hot condensation." It is natural that, from the vapours of the crude gas, there should first separate that part of the naphthalene and benzene the density, tension, and temperature of which are in a certain relation to each other; and from this it may be inferred that the vapours, supposing the decrease in temperature to be gradual, are always kept at the limit of their condensing points.

Now, in accordance with a law of physics, there is such a close relation between the density, tension, and temperature of all vapours, that any alteration of one of these factors must necessarily influence the others. In the manufacture as well as in the consumption of illuminating gas, we regulate the tension required in the apparatus and mains by the prevailing pressure; and, on the other hand, we influence the temperature by artificial or natural cooling, and thereby compel the density either to adapt itself to the given conditions, or to yield to an over-saturated state. In this anomalous condition, it requires but a trifling cause to change the aggregate; and as, in our special case, this alteration means deprivation of heat, the naphthalene vapours are consequently condensed to a fluid or a solid body. Such an impulse can be caused by rapid cooling; and while the benzene vapours are condensing and form fluid benzene naphthalene vapours, from their tendency to crystallize, pass directly into the solid aggregate, before uniting to form a fluid.

* See JOURNAL, Vol. XXX., p. 491.

To show this, we take a solution of common salt, saturated when hot, and allow it to cool down gradually and without motion. When cold, the solution will be in a state of anomalous tension, and the least motion—for instance, a grain of sand dropped into it—will suffice to cause a local cooling, and crystallization will take place instantaneously. The same phenomenon will be observed with water cooled down below its freezing-point while it is in a state of absolute rest.

If we consider that naphthalene vapours are readily absorbed by benzene vapours, or, in other words, are dissolved in them, we cannot but suppose that the formation of crystallized naphthalene will also take place, in consequence of the condensation of benzene vapours. This is the more feasible seeing that the separation of solid naphthalene is always initiated by local causes, as practice has shown. These in all cases prove to be deprivation of heat, either direct, such as cooling, or indirect, such as friction, changes of speed, or decrease in the diameter of pipes, &c. Moreover, under ordinary circumstances, the illuminating gas will always be saturated with naphthalene and benzene vapours and steam. The latter, however, is an excellent conductor of heat; and as it possesses the highest condensing-point, when the temperature is decreasing, it will condense first and deprive benzene and naphthalene vapours of their heat—thus causing indirectly the deposition of crystallized naphthalene.

M. Lucien Brémont endeavoured to find out the part that steam plays in the formation of solid naphthalene, by making experiments with dried illuminating gas; and he came to the conclusion that no naphthalene is deposited from dry gas. We made some similar experiments in our laboratory with undried and dried illuminating gas, and found that, from the former as well as from the latter, naphthalene can be deposited to such an extent that the pipe used was blocked. To try, by experiments on a larger scale, the effect of the removal of moisture from the gas on the deposition of solid naphthalene, the gas we were using in our works in Dantzig was dried by aid of two small boxes, of the shape of purifier-boxes, filled with chloride of calcium. The gas-pipes on our works fulfilled all the conditions suitable for the deposition of solid naphthalene. During the whole of the winter of 1889-90, the gas required for the lighting of the works (upwards of 100 cubic metres daily) was thus desiccated. The results confirmed our laboratory experiments, for the pipes remained free from such naphthalene deposits, which are the result of the presence of water, while each lowering of the temperature caused the deposition of this substance.

Some experiments made by Dr. Tieftrunk and Mr. Friedleben, the results of which showed that the deposition of naphthalene from gas bears a certain ratio to the presence of ammonia, entitle us to suppose that the removal of the latter from the gas means also the removal of naphthalene. In order to check this statement, ammonia was stored in a small gasholder, and the dried gas burnt on the works was mixed with certain quantities of it. As, notwithstanding the favourable winter cold, no deposits of naphthalene were to be effected with small quantities of ammonia, the amounts were gradually increased so as to get as much as 190 grains in 100 cubic feet of gas—*i.e.*, about a hundred times as much as is present in ordinary gas. There were no traces of naphthalene found in the pipes. Although I cannot agree in attributing influence to ammonia itself in separating naphthalene from gas, I partially admit the correctness of this observation, inasmuch as the separation of ammonia includes the removal of water.

Having completed these experiments with dried gas, I proposed, instead of taking the moisture, benzene, and naphthalene from the gas by means of a drying apparatus, simply to cool the gas. This was to be easily effected; the winter of 1890-91 being exceedingly cold. We passed the gas through a box constructed of tin plates, the surface exposed to the air being about 3 square metres. Two pipes, each 40 mm. in diameter, connected the box with the main. In the box there were two small glass windows, to admit daylight; and in the inlet and outlet of the box, two thermometers were inserted. The ratio of cooling surface and maximum of gas passed through the apparatus were favourable to the cooling of the gas down to 2° to 3° C. below the outside temperature. The apparatus was working the whole of the winter, and with the same results as the drying apparatus. The moisture was removed apart from the artificial drying; and therefore no pipes were obstructed or frozen. The box contained all the moisture and the condensed substances, which when warmed yielded an emulsion. On being allowed to stand for some time at about 15° C., a light yellow oil collected on the surface of the liquor. The quantity depended on the degree of cooling to which the gas was subjected. From one cubic metre of gas cooled down from 6° C. to -7° C., 1·71 cubic centimetres of water and 0·02 cubic centimetres of oil were obtained; and when the gas was cooled down to -11·5° C. or to -16° C., the condensed water amounted to 3·835, and the oil to 3 centimetres. The nearer the temperature approached the freezing-point of water, the less oil was condensed; but crystals of naphthalene were observed instead. Of course, the separation of oil, which, on the whole, consists of benzene and small quantities of naphthalene, reduces, however slightly, the illuminating power of the gas in question. We found this difference to be 0·2 candle—*i.e.*, the gas without the oil condensed showed as 17·6 candles, while the ordinary gas showed 17·8 candles. In these tests the differences in tempe-

rature were not taken into consideration. It does not matter whether moisture is removed by artificial drying or by natural cooling, the result with regard to the separation of naphthalene from the gas will be the same in both cases. If, however, cooling of the gas should be chosen for removing naphthalene, this can only be done by powerful condensation.

Our results therefore confirm those arrived at by Herr Pitschke who obtained naphthalene from dried gas, and are opposed to Brémont's assertion as to the part played by moisture. Moreover, supposing the naphthalene to be found ready made in gas, our results admit the further conclusions that, under similar conditions, it should not separate from dried and re-moistened gas when the former had once been freed from it, and that it should be deposited from the latter when the dried gas had not been cleared of it properly the first time. Experiments have confirmed the fact that from dried and re-moistened, as well as from dry gas, naphthalene may be obtained; and in the latter case the second tube in which the experiment was made only showed condensed water when the separation of naphthalene in the first tube had been completely effected.

I will now describe the apparatus, beginning from the inlet for the gas. It consists of a drying vessel, filled with chloride of calcium, a refrigerator, a water-pot, a tube, a second water-pot, a moistening arrangement, a second refrigerator, a third water-pot, a second tube, a fourth water-pot, a gas-meter, and a long pipe with a burner attached to it. Before the refrigerators, which have to maintain the gas at a certain temperature, there are thermometers inserted in the water-pots. The two tubes mentioned above were gas-pipes 10 mm. in diameter and 30 centimetres long; and they were placed in one box filled with ice, so as to keep them at the same temperature. The refrigerators were flat tin boxes, and could be dipped in water. The whole apparatus consisted of two parts, one of which was in connection with a drying, the other with a moistening appliance. The corresponding pieces of both parts had similar dimensions, so as to cause the gas to pass through them at the same speed. The first part had attached to it the drying apparatus; the second, the moistening apparatus. As already mentioned, these experiments confirmed our supposition, and proved that naphthalene occurs ready made in illuminating gas, and that it is the benzene in a vaporous state that causes naphthalene to separate in a solid form.

In order to work the apparatus, the following precautions are necessary: The gas used must be freed from moisture by slowly cooling it, to bring it to a density which is in proper ratio to the temperature and pressure of the gas. The first tube is to be placed sloping from behind, so as to cause the water separating out to flow back into the first water-pot. If this is neglected, no naphthalene will be obtained. I allude here to the fact that if naphthalene is found in gas-pipes, it is, as a rule, in ascending inclines; and where it occurs in descending inclines, the crystals have been drifted there by the current of gas. As to the decrease in temperature that effects the separation of naphthalene in a solid form, we have shown, by our experiments, that a difference of a few centigrades—nay, under especially favourable conditions, half a centigrade—will suffice to cause a deposit of crystals, supposing the deprivation of heat takes place abruptly. The occurrence of naphthalene in gas-pipes confirms this result so far, as some cases of obstructed pipes prove to have originated by such very slight lowering of temperature.

I will refer to a case which happened in my practice, and which may be interesting enough to be quoted. In a certain place where there was an ascending gas-pipe of 150 mm. in diameter, which was covered by earth to the extent of about 1·5 metres, an accumulation of naphthalene crystals was found one day without any assignable cause whatever, as all the other parts of the pipe were perfectly clean. On investigation, we found that only a few centimetres below a water-main was crossing the pipe; thus imparting a local refrigeration to it. In summer, the temperature of the gas was about 16° C.; that of the water, 10° C.—the difference in temperature being 6° C. In winter, the corresponding temperatures go down to 10° C. and 6° C.; and therefore the difference is 4° C. Such slight differences between the temperatures within and outside the pipes cool the current of gas but slightly, and yet they do so sufficiently to separate naphthalene from it. Therefore, for the separation of this substance from illuminating gas, no temperature below the freezing-point of water is required. The only thing necessary is a rapid decrease in temperature of a few centigrades; and thus it is easily to be understood that nuisances from naphthalene may happen at other seasons besides winter.

A question of considerable interest and importance to a gas manager now arises: Are there any means to prevent the formation of naphthalene? Before entering upon this subject, I will repeat that naphthalene is formed in the retorts as a vapour. By condensation, a portion of it is dissolved by benzene and runs off with the tar. The remainder is kept dissolved by the benzene vapours of the gas, and is not condensed before, owing to rapid refrigeration, those vapours drop (if the term may be used) the naphthalene. By removing the benzene vapours from the gas, we remove the naphthalene as well; and this can be done by condensation. To obviate the formation of naphthalene in the retort has not yet been practicable; and so we shall have to deal with it in the gas. Were it possible to get rid of it and the benzene vapours in the dip-pipes, the question

of naphthalene would be settled. This, however, is impossible by the means at our disposal, as the temperature of the surrounding air would not be low enough, not even in winter, to effect condensation; and any artificial cooling agent (ice, &c.) would be too expensive, if not altogether impracticable. Therefore, from the dip-pipe to the purifiers, we cannot use any artificial refrigeration save that by air or cold water. All we can do is to get rid of as much water, benzene, and naphthalene as we possibly can on the way. On the other hand, we ought to avoid any rapid changes of temperature in these mains which will cause the last-named substance to settle down.

The safest way of effecting this is to have a large condenser where the current of gas is cooled constantly, but not rapidly; thus eliminating moisture, benzene, and naphthalene. By taking the two latter from the gas, we cannot help lowering its candle power; but this we shall have to put up with in favour of the tar, which is enriched accordingly. If we wish to do better, we shall have to place a more powerful condenser behind the purifiers. This second condenser would not only dry the gas, but cool it down to a very low temperature; and on entering the main, the gas would be warmed, and take up moisture eagerly. This re-saturation would mostly occur in the station meter, which is situated between the purifiers and the mains; and consequently all the work would have to be done in vain. The water in the meters might be covered with some oil—petroleum, for example—to prevent the evaporation of the water; but this would probably destroy the joints of the meter, by dissolving the cement. Unless we find a substance that will replace the liquid in the meters without destroying them, we shall have to use a second condenser between the station meter and the main.

As I have already stated, the dry gas eagerly absorbs any moisture; and for this reason the pipes should be kept as dry as possible, and the water-pots be emptied very frequently, or, as this might be too troublesome, the water covered with petroleum. A careful person can pump out the water from a water-pot without removing the oil. To do this, the pump is dipped into the pot, the oil on top inside the pump blown out, and the water pumped. Farther on, the water in the wet meters would have to be covered with petroleum. Instead of water, the gas would then absorb petroleum vapours, which would cause an increase in its illuminating power, and also redissolve the naphthalene already deposited in the pipes. By a second condensation, we therefore avoid the trouble arising from the pipes being frozen and obstructed. If required, we may employ cooling by ice for a second condensation; but this is not absolutely necessary, as in winter the temperature of the air will suffice. In summer, naphthalene troubles are much less annoying than when the cold weather is coming on. In prolonged condensation, there is another point to be considered—viz., decrease in the volume of the gas; and thus the customers would be supplied with a greater quantity of light for the same money. This, however, would be compensated for by the saving arising from a less frequent use of tools for thawing and mending pipes, and from an increased consumption of gas, as no pipes would be blocked.

Before I conclude this paper, I will give a few hints for the prevention of choked pipes. The gas pipes and conduits should be kept as dry as possible, and the water-pots, &c., covered with petroleum. The time to begin is the summer, as then a good deal of the oil will evaporate and clean the pipes. To pump the water from the water-pots, a vacuum-pump should be used, and the water carefully drawn out. Gas-meters that serve pipes which run from hot rooms into the open air should be filled with petroleum. Pipes obstructed with naphthalene—not frozen ones—are to be cleaned with warm petroleum. To do this, a box should be used which is filled with warm petroleum, and connected by one tube with the choked pipe, while air is forced into the box by means of an air-pump. To the apparatus there is attached a pressure-gauge; and in order to warm the oil, the apparatus is placed in a tub filled with hot water. Such places in the line of conduits as are exposed to great changes of temperature should be covered by suitable substances.

In the course of some remarks upon the paper, Herr Hasse, of Dresden, said that pipes obstructed by naphthalene would appear at first when the days were beginning to shorten; and this time would coincide with an increased production of gas. During this period, the days would be still rather warm; while the nights would become gradually colder. The warm gas from the holder was kept warm in the earth; but when, in passing the conduits, it was exposed to the cold air in the evenings, it would be rapidly cooled down, and the pipes choked with naphthalene. So far, he was quite of the opinion expressed by Herr Kunath; but he also fully acknowledged the part Dr. Tiefrunk attributed to the vapours of tar and ammonia with regard to the absorption of naphthalene. The latter had proved that gradual refrigeration never caused separation of naphthalene from the gas; while rapid cooling, if by some few degrees only, sufficed to cause a deposition of naphthalene. This process was promoted by friction; for instance, when gas had to pass narrow pipes at great speed. Experience had fully proved this assertion. How far an increase in the temperature of the retorts, especially since the introduction of generator firing, might influence the formation of naphthalene, he would not venture to

say; but, speaking generally, he was of Herr Kunath's opinion, that the temperature of the retorts could have but a slight effect upon it. The naphthalene nuisance had given rise to complaints from 25 to 30 years ago, when the production of gas per retort and per 24 hours was about 6000 cubic feet, and when this was considered an excellent output. When he (Herr Hasse) went to Dresden, it was about 3000 cubic feet per retort per 24 hours; and the formation of naphthalene, and the subsequent trouble, was worse than ever. Now the make per retort per day was as much as 9000 cubic feet; and complaints of obstructed pipes were not more frequent. In his opinion, the vapours of ammonia and tar absorbed naphthalene; and he thought Herr Kunath had not proved the contrary. When ammonia was artificially added to the gas, no naphthalene could be taken up, as what was present had been already combined with ammonia and tar. When, on the other hand, the gas, before entering the purifiers, was washed with dilute acid, to remove ammonia, heavy deposits of naphthalene might be observed in the station meters, the holders, or the gas-pipes. The only way of avoiding these deposits was to have efficient condensation; and, as Herr Kunath had observed, the gas should be cooled as slowly as possible. They had experienced this in the three gas-works in Dresden. Whenever the production had to be increased, and the condensers were not able to act thoroughly, there were obstructed pipes. In the new works, established ten years ago, no naphthalene crystals had ever been seen, whether in the purifiers, the meters, the mains, or the services. Not even during the severe winter of 1889-90, when quite two-thirds of the whole of the town had more or less to complain of the naphthalene trouble, the remaining part, which was supplied from the new works, never had any cause to do so at all. The first reason was that the new works were provided with some excellent condensers, which worked slowly and thoroughly; and the second was that this part of the town had large mains, so as to avoid friction of the gas as much as possible. That this was not unimportant was shown by the fact that when, in places where chokes occurred regularly once a week or so, the pipes were changed for larger ones, obstructions occurred much less frequently. As to the addition of benzene or petroleum to the purified gas, he (Herr Hasse) was of opinion that this would be of very little use, as the vapours would occasionally condense again. Benzene could not by these means become a permanent constituent of illuminating gas which would prevent the separation of naphthalene by refrigeration. In the winter of 1890-91, the naphthalene trouble in most places was as bad as it could be, while in Dresden comparatively little was heard of it. This had to be attributed to the fact that one of the three gas-works in the town had been enlarged, and the number of condensers nearly doubled, while the production of gas had not been correspondingly increased. The old works had subsequently been relieved; and thus the condensation of the three works had been improved. As soon as the supply came up to the former conditions, the naphthalene trouble would probably reappear, unless the condensers were enlarged. He had been asked how it was explained that the nuisance should have appeared so grievously with the introduction of generator firing for retorts. All he could reply was that gas-works in which generator firing was introduced were saved the trouble of increasing the number of retorts with the extended demand for gas. Therefore, while the production of gas became larger by working the retorts at a higher temperature, the number of condensers remained the same, in consequence of which condensation could not be anything like so complete. In practice, he found that, whenever the condensers were proportionately enlarged, the difficulty with naphthalene abated.

The Standards of Light Committee.—The first meeting of this Committee was held last Friday at Whitehall Place, and adjourned for a fortnight after the transaction of some preliminary business, including the selection of a Chairman. The constitution of the Committee (most of the members of which were present at the meeting) is as follows: Dr. W. Odling (Chairman) and Dr. W. J. Russell, of St. Bartholomew's Hospital, as representing the Board of Trade; the three London Gas Referees—Dr. W. Pole, Mr. A. G. Vernon Harcourt, and Professor Tyn-dall's successor when appointed; Mr. George Livesey, Mr. G. C. Trewby, and Mr. H. E. Jones, for the Gas Companies; and Mr. W. J. Dibdin and Dr. E. Frankland, nominated by the London County Council.

Determining Sulphur in Coal.—A method of determining the quantity of sulphur in coal has been proposed by M. Eschka. It consists in heating 1 gramme of coal with 15 grammes of a mixture of two parts by weight of magnesia and one part of dry sodium carbonate in a 30 c.c. platinum crucible, placed in a sloping position, so that only the lower part is red hot. The mixture is stirred two or three times in the course of an hour, at the end of which time the coal is fully burned off. Solution in hydrochloric acid, oxidation with bromine, and precipitation with barium chloride, complete the operation. It is found, the *Analyst* says, that no loss of sulphur occurs, and that, where several determinations have to be made, porcelain crucibles heated in a muffle for 20 to 30 minutes can be advantageously substituted for the platinum crucible and the Bunsen burner.

FUEL GAS: ITS PRODUCTION AND DISTRIBUTION.

A Paper read by Mr. Arthur Kitson before the Franklin Institute.

Fuel gas is not quite so recent a discovery as many people suppose. Half a century ago, M. Ebelmen described, in a paper read before the French Academy of Sciences, a method for utilizing charcoal *débris*, coal slack, and other carbonaceous refuse, by converting them into the form of gaseous fuel, which was conveyed to suitable furnaces, and there consumed. This process was operated with considerable success at the iron forges of Audincourt. Ebelmen's method formed the basis of nearly all the fuel-gas systems that have since been produced, and consisted in the partial combustion of carbon by forcing a limited supply of air, or a mixture of air and steam, into a furnace containing the solid fuel in a state of combustion. The gaseous products resulting from the gasification of charcoal by a blast of hot air consisted of—

		By Volume.	
Combustible . . .	{ Carbonic oxide (CO) = 33.30 Hydrogen (H) = 2.80	36.1 per cent.	
Non-combustible . .	{ Nitrogen (N) = 63.40 Carbonic acid (CO ₂) = 0.50	63.9 "	
		100.00	

With a mixture of air and steam, the products were—

		Percentage.	
Combustible	{ CO = 27.20 H = 14.00	41.2 per cent.	
Non-combustible	{ N = 53.30 CO ₂ = 5.50	58.8 "	
		100.00	

Twenty years later, the Siemens regenerative furnace was introduced; and the startling results achieved by its inventor in metallurgical work, rapidly opened a wide field for the use of fuel gas in the iron and steel industries. It was demonstrated that 7 cwt. of coal would do the same work that had hitherto been performed with a consumption of at least 2 tons of coke, in heating a ton of iron to welding heat; and 12 cwt. of coal, replaced 3 tons in melting a ton of steel by means of this gas, furnace. The success of fuel gas for metallurgical work was at once assured.

Until the supply of natural gas in Pittsburg had created a demand among domestic consumers for this desirable addition to modern household conveniences, there had been scarcely any attempt to provide private dwellings with any other than illuminating gas. It is true that some attempt was made in Germany to introduce a heating gas; and that, as long ago as 1862, a company was formed in Birmingham (England) to supply that city with fuel gas at a cost of 6d. per 1000 cubic feet. The Bill was actually presented to Parliament; but it was thrown out in Committee of the House of Lords, because their Lordships thought that, if the scheme was as good as represented by its promoters, existing gas companies would gladly engage therein. It is needless to say that the existing gas companies, already possessing the lighting monopoly of cities, did not care to undertake any experiments or embark in fresh schemes; and it was reserved for an individual 25 years later to put the first fuel-gas plant in operation for domestic purposes.

In America, progress has been more rapid, owing, undoubtedly, to the presence of natural gas. The great boon that the discovery and use of this gas has been to certain portions of the West, resulting in the foundation and growth of large and prosperous towns—a discovery that has brought health and happiness to thousands, besides enriching the districts where it exists to the extent of millions of dollars—has excited a demand for an artificial substitute where natural gas does not exist, that must sooner or later be supplied. Moreover, the long-predicted exhaustion of natural gas in those regions where lately it was most abundant seems nearing realization, as foreshadowed by the action of the Pittsburg companies in cutting off all supplies for industrial uses, and confining themselves to domestic consumers. Such districts cannot well go back to their old habit of burning coal direct. A substitute for natural gas is therefore inevitable.

The distinction that is made between fuel gas and illuminating gas arises chiefly from the difference in cost. Illuminating gas makes an excellent fuel gas, providing it can be sold at a price sufficiently low to allow of its use for fuel. In thousands of instances, both coal gas and carburetted water gas are used in cooking and heating stoves; but their uses as fuel are limited, owing to the cost of such heat. Fuel gas necessarily means cheap gas; and in order to take the place of solid fuel, it should not exceed the cost of coal at the place of consumption. Now, since the combustible gases generated from coal—whether by the process of distillation, as in the ordinary coal-gas system, or by the conversion of the carbon into carbon monoxide, with the addition of hydrogen from decomposed steam, as in the water-gas system—contain less energy than that from which the gases are obtained, it would appear at first sight impossible to replace coal by its gases, economically speaking. But when we reflect that, out of possibly 29 million units of potential heat contained in a ton of coal, we derive, in ordinary domestic uses, scarcely perhaps 5 million, whereas from 30 to 50 per cent. of the total heat of combustion of gas is readily available, it becomes evident that we can afford a good margin of loss for the conversion of coal into gas, and still achieve better results than with the coal itself. The saving of space occupied for coal

storage, and all the expense and trouble incident in handling coal and removing ashes, to say nothing of the cleanliness and healthfulness, are points of sufficient advantage to give to fuel gas a superiority, if even the economy were no greater than with coal. I do not mean to say that it is cheaper in all cases to convert coal into gas, and burn the gas, than to use coal direct. There are uses for which coal burned directly is the cheaper system. Such, I believe, is at present the case with the modern steam-boilers, where combustion is, in able hands, nearly perfect, and the products escape at a temperature not exceeding 500° Fahr.

In order to ascertain the cost of a gas, we must know, firstly, its composition; secondly, the purpose for which it is to be used; and, lastly, the price per unit of volume. Its composition gives us both its heating value and flame temperature. Having given the use to which it is to be applied, we may judge of the quantity we must consume to produce a certain effect. Finally, its price per 1000 cubic feet enables us to figure the cost at which we can do our work.

It may be useful at this point to call attention to the distinction between the calorific value of a gas and its calorific intensity, as there is a great deal of misapprehension prevalent on this subject. If we wish to select a gas for heating a substance to incandescence—a Welsbach burner or a Fahnehjelm comb, for instance—we need a flame of high calorific intensity; and we should choose uncarburetted water gas. If, on the other hand, we wish to boil water, we should choose natural gas; and next to that, coal gas. Of course, this supposes no difference in their cost. The calorific value of a gas is the sum total of the heat-units contained in its combustible constituents, irrespective of the diluents associated therewith—i.e., heat-units per unit of volume. Calorific intensity is dependent not alone on the thermal units contained in the gas, but varies inversely with the weight of the resultant products of combustion of the gas multiplied into their specific heat.

Of all artificial substitutes for natural gas, that commonly known as water gas is by far the most popular, and claims the greatest number of advocates. Water gas is made, as most of you are aware, by forcing steam through a deep body of incandescent coal or coke. This action is alternated with that of blasting air through the fuel to regain the necessary temperature of combustion preparatory to again driving in steam. The steam is decomposed in presence of the incandescent carbon, forming carbon monoxide; the hydrogen of the steam remaining free. These two gases are given off in about equal quantities, and burn with a beautiful pale blue flame. The chemical transformation is conveniently represented by the equation



This, however, is not the precise manner in which the transformations occur. Carbonic acid gas is first formed, and is converted into carbon monoxide in presence of more carbon. It is exactly represented thus:



Coal gas—that made by the retort system—has also its advocates as a fuel gas; but hitherto there has been no practical demonstration of its production at a price calculated to ensure its use as a fuel to any great extent. The returns from its manufacture and supply are based largely upon the sale of the bye-products—coke, tar, naphthalene, ammoniacal liquor, &c.—and the profits are, therefore, dependent upon fluctuating markets for these products, as well as the price of gas. This system pertains, therefore, rather more to what is commonly known as the chemical than to the gas industry. It has been proposed to convert the bye-products coke and tar into gas, and mix with the distilled gases; but this virtually brings the system within the class of water-gas systems, since the solid fuel (coke) would be treated by the ordinary water-gas process. Moreover, it is quite possible to carry on the process of distillation and the water-gas process in one and the same generator, and so avoid the extra labour and expense which the retort system entails.

Let us now investigate the methods described for gasifying coal for fuel purposes, in order to ascertain in what way we are likely to achieve the best results. We may conveniently divide them into three classes—viz., water gas, semi-water gas, and producer gas. The first is known as the alternate system, in contradistinction to the last two methods, which are continuous.

Taking the first method described by Ebelmen of gasifying carbon—viz., forcing a blast of air through a deep bed of the ignited fuel (producer gas), you will see by the table above given that we only get about 35 per cent. of combustible gases. If we could eliminate the nitrogen from the atmosphere by a cheap and simple process, and supply oxygen alone and in the requisite quantity to convert all of the carbon into carbonic oxide, we should get from a ton (2240 lbs.) of anthracite 4666 lbs., or nearly 60,000 cubic feet of this gas, containing 20,200,000 heat-units. The coal itself would possess almost one-third more heat-units than this—i.e., 29,000,000, if we allow 240 lbs. of the ton as ash. Apparently there is here a decided loss in converting coal into gas. The loss is, of course, due to the partial combustion which takes place when one atom of oxygen unites with one of carbon—carbonic oxide being the product. In other words, if we convert the carbon at once to its final product—carbonic acid—from 1 lb. of carbon so consumed 14,500 heat-units are evolved; whereas, if we turn the carbon first into carbonic oxide, we evolve from the same quantity of carbon 4400 units, obtaining

233 lbs. of carbonic oxide. This, when it is burned, evolves only 10,092 heat-units; so that the 4400 units appear to be lost.

What becomes of the heat we call lost? It is generated in the furnace; and while some of it is radiated through the sides, most of it is carried off by the gas, which leaves the furnace at a high temperature. If, therefore, we use the gas in its heated condition as it is generated, we shall lose, approximately, only that quantity lost in the furnace itself. We should obtain the 20 million heat-units from the actual combustion of gas, and probably 7 million units more of sensible heat. Now, the effect of the nitrogen—the presence of which we cannot avoid, if we use air—is not to lessen the total quantity of the carbonic oxide producible, but to lower the temperature of the furnace. The weight and volume of gaseous products being greatly increased, the heat is spent over a larger volume, and the temperature is necessarily reduced. Of course, a given volume is less combustible than when the nitrogen is absent. In this case we obtain 170,000 cubic feet of gaseous products, 110,000 cubic feet of which is inert nitrogen. What would be the temperatures of the furnace where the nitrogen is present and where it is absent? In the one case, the furnace heat would be—

$$\frac{2000 \times 4400}{4666 \times 0.2479} = 7600^\circ \text{ Fahr.}$$

In the other—

$$\frac{2000 \times 4400}{(4666 \times 0.2479) + (8664 \times 0.244)} = 2685^\circ \text{ Fahr.}$$

By furnace heat we mean the average temperature existing in the furnace. In practice, we have really a gradually descending degree of temperature from the zone of combustion to the zone of distillation—where the gases leave the furnace. The zone of combustion exists where the air is supplied to the fuel. In this region active combustion ensues; and the carbon is converted into carbonic acid gas *per saltum*. In passing through the superincumbent coal, the carbonic acid gas gives off part of its sensible heat to the coal, and at the same time undergoes a transformation by losing an atom of oxygen, which unites with the free carbon, and is thus converted into carbonic oxide (expressed by the equation $\text{CO}_2 + \text{C} = 2\text{CO}$). That portion of the furnace in which the chemical transformation occurs, we term the “zone of carbonization.” This change entails a further loss of heat. In passing out at the top of the furnace, the gas imparts a further quantity of sensible heat to the top layers of fresh unconsumed coal, and carries off the moisture in the form of steam. There is, therefore, a gradually diminishing furnace heat from the zone of combustion—say, 2500° to 3000° Fahr. down to probably from 1000° to 1500° Fahr. at the take-off pipe.

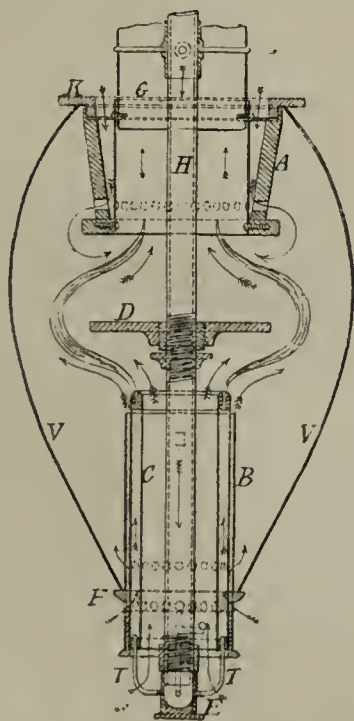
Now, if the gas has to be stored for any length of time, or conveyed long distances through cold pipes, a very severe loss is necessarily entailed. For instance, in burning the gas produced from a ton of coal, at atmospheric temperature, we should lose an amount of heat equal to from 4 million to 7 million heat-units. This would prove a serious loss; and, in order to avail ourselves of a portion of this thermic capital, we must burn the gas as it issues from the furnace, without permitting it to cool. As most of you are aware, the feature of the Siemens regenerative furnace consists in the utilization of this sensible heat.

(To be continued.)

REGISTER OF PATENTS.

Regenerative Gas-Lamps.—Greene, T. A., and Walker, C. M., of Cannon Street, London. No. 18,618; Nov. 18, 1890. [6d.]

This invention relates to a gas-lamp having an Argand flame spread out below by a deflector, and contracted above towards a central



chimney, and supplied with air partly from below heated by conduction from the burner, and partly from above heated by conduction from the chimney; the burner and air passages all being enclosed within an elongated bulbous glass.

In this illustration, H is the gas-supply pipe, the lower end of which is closed by a screw cap or plug E, removable to clear out matter deposited from the gas. Gas passes by several branches T to an elongated Argand burner C, surrounded by a concentric jacket B, so that there is a narrow annular air passage between the jacket and the burner tube. On the jacket (which is held on the burner tube by a bayonet catch) there is a flange F, supporting the glass V. Below the flange perforations through the jacket-tube allow air to enter—some of it passing by perforations above the flange into the space enclosed by the glass, but most of it ascending between the jacket and the burner, and so becoming heated and issuing under the flame, which is spread outwards by a deflector D, and above the deflector turns inwards to the mouth of the chimney G. This chimney, which is carried on the gas-pipe, has its lower end surrounded by a concentric casing A, the lower part of which is perforated with numerous holes. Above the casing is a loose flanged ring K, resting on the upper edge of the glass V, which is of an elongated bulbous form, enclosing the whole of the lamp, except the upper part of the chimney and the lower part of the burner. The lamp is lighted from below, inside the burner; the flame being supplied with heated air, partly below from the jacket B, and partly above from the annular passage between the chimney and the casing.

Distilling Tar.—Lennard, F., of East Greenwich. No. 844; Jan. 16, 1891. [1s. 1d.]

The object of this invention is to provide means by which tar distillation can be carried on “expeditiously, and so as to obtain in a manner readily under control, the various products of distillation; the heat of the vapours of distillation being used to effect the partial heating of the matter to be distilled, which assists the condensation of the vapours.”

The tar to be distilled passes, or is forced, from the store-tank into vessels in which the ammoniacal liquor separates, owing to the heated condition of the tar. This heating is effected by forcing it (on its way to these vessels) through one or more condensers, so that the tar acts as the cooling medium for condensing the tar vapours therein. The tar is then passed or forced through heated coils of pipes or like extended passages; the heat being applied to the coils or passages in any suitable way—for instance, by the coils or the like, or some of them, being situated in an oven or sand bath. The tar flowing through these coils thus becomes heated to, or above, the point at which its vaporizable constituents required to be extracted would become vaporized if not confined therein. It then passes into a scrubber, on admission to which its vaporizable constituents vaporize; it being therein subjected to the action of steam or other disassociating agent—the pitch depositing in the scrubber, while the vapours pass therefrom into condensers, in which the various products deposit separately.

One arrangement of apparatus consists of a furnace with return flues, preferably heated with liquid or gaseous fuel, and above it an oven or sand bath, in which are coils communicating with other coils situated in a chamber through which the products of combustion pass, and which the patentee calls the “economizer.” There is also a scrubber, consisting preferably of a vertical tower, having a series of tubular passages so arranged that the tar will pass downwards there-through in a circuitous manner, meeting a current of steam or other disassociating agent in its descent, which carries off the desired products from the tar; the pitch which is thus formed depositing at the bottom of this tower. There are also condensers into which the vaporized products pass, and in which the several products deposit separately. These condensers preferably consist of vertical vessels provided with tubes, and with outlets and inlets arranged so that the vapours pass inside the tubes, while the cooling and condensing agent passes on the outside.

In the first condenser of the series, the condensing agent is the tar from the ammoniacal liquor separators; while in the others, it may be the coal tar which is ultimately to be distilled. The tar to be distilled may be pumped through (say) the last of the condensers, and passes around the tubes thereof and thence either direct by a pipe to the tanks or vessels in which the ammoniacal liquor separates from the tar and is retained; or before passing to these tanks or vessels, it may be sent through another of the condensers, and around the tubes thereof. The tar is forced from these tanks or vessels, by a pump, into the first of the condensers; then through the coils in the economizer; and thence through the coils in the oven or bath. Thus the tar is heated to the degree requisite to cause the vaporizable constituents to vaporize. The tar then issues therefrom and passes into the scrubber, where it meets a current of steam, or other disassociating agent, by which the vapours are driven to the first condenser, wherein the heaviest products (the anthracene oils) deposit, while the pitch deposits at the bottom of the scrubber. The uncondensed vapours pass from the first into the second condenser, in which the next products (creosote oils) deposit; the vapours which are still uncondensed passing into the last of the condensers, wherein the lightest products (naphtha and light oils) are condensed.

The coils of the economizer and oven or bath are preferably flattened; and to provide extended heating surfaces, they have fins on them. Also, to conduct heat to them, there are pipes or passages of refractory material extending from the furnace or flues (or both) to between the convolutions of the coils. By regulating the speed at which the tar is passed through the apparatus, the proper degree of heat for distilling is obtained, irrespective of the temperature above that required for distilling tar, at which the furnace and the oven or bath may be maintained.

Gas Motor Engines.—Abel, C. D.; communicated from the Gas Motoren Fabrik Deutz, of Coeln-Deutz, Germany. No. 1903; Feb. 2, 1891. [8d.]

This invention relates to valve apparatus for controlling the admission of gas and air to the working cylinder of gas motor engines; and it consists in an arrangement whereby the simultaneous opening and closing of valves controlling respectively the gas and the air supply is effected, in order to insure the formation of a uniform explosive mixture during the whole of the suction stroke.

For this purpose, an annular gas passage in the casing of the gas and air mixing-valve communicates by a passage (provided with a shut-off cock, valve, or slide) with a space on the underside of the gas-admission valve, the chamber above which communicates with the gas-supply pipe. The stem of the gas-valve passes down through a partition into a lower chamber; and it there carries a second valve that closes the air-supply inlet—such chamber being also made to communicate by a passage with the chamber below the mixing-valve. The gas and air valves are so proportioned that, on the production of a partial vacuum beneath the former and above the latter, the upward pressure of the outer air tending to open the air-valve will overbalance the downward pressure of the gas supply on the gas-valve, so that the two valves will be simultaneously opened to an extent dependent on the differential pressure produced. The annular gas passage of the mixing-valve is provided with a series of small horizontal holes communicating with the chamber below the valve.

The action of the arrangement is as follows: On the engine piston commencing its suction stroke, the gas and air mixing-valve will be first opened by the suction produced; and an exhaust being then produced above the air-admission valve and below the gas-valve, these will be made to open (as described), so as to cause gas and air of the desired proportions to enter the chamber of the mixing-valve, and to pass thence into the cylinder—the gas being made to issue in a number of small jets transversely through the air current, so as to become effectually mixed therewith, in order to produce a uniform explosive mixture. On the engine running too fast, the cock, valve, or slide in the gas passage is closed by the action of the governor, by means of any well-known arrangement; and hereupon, although both the gas and the air valves will be opened on the suction stroke as described, only air will enter the cylinder until, on the reduction of the speed, the gas passage is again opened.

Manufacture and Distribution of Gaseous Fuel.—Ormiston, J. W. A. R., and J., all of Glasgow. No. 1909; Feb. 3, 1891. [8d.]

In carrying out this invention, ordinary coal is employed to make the gaseous fuel; such coal being put into a large cupola or chamber like that of a blast-furnace, and provided with apparatus for injecting a strong blast of air in one or more streams at its lower part, also with apparatus at its upper part for leading away the volatilized products to condensers, scrubbers, and other apparatus for separating and recovering their various constituents. The upper part of the cupola is also provided with appliances of well-known kinds for charging in coal or carbonaceous materials as required; while at the lower part arrangements are made for withdrawing unvolatilized residues. These unvolatilized residues or ashes of ordinary coal are, by themselves, troublesome to deal with; but by this invention, say the patentees, when ordinary coal is used, suitable earthy materials are mingled therewith—these materials being such as will, with the earthy ingredients of the coal itself, form a fluid slag, which can be tapped at the bottom of the cupola, and be thus withdrawn with great facility and with little labour.

Instead of ordinary coal forming the only carbonaceous part of the charge, there may be mixed therewith, or used instead thereof, any carbonaceous minerals of the kinds comprising comparatively large proportions of earths—such, for example, as the poor shales known as "blaes," and not considered profitably workable for the obtainment of paraffin oil. In case the earths of such minerals are found to be by themselves not well adapted for forming a fluid slag, other suitable earthy matters may be added to combine with them to form a flux. The addition of earthy matters for fluxing purposes will also prevent fusing and caking together of coaly constituents having this tendency in the upper part of the cupola. Among the materials to be added for fluxing purposes, mention is made of ordinary blast-furnace slag; also of limestone or other carbonate, the carbonic acid from which contributes to the formation of the gaseous fuel, while its use somewhat diminishes the percentage of nitrogen in the total products.

In operation, an intense heat is maintained at the lower part of the cupola, by means of the blast, so as at that part to drive off the remainder of the volatile matters, and fuse the earthy residues. The highly-heated gases evolved at the lower part will, in rising, operate on the materials above; the heat of the gases being utilized in gradually volatilizing the carbonaceous matters. Any carbonic acid formed at the lower part will be converted to carbonic oxide a little higher up; and the gaseous products passing off from the top of the cupola will consist largely of carbonic oxide, which is one of the principal ingredients of the gaseous fuel intended to be manufactured, but which will have associated with it hydrocarbons and other matters. Excepting the nitrogen of the air forming the blast, and permanent gases containing carbon and hydrogen, the volatilized matters associated with the carbonic oxide will be separated and recovered by any well-known means, and will form saleable products, the value of which will reduce the cost of the gaseous fuel.

In large works—such as those for making steel, where quantities of fuel have to be consumed—special or separate installations for making the gaseous fuel may, the patentees remark, be provided; but in the case of a large number of works in each of which only moderate or small quantities of fuel are used, it will be advantageous and economical to provide in a district a large central installation, from which the gaseous fuel can be distributed to consumers through pipes or other channels. It is moreover contemplated, by the present invention, to supply the gaseous fuel even to dwelling-houses, and to any structures using fires, however small. As the distribution of the gaseous fuel in the general way indicated will necessitate means for conveying very large volumes, it is proposed, while using iron or steel pipes where only moderate sizes are required, to form underground tunnels, to serve as the larger channels required. Such channels would be constructed of, or lined with, brickwork or concrete where necessary; and where such tunnels would have to be at some depth below the surface, vertical shafts or wells would be formed in connection with them at suitable points, from which smaller distributing-pipes would radiate.

Advantages of some importance would arise from the use of "blaes," or poor shales in the manner indicated, as it has been ascertained that the carbonaceous constituents of such shales (although associated with a large proportion of earthy matters) are of a nature to yield, when

volatilized, both condensable and permanently-gaseous products, which are considerably richer in hydrocarbons than ordinary producer gas; so that a given volume of the gases produced from the "blaes" will contain more combustible matter, and yield more heat, than an equal volume of producer gas.

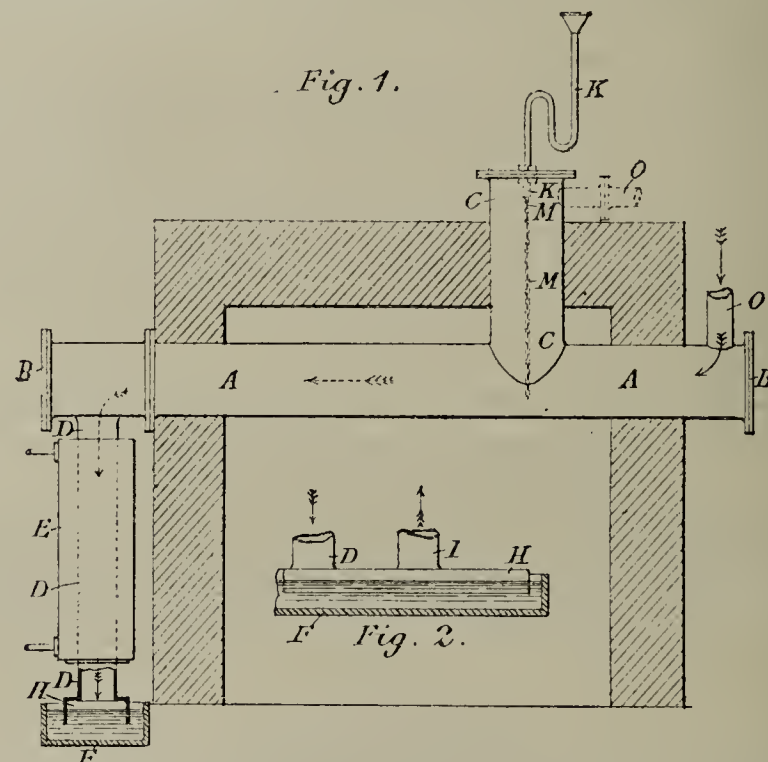
Manufacture of Illuminating and Heating Gases.—Dinsmore, J. H. R., of Liverpool. No. 2948; Feb. 18, 1891. [8d.]

This invention, says the patentee, has "mainly reference to those processes of making illuminating or heating gas in which tar or other hydrocarbon liquid is employed and converted into gas in conjunction with coal or other carbonaceous material; and it has for its object, and consists of, certain arrangements and dispositions of parts and modes of carrying out such processes."

According to this invention, there is employed one or a plurality of retorts or chambers set in a suitable heating chamber or bench, and adapted to be externally heated by coal or coke fires, or by gaseous fuel. These retorts are provided with a door in front of the bench, or with a door both at the back and front; and they are so arranged, and the bench so built and adapted, that access to the inside of the retorts can be readily had, and their interiors operated upon from the ground level. Tar is passed into the retorts at any convenient point; and, in conjunction therewith, gas (say, ordinary illuminating gas) is also introduced—the result being that the gas combines with the tar gas resulting from the distillation of the tar by the heat of the retort, and a combined gas of a high illuminating power and great volume is produced. This combined gas leaves the retorts in a downward direction—that is, it is carried from the chamber or retort exit downwards—and directly upon leaving the retort, it is artificially cooled. This is preferably done by passing it through an externally cooled (say, a water jacketted) conduit, which opens out at the bottom into a chamber sealed in water, tar, or other suitable liquid, wherein any grosser particles of tar, or unfixed tarry vapours or carbon are arrested. From this chamber the gas is led away to be cooled or condensed in any ordinary suitable apparatus, and then stored or used.

In an ordinary illuminating gas-works, the patentee remarks, the whole of the gas produced may be treated as described, or only a portion may be so treated, and such portion mixed with the bulk. And, in lieu of illuminating gas, water gas, hydrogen, or other suitable gas may be heated in conjunction with tar as explained, and its illuminating power and volume increased. The hydrocarbon liquid—i.e., tar, or other hydrocarbon or mixture thereof—may be introduced into the retorts in a solid form—say, from above, allowing it to fall on to the bottom thereof. Or it may be supplied by spraying or atomizing devices.

In the accompanying illustration, there is shown the apparatus for distilling tar in the presence of coal gas (or other gas), consisting of a duct or retort, and having covers at each end. Although only one duct is shown, "any suitable number may be disposed within the bench in any convenient manner, and heated by a furnace in any known suitable way."



A is the retort or duct having covers B and B1, and an upright extended portion C. D is the descending outlet-pipe of the retort or duct; and E is a jacket round it, through which cooling water or other fluid is circulated, and by which the pipe D, and the gas passing through it, are artificially cooled. F is a trough for water, tar, or other liquor; and H is an inverted trough connected to the pipes D, and by which a seal is made between these pipes and the outside atmosphere. I is an ascension or outlet conduit, by which the gases are conveyed away from H to the place required. K is a syphon tar-supply device; and M represents a length of chain, or the like, connected to the delivery end of the pipe K within the retort or duct portion C, and by which the tar is led to near the bottom of the duct A before it falls on to it. O is a pipe by which coal or other suitable gas is introduced into A.

The operation of this apparatus, according to one mode, is as follows: Coal gas—say, previously mainly ridged of water or condensable watery matters, or containing such watery matters, is introduced into the duct or retort A by the pipe O; and, in conjunction with this gas, tar is introduced, in regulated quantities, by the device K into the duct or retort. As the tar falls on to the bottom of the duct, it is vaporized, the vapour becoming mixed with the coal gas. In the passage of the tar vapours through the duct, in combination with the coal gas, they are more or less converted into permanent gas by the heat of the duct. The tar and coal gases, in their mixed condition, are then conveyed downwards through the pipe D; and, in their descent, they are artificially cooled by the cooling fluid passing round the pipe D. By this cooling effect, the pitchy and some of the tarry

vapours or matters in the gases are arrested, and fall toward the cooler part of the pipe and into the trough F. By this mode of ridding the gases of objectionable matters, all liability of the outlet-pipe of the ducts becoming choked, is obviated. The pitchy and tarry matters as they condense, or are arrested in D, fall by gravity into the liquid in the trough F; and thus solidification and incrustation in the pipe D is prevented.

In addition to the liquid seal, a cock or valve on the pipes D may be employed to shut off a retort or duct A, when required. Or a cock or valve only may be used; the pipes D in such a case delivering the gas into a suitable main.

In some cases, in lieu of introducing coal gas through the pipe O, the gas may be distilled from coal charged into the retorts (say) through the charging-mouth door B. Or again, coal gas may be introduced from the pipe O in conjunction with its manufacture from coal in the retort. Or, as a further modification, hydrogen, water gas, producer gas, or other gases, may be introduced into the retort alone or with other gases, and carburetted, or its illuminating power increased, by its mixture with tar gases generated as described.

In lieu of tar being used, other hydrocarbon oil may be employed for the purpose of raising the illuminating power and increasing the volume of gases of the nature described in operating according to this invention.

APPLICATIONS FOR LETTERS PATENT.

- 15.—CAMPELL, H., "Gas motor engines." Jan. 1.
 24.—WILLIAMS, H., "Gas-purifying apparatus." Jan. 1.
 55.—POTTER, W. G., "Gas and petroleum and hot-air engines for propelling trams, bicycles, torpedo, and other boats." Jan. 2.
 112.—RICHARDSON, J., and NORRIS, W., "Gas and vapour engines." Jan. 4.
 247.—NICHOLSON, T. and E. T., "Heating gas and air, and supplying the same to boiler and other furnaces and fire-places." Jan. 6.
 260.—EDWARDS, E., "Carburetted air or forming explosive mixtures for gas-engines." A communication from G. Petit and E. Blanc. Jan. 6.
 261.—SPRATT, C., "Gas-valve and regulator." Jan. 6.
 465.—THORP, T., MARSH, T. G., and HAYNES, J., "Prepayment mechanism of gas-meters." Jan. 9.
 482.—MARTIN, J. C., "Manufacture of coal gas." Jan. 9.

European Gas Company.—The Directors of this Company have declared interim dividends of 8s. each on the £10 shares, and 6s. each on the £7 10s. shares.

Shocking Death of a Gas Stoker at Blackpool.—Whilst attending to a fire at the Blackpool Corporation Gas-Works recently, a stoker, named Richard Brady, allowed the whole of the fire to drop into a trough below; and the steam and water scalded him to such an extent that he died on Sunday night of last week.

New Joint-Stock Companies.—A limited liability Company has been formed to take over the businesses of Messrs. Oates and Green and of the Ellen Royde Brick and Fire-Clay Company, both of Halifax, and old-established and well-known firms in the fire-clay trade. The business will be conducted under the style of Oates and Green, Limited. No shares will be issued to the public; the whole of them having been taken up by the members of the old firms. The Electric Fittings Hiring and Maintenance Company, Limited, has been registered with a capital of £200,500, in 40,000 ordinary, and 500 founders' shares of £5 and £1 each respectively, to establish and maintain cables, wires, lines, accumulators, lamps, works, and fittings of every description for the generation, distribution, supply, accumulation, and employment of electricity; to carry on business as electricians, generators and suppliers of electricity, mechanical engineers, manufacturers of, and dealers in all kinds of apparatus therefor; and to effect insurances against fire or accidents arising from the employment of electricity. The Metropolitan Light Company, Limited, has been formed with a capital of £5000, in £1 shares, to acquire the undertaking of D. C. Defries, now carried on at Nos. 43 and 44, Holborn Viaduct, under the style of the Metropolitan Light Company, in accordance with an agreement made between D. C. Defries of the one part and the Company of the other part, and generally to carry on business as gas, electrical, and general engineers.

The Staffordshire Gas and Coke Company.—In the Chancery Division of the High Court of Justice last Wednesday, before Mr. Justice Kekewich, Mr. Dunham, in an adjourned summons relating to the above matter, applied to vary the Chief Clerk's certificate by removing the names of Mr. T. Nicholson and others from the list of contributories to the Company; the names having been placed thereon by the Chief Clerk at the instance of the Liquidator, whom Mr. Renshaw, Q.C., now represented. The learned Counsel, in support of the summons to vary, said the applicants had been placed on the list of contributories for shares of £5 each under the following circumstances: Mr. Nicholson was the owner of two patents for making coal gas, and he formed a Company, called the Mercantile and Domestic Company, consisting of himself and his relatives, to purchase the patents. By an agreement between the Mercantile and Domestic Company—Mr. Nicholson and Mr. Burrows acting on behalf of the Staffordshire Gas and Coke Company—the exclusive right of licences in respect of those two patents was granted in consideration of a sum of £60,000, to be paid in fully paid-up shares of the intended Company, or cash, at the option of the purchaser, Mr. Burrows. By virtue of this agreement, a certain number of shares were allotted to Mr. Nicholson; but, it being discovered that there was no registration under the Act of Parliament, a re-allotment took place, and the Liquidator claimed in respect of this to have the applicants placed in the list of contributories as the holders of unpaid shares. Mr. Dunham contended, on behalf of the applicants, that, inasmuch as a mistake had been made, the Company were justified in making the necessary correction by cancelling the first allotment. Mr. Renshaw, on behalf of the Liquidator, opposed the summons. He submitted that the Chief Clerk was right in what he had done; and argued that Mr. Nicholson and the others were privy to it all. Mr. Justice Kekewich, in the result, held that the Chief Clerk had acted rightly; and he disallowed the summons.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

Standards of Light.

SIR,—After the invitation in your recent leader for expressions of opinion from your readers on this question, I am disappointed that such an important subject has not provoked a better and more varied discussion. With a view of, if possible, inviting others to publish their opinions, I may give a brief epitome of my own views on the matter, more especially as I have recently devoted considerable time to testing the most improved forms of modern standards and apparatus.

In the first place, I wish to emphasize the fact that, whatever form of standard of light or of apparatus employed is proposed to replace the present candle standard and the present apparatus, it will be a distinct advance to introduce a system of gas testing which will be thoroughly reliable, which is not too technical, and which can consequently be relied upon to give practically identical results in the hands of competent men. In my opinion, such a system is already in existence; but the main difficulty to its adoption will be the fixing of the exact equivalent of the old and the new methods. To make my meaning more clear, it cannot be ignored that gas companies, at the time their respective Acts of Parliament were passed, accepted certain conditions as to the price of the material which they were to supply, and the conditions under which it was to be valued. It was subsequently found by the companies that these conditions could be conformed to by certain definite expenses of manufacture; and, on this basis, reductions in the price of gas were made, with increased profit to both shareholders and consumers. In the meantime, the Referees were making radical changes in the construction of the photometers employed in official testing; and the general consensus of opinion among the companies where gas is now tested by the scientifically improved forms of instrument is that, under the same manufacturing conditions as prevailed of old, a lower value is attributed to their gas. The consequence of this is that the companies claim they have increased cost of manufacture to comply with their statutory obligations. In proposing a new standard of light, this claim should certainly receive impartial investigation, and (as I stated in a previous letter) the equivalent in standard candles of any substitute must be fixed in terms of standard candles as employed at the time the respective companies accepted their present parliamentary obligations.

I now turn to the subject of the lines upon which the photometry of the future may be conducted. Initially, I think that everyone recognizes candles as an unsatisfactory standard; and that, if gas companies have not sufficiently endorsed this, it is due to a mistrust in the powers that be, and a general feeling of a Shakesperian character with regard to "rather bearing the ills they have, than fly to others which they know not of." Admitting this much, and that the equivalent of any standard for candles would be fairly and equitably decided; admitting also that if this were done, any system of photometry would be welcome that would be the most reliable, I should wish to make the following recommendations:—

- (1) That the future standard should be the pentane Argand as proposed by Mr. Dibdin, but so constructed as to afford a light of 16 candles in place of 10 candles as at present made
- (2) That the form of photometer be an open table instrument, such as advocated by Mr. Vernon Harcourt.
- (3) That the temperature of the room be maintained practically at 60° by a thermostat, and that its *minimum* size and conditions of ventilation be (as nearly as possible) defined.
- (4) That considering the effects of water vapour (as shown by Mr. Methven's experiments), and also of varying barometrical conditions on the luminosity of flames, some correction other than that in use should be employed.
- (5) That the rigid adherence to a 5-foot consumption should be abandoned; and the gas burned to a constant 16-candle flame, as advocated by Mr. Vernon Harcourt.

I should have been glad to have amplified this better, in giving my reasons for the above recommendations; but I must defer this to your next issue.

Jan. 16, 1892.

H. LEICESTER GREVILLE, F.I.C., Etc.

The Effect of Air on the Illuminating Power of Gas.

SIR,—In view of the confident assertions made by the author and some speakers on the paper on "Purification" read at the meeting of the Incorporated Institution of Gas Engineers in May last, do not Dr. Schilling's experiments, recorded in the "Note" in your last issue (p. 65) call for some notice from those gentlemen and others who have from time to time expressed a contrary opinion? Dr. Schilling is a careful experimenter—one of the most careful in Europe—and is not likely to put on record the result of experiments that can be disputed.

To be perfectly open in this matter, I may say that I have a reason in writing—viz., that experiments of my own, carefully repeated many times, and again re-tried after reading the paper referred to, bear out, within a point or so, the report of Dr. Schilling. Moreover, I find no difference in my results if I admit a known percentage of air into a test holder, mixing it direct with the purified gas, or if the same known percentage is admitted at any part of the apparatus used in manufacture, either before or after purification, no matter whether the purifying material is lime or oxide. This latter result was not to be expected, seeing that one-fifth of the air should be taken up in passing either the lime or the oxide. Nevertheless, it is so; and I must honestly confess that, in my case, the use of air reduces the illuminating power to the extent shown in Dr. Schilling's paper.

London, Jan. 14, 1892.

A PUZZLED INQUIRER.

Proposed Reduction in the Price of Gas at Doncaster.—At a meeting of the Gas Committee of the Doncaster Corporation last Thursday, it was decided to recommend the Council to reduce the price of gas from 2s. 11d. to 2s. 6d. per 1000 cubic feet, and to give discount to all customers to the extent of £1 per annum.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Monday, Jan. 11.

(Before Mr. Justice CHITTY.)

Andrew and Co. v. Crossley and Co.—Crossley and Co. v. Andrew and Co.

These actions raised important questions as to the procedure under the Patents Acts. Messrs. Crossley Bros., Limited, were the owners of a patent granted in 1881 for improvements in gas motor engines, &c.; and an action having been brought and a motion made by Messrs. J. E. H. Andrew and Co. for an injunction to restrain Messrs. Crossley Bros. from alleging that Messrs. Andrew and Co. had infringed their patent, and from making threats of taking proceedings in reference to such alleged infringements, the motion stood over on an undertaking given by Messrs. Crossley Bros., embodied in an order of March 28, 1890, to bring an action against Messrs. Andrew and Co. for an infringement so soon as a disclaimer by Messrs. Crossley Bros. of certain claims in the specification of their patent should be allowed. At the date of the undertaking, Messrs. Crossley Bros. had, in pursuance of the provisions in section 18 of the Patents Act, 1883, applied for leave to amend their specification. Notice of opposition was given by Messrs. Andrew and Co., who, on May 19, 1890, appeared before the Comptroller and opposed. On June 9, 1890, the Comptroller gave his decision, allowing the amendment with a certain modification, and subject to the condition that Messrs. Crossley Bros. should not sue for infringements committed before Jan. 1, 1884—that was to say, the day on which the Patents Act of 1883 came into force; being a condition which is invariably imposed in such amendment proceedings when the patent was granted before that date. On June 11, 1890, Messrs. Crossley Bros. issued their writ commencing the infringement action against Messrs. Andrew and Co. On June 30 a notice was sent to Messrs. Crossley Bros. from the Patent Office, requesting them to furnish "the undertaking required" by the Comptroller that they would not take legal proceedings in respect of infringements antecedent to Jan. 1, 1884. On July 9, 1890, Messrs. Crossley Bros. gave the undertaking. On Aug. 25 the specification was formally amended; and on the following day, the amendment was duly advertised under the Act. The two actions having been referred by consent to a learned Arbitrator, and it having been proposed on behalf of Messrs. Crossley Bros., when opening their action before the Arbitrator, to put in the amended specification, objection was taken on behalf of Messrs. Andrew and Co. as to its admissibility in evidence, on the ground that on June 11, 1890, being the date of the issue of the writ, the amendment had not been actually made, and that, by the 10th sub-section of section 18 of the Act of 1883, it was provided that the procedure, under the foregoing provisions of section 18, should not apply when and so long as any action for infringement or other legal proceeding in relation to a patent was pending. The Arbitrator delivered a written decision on the point raised, in which he held that the amended specification could not be admitted; holding that the amendment must be treated as dated July 9, when Messrs. Crossley Bros. gave the undertaking, and therefore as subsequent to the date of the writ in the action, and that the undertaking was a material and necessary step for the completion of the disclaimer. This decision of the Arbitrator was now reviewed by the Court; and it was not upheld.

The ATTORNEY-GENERAL (Sir R. E. Webster, Q.C., M.P.) and Mr. W. N. LAWSON appeared for Messrs. Crossley and Co.; Mr. HOPKINSON and Mr. J. C. GRAHAM, for Messrs. Andrew and Co.

Justice CHITTY, in delivering judgment, said that, although no authority for the Comptroller to impose conditions was mentioned in sub-section 3 of section 18, which related to opposed applications, it was clear that he had such authority. The Comptroller, however, in the present case had not, in fact, required an undertaking to be given. All that was needed was that Messrs. Crossley Bros. should give their assent in writing to the condition imposed by the Comptroller's decision. The Arbitrator had decided that the leave to amend was not complete until the undertaking was given on July 9. It followed from this view that, by reason of the issue of the writ on June 11, the proceedings before the Comptroller were stayed by virtue of sub-section 10. Before him (Justice Chitty) it had been contended that this was the right view, and also that any writ issued before Aug. 26—the date when the amendments were actually made—would necessarily stay any further proceedings before the Comptroller. In other words, it was argued that Messrs. Crossley Bros. were not entitled to commence any action on the amended specification until after Aug. 26. The decision of the Arbitrator and this further contention, which went beyond his decision, were grounded on sub-section 10 of section 18, and went, if sound, to upset all that had been done in the Patent Office after June 11, because on and after that date an action for infringement was pending. Accordingly, with all that, Messrs. Crossley Bros. must have dismissed their action for infringement, and have proceeded *de novo*, before they could bring another action for infringement. But, in his opinion, neither of the contentions on behalf of Messrs. Andrew and Co. could be maintained. The correct reading of section 18 was that the proceedings for amendment terminated with the leave to amend. No further provision was made. True it was that the actual amendment was made by virtue of section 18, and of that section only; but there was no direct provision for making the amendment. It was treated as something which followed from the Comptroller's decision, and something to be done as a mere ministerial act, and as a matter of course in pursuance of the decision. Sub-section 9 enacted that leave to amend should be conclusive as to the right of the party to make the amendment, except in the case of fraud; and then, tacitly treating the amendment as in fact made, and without any provision as to the amendment being made, it went on at once to enact that the amendment should, in all Courts and for all purposes, be deemed to form part of the specification. Obviously, the Legislature thought it superfluous to insert any provision as to the making of the amendment. Further authority was given to the Comptroller and to the Law Officer, when there was an appeal, to impose conditions; but no provision was

made for the acceptance of any condition imposed. No doubt the patentee could, if he were dissatisfied with the conditions imposed, decline to allow his specification to be amended; and he might, by notice to the Patent Office, require that no amendment should be made. No doubt it was also a convenient and reasonable course on the part of the office to obtain an assent in writing from the patentee before making the actual amendment. The written assent precluded the patentee from alleging that he did not accept the conditions. It was an error, however, to ask for an undertaking. The undertaking given in this case added nothing to the force of the condition imposed by the Comptroller under his statutory authority. No action or proceeding of any kind could be taken to enforce the undertaking, which was given to the Comptroller alone. It also appeared that the Comptroller did not insist upon any particular form of undertaking or consent; but all that was required was an assent before proceeding to make the amendments. In this case, the assent was given on behalf of Messrs. Crossley Bros. at the hearing before the Comptroller on May 19, although it was not stated in the Comptroller's written decision of June 9 that they had accepted the condition. He (Justice Chitty) thought that a subsequent written assent to the condition was not necessary, although, as a mere matter of business, and to preclude any possible question, it was not unreasonable to ask for an assent in writing. In any case, he held that a written assent to a condition imposed by the statutory authority related back to the Comptroller's decision. He held—and that appeared to him to be the one crucial point of the case—that the giving of the assent did not fall within the meaning of the words, "the foregoing provisions of this section," contained in the 10th sub-section of section 18, and consequently that it was not a step the taking of which was prohibited while an action for infringement was pending. For these reasons, he held that the amended specification was admissible. The practice of the Patent Office was to state at the top of the printed copies of amended specifications as the date of the amendment the date of the decision giving leave to amend. He held that such practice was correct, and in conformity with the Act of Parliament.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Wednesday, Jan. 13.

(Before Justices LAWRENCE and WRIGHT.)

Page v. Kettering Water-Works Company.

This was a special case submitted for the opinion of the Court under the following circumstances: The plaintiffs are owners of mills on the River Ise, below Kettering; and they claimed compensation from the defendant Company in respect of the injury sustained owing to the latter impounding the water of two brooks above the town, which formerly united in another stream which ran into the Ise before it reached the plaintiffs. The matter had been submitted to arbitration; and the Arbitrators had found that, if the Company were to compensate the claimants for all the water intercepted, the amount should be £825. But, as circumstances stand at present, the bulk of the water, after being employed for domestic and other uses by the inhabitants, and by the Local Board of Kettering for sewerage purposes, is returned into the stream, and ultimately reaches the Ise as before; and if this ought to be taken into account, the amount of compensation should be £55 only.

Mr. LUMLEY SMITH, Q.C., and Mr. RIGG appeared for the claimants; Mr. MEADOWS WHITE, Q.C., and Mr. COWARD for the Company.

Mr. LUMLEY SMITH contended that the Company must be taken to be purchasers of the water they impounded from the two brooks, and that, when they sold it in retail or bulk, they had no further control over it; and the Local Board might, by a change of sewerage system, at any time prevent the return of the water to the Ise. There was no certainty, therefore, that the present state of circumstances would continue; and the claimants were entitled to the higher amount of compensation.

Mr. MEADOWS WHITE, on the other hand, argued that it was a case of "injuriously affecting," and not of purchase. The claimants were, he said, only injuriously affected to the amount of £55. They were not the owners of the two brooks which were intercepted, and therefore were only entitled to the smaller amount.

Justice LAWRENCE, in giving judgment, said in his opinion the case ought to be remitted to the Arbitrators, because it was somewhat doubtful in his mind on what principle they had found the sum of £55. If they had looked at all the circumstances which might arise hereafter—including the question whether the flow of water which at present ran into the Ise was likely to continue, taking into account what might happen if Kettering were to increase to a large extent, and whether more water would be required if another system of drainage were adopted—then no further consideration would be necessary. But with regard to the amount of £55, he thought it would be more satisfactory that the matter should go back. The main question was what was the compensation to which the mill-owners were entitled? Were they entitled, under the Water-Works Clauses Act, as for a purchase? Or were they entitled only to compensation for being injuriously affected, under the Lands Clauses Consolidation Act? The case did not seem to come within *Stone v. The Corporation of Yeovil*, but was more like *Bush v. The Trowbridge Water Company*. There the plaintiff was the owner of a stream, and the Company put in a pipe higher up the stream, and diverted a portion; and the plaintiff sought to make the Company purchase the whole stream. It was pointed out there that the plaintiff had no right to anything of the kind. What she was entitled to was compensation for being injuriously affected. Here a small part of the water of the River Ise was being taken away; and the Water Company could not be compelled to pay the whole value in the same way as if they were forced to purchase the two brooks. The true principle on which the compensation should be based was that the Arbitrators should look at the probabilities of the case; taking all the facts into consideration as though they were valuing a piece of ground likely, within reasonable time, to be turned into building land. The judgment must, therefore, be for the respondents.

Justice WRIGHT gave judgment to the same effect.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Friday, Jan. 15.

(Before Mr. Justice DENMAN and a Special Jury.)

Higgins v. Ward.**Slander by the Assistant-Secretary of the Gas-Workers' Union.**

To-day an action brought by John William Higgins, a gas stoker, formerly of Salford, but now in the service of the South Metropolitan Gas Company, against William H. Ward, Assistant-Secretary of the Gas-Workers' and General Labourers' Union, to recover damages for an alleged slander uttered by him against the plaintiff, came on for hearing. The litigation arose in connection with some statements made by Ward at a meeting of gas workmen held in May last; plaintiff being one of the men taken on by the above Company when their old hands threw up their work on the occasion of the strike. Defendant denied having uttered the slander; but said if he had, it was not done maliciously.

Mr. MURPHY, Q.C., and Mr. MEWS appeared for the plaintiff; Mr. T. TERRELL for the defendant.

Mr. MURPHY, in opening the case, said the action had only been brought by plaintiff to vindicate his character, and to put a stop to the persecution to which he had been subjected. Prior to the strike of gas workmen in 1889, plaintiff had been employed by the Salford Corporation; but he left their employment, and took service with the South Metropolitan Gas Company. As a result of his action, he was described as a "blackleg," and became a marked man. On May 7, 1891, speaking at a meeting of Union men, in Blackwall Lane, East Greenwich, defendant made imputations on plaintiff's character which, it was admitted on the pleadings, were absolutely without foundation. The words complained of were these: "There is a man working for Joe Tysoe [the Superintendent of the Company's East Greenwich station] named Higgins, whom and whose parents I have known for nearly 30 years. He is nothing but a common thief and a street-corner boy, who would rob any hard-working man of his wages or his watch and chain if he were lucky enough to have one, especially if he saw the man was drunk. He knows the cells inside Strangeways Goal better than he knows the retorts in the gas-works. I remember on one occasion, when he was taken into custody, when searched there were over 40 pawn-tickets upon him relating to stolen watches and chains which he could not account for." These statements were altogether untrue. The matter having come to the knowledge of the Directors of the Company, the plaintiff was asked to explain it; and thereupon he told the truth. The Directors accordingly ordered their Solicitors to assist him in bringing the present action. They wrote a letter, and the answer to it was that the defendant had never referred individually to the plaintiff in most of what was said; and that the statement was as to the class of men to which the plaintiff belonged. He did not know the plaintiff personally; and he had simply stated the effect of the report he had received. The learned Counsel concluded by saying that even at this stage of the proceedings his client would be willing to accept an apology; but, if this were not tendered, the jury must say at what amount they ought to assess the damages.

Justice DENMAN asked whether it was to be peace or war.

Mr. TERRELL replied that the case must go on, as he had no instructions to tender an apology.

Plaintiff was then called, and stated that he entered the service of the South Metropolitan Gas Company in December, 1889, having worked for the Salford Corporation for 16 years. There had never been the slightest suggestion of dishonesty against him. He was once fined 2s. 6d. for being drunk.

Cross-examined by Mr. TERRELL: He had been employed by the Company to get them labourers. He heard of the speech from a fellow-workman on the same day.

William Drain, a constable in the Metropolitan Police, examined, said he was present at the meeting on May 7, and heard the defendant say plaintiff had never done a day's work in his life, and was a street-corner boy and loafer. He would stand about and rob any hard-working man of his week's wages or his watch and chain, if he were lucky enough to have one; and he knew the cells in Strangeways Gaol better than the retorts in gas-works. He had often been convicted, and on one occasion, when he had been taken into custody, upwards of 40 pawn-tickets were found on him relating to stolen watches and chains which he could not account for. He (Ward) had known plaintiff's father for 20 years as a hard-working, honest man, and all the rest of his family. Plaintiff was the only black sheep in the flock.

Cross-examined: There had been a procession, and he had followed it to the place of meeting. He was about ten yards away from the defendant when he was speaking. He took no notes of the proceedings. About a week after the meeting, his Inspector asked him to put down what he remembered having been said about the plaintiff. He did so. There were three other policemen at the meeting. He did not consult the other men before he made his note. He had probably talked about it since. He did not hear defendant say he did not know plaintiff, or that what he was telling the meeting was only what he had heard about plaintiff in Manchester. He did say he was not sure about all he had said.

Justice DENMAN, having read the note made by witness, found the word "thief" was used.

Witness: Defendant said plaintiff was a thief and a scamp.

Police-constables Aylward and Angell gave similar evidence. They stated that defendant said plaintiff was a disgrace to his family, and would get hold of a man's watch and chain if he could. He was known as a thief and street-corner boy.

Cross-examined: Defendant spoke well of plaintiff's father and uncle; and did not say the plaintiff was reported to belong to a gang who did these things, but that plaintiff himself did them. They (the policemen) thought from what they heard that plaintiff was a man to be watched. The remarks were not made as showing the class of persons employed by Mr. Livesey.

Police-constable Cullum gave similar evidence.

Cross-examined: The police all made their written reports in the same room at one time. They might have been talking about what

had been said on the occasion. Each man wrote what he remembered. They did not read over their reports to one another.

This was the case for the plaintiff.

Mr. TERRELL, in opening the defendant's case, said that the defence would be a complete denial that the words complained of had been used. It was clear that the police evidence had been agreed upon, and that the action was really one by the Directors of the Gas Company against the Union.

William Henry Ward was then called, and said he had been a gas stoker for 23 years, and was now Assistant-Secretary of the Gas-Workers' Union. He remembered what he stated at the meeting in question. He said: "There is at present working for Joe Tysoe a man named Higgins, whom I have never seen in my life, but whose father and uncle I have known for years. If the account I received of young Higgins in Manchester is correct, all I can say is that he has disgraced an honourable and honest parent; for a better foreman than old Dick Higgins I never knew. I have been informed that Higgins belonged to a gang who loitered about the Regent Road Barracks on pension-day, watching the pensioners. This gang knows more about the inside of Strangeways Gaol than about the inside of a retort. How true this is, I cannot say; I give it you as I received it. But if the information is correct, it proves to me that the South Metropolitan Gas Company don't care who they employ to bring them in anything in the shape of humanity at £1 a head. At one time, when a raid was made on the gang, 40 pawn-tickets for watches were found on them." He did not call the plaintiff a thief, or any of the other things complained of. He said that the gang, and not the plaintiff, had done all these things.

Cross-examined by Mr. MURPHY: The Gas Company were ready, and are even ready now, to take anyone who will work for them, whether he be a thief or not. The gang he mentioned were bad characters—street-corner boys and loafers, who picked the pockets of pensioners and others. He did say he had heard plaintiff was a member of this gang, who picked pockets.

John Fitch, the chairman of the meeting, said the police were outside the crowd. Defendant began by saying that, if the information he received was true, plaintiff was a disgrace. He did not hear the words complained of. He should have heard them, he thought, if they had been used.

Thomas Blackburn said he called the meeting, and stood near Ward with a banner. Defendant said that, if what he heard about the plaintiff was true, he had disgraced his parents. Defendant did say plaintiff's character would not bear investigation, and that he was an agent for procuring blacklegs. Defendant also said plaintiff was an associate of street-corner boys. "Watches and chains" were mentioned in connection with the class of men employed by Mr. Livesey.

Counsel having addressed the jury,

Justice DENMAN, in summing up, said defendant had himself admitted having said that the plaintiff was one of a gang of thieves. The mere fact that he had been told what he said was no defence. The evidence of the police was very strong; their attention having been drawn to the matter on account of the language used about the plaintiff. If, in substance, the words complained of in the statement of claim were made out, the verdict should be for the plaintiff. He could not say that this was not a very serious slander, as systematic dishonesty of a very low character was charged against the plaintiff. At the opening of the case, Mr. Murphy, on behalf of the plaintiff, said he was willing to accept an apology. But defendant's Counsel had been instructed to fight the matter out; and now the question of damages would be on a different footing. The jury must consider what sum would mark their opinion that the attack was an unfounded, unfair, and cruel one.

The jury almost immediately found for the plaintiff—damages £200.

His Lordship gave judgment accordingly; certifying for a special jury.

COUNTY OF LONDON ASSESSMENT SESSIONS.**Sessions House, Clerkenwell, E.C.—Monday, Jan. 11.**

(Before Sir P. H. EDLIN, Q.C., Chairman, and a Bench of Magistrates.)

The Gaslight and Coke Company's Assessment Appeals.

Representatives of the parties concerned in these appeals attended to-day for the purpose of answering certain questions to be submitted by the Court.

The CHAIRMAN said he wished to obtain from both sides answers to questions which he proposed to put for the speedier determination of the case. First of all, was the Court to understand that the parties were all of opinion that, with regard to the distribution of the rateable value of the productive mains, the Court should consider the proportion which the gross receipts in each Union bore to the total receipts, and in the same proportion distribute the rateable value of the whole as between the parishes? He apprehended that this was conceded on both sides.

Mr. POLAND: I understand that, when your Lordship has arrived at the total value of the whole, and deducted the indirect portion, so as to get at the total value of the direct portion of the whole, then, according to the Mile End and West Middlesex Water-Works cases, the total amount of the indirect portion would be divided among the different parishes proportionately to the total receipts in those several parishes.

The CHAIRMAN: I think this would be an accurate formulation of the procedure: The distribution of the rateable value must be proportionate to the receipts in each parish; that is to say, in the same ratio or relative proportion as the receipts in each parish respectively bear to the total gross receipts of the Company.

Mr. LITTLER: Quite so.

Mr. POLAND: The proportion should certainly be before the rates are deducted.

The CHAIRMAN: There may be questions of arithmetic to be determined after we have found the rateable value; but the proper rateable value cannot be arrived at until we have calculated the amount of rates for which the Company would be entitled to have credit. Then, when we find the amount from which the rates would have to be deducted, we may have to ask the assistance of the accountants in doing the necessary sums as between the parishes.

Mr. LITTLER, Mr. POLAND, and Mr. FULLERTON assented on behalf of their clients.

Mr. MARSHALL: I assent, with this qualification, if it is one—that the proportion shall be taken first, and the rates deducted for each parish separately afterwards, because the local rates differ as between themselves.

The CHAIRMAN: The rates would have to be considered subsequently, and deducted according to their respective amounts in each of the Unions or parishes. Then I take it that, in the valuations which we have had from the several professional gentlemen called before us, the rateable value of the stations, and what are coupled therewith under the heading of unproductive or indirectly productive mains, has been deducted by each of the valuers from what he presents as the rateable value of the productive mains.

Mr. LITTLER: That is so.

Mr. POLAND: I am afraid that it is not quite so.

The CHAIRMAN: Are the several localities supplied with gas from those stations distinct, or are they intermingled in such a way as to render it impossible to attribute a rateable value to the mains indirectly productive which are fed from the several stations separately?

Mr. LITTLER: It is quite impossible, my Lord.

Mr. POLAND: I think all the valuers take the view your Lordship has presented—that, a number of separate undertakings being brought up by one great Company, they are intermingled, and worked together.

The CHAIRMAN: Then we have not to trouble ourselves with any such separation?

Mr. POLAND: No; it is on the whole.

The CHAIRMAN: There is another question, and a nice one, to which I have to draw your attention. The parishes in which the several stations are situated have agreed with the Company; and there has been an accord as to the value of each of the stations.

Mr. POLAND: No, my Lord.

Mr. LITTLER: I am told that St. Pancras has not agreed.

The CHAIRMAN: We have had no evidence as to the value of the St. Pancras station.

Mr. POLAND: It was agreed, first of all, that your Lordships should decide the main question of the total of the value of the Company's property so far as the indirect portion is concerned.

The CHAIRMAN: Then our decision in the first place would be only an interlocutory judgment.

Mr. POLAND: Yes, my Lord.

Mr. LITTLER: If we get a decision of the main question, I hope we should have little or nothing to trouble the Court about. We should certainly endeavour to agree to anything; and all we should have to do would be to come, as they say in the Court of Chancery, for further directions.

Mr. POLAND: If we had this great main question decided, it was the hope, not to say the belief, of several of the parishes which have works their area, that we should be able probably to come to some agreement.

The CHAIRMAN: Then Mr. Littler puts it correctly—you would have to come for further directions?

Mr. POLAND: Yes.

The CHAIRMAN: And the accountants would have something to do in distributing the amount which we may find?

Mr. FULLERTON: That is it, exactly.

The CHAIRMAN: The settlement, as far as I understand it, between the parishes and the appellants in respect to the stations was arrived at, not upon the basis of the account year, but upon that of the figures as they were originally presented for the purpose—that is to say, for the current year ending Dec. 31, 1889. You have agreed between you not to reopen that question; but, in dealing with the entire value, it strikes me as possible that there may have been a disproportionate appropriation of value to those stations. If there has been any disproportion, inasmuch as their value was considered before we entered upon the arbitrament of the values of the works, there may be some differences to be considered.

Mr. LITTLER: I think not, my Lord; I consider the value would be the same in the account year as in the current year.

Mr. POLAND said some of the valuers for the respondents did not agree with the appellants as to the values of the indirectly productive portions of the stations; and the Court would have to decide the point upon the evidence.

Mr. DANCKWERTS said the difference between Mr. Ryde and Mr. Jones was only a few hundred pounds in a matter of £16,000.

Mr. POLAND: Your Lordship should, in a broad view, take the various valuations put before you by the different surveyors.

The CHAIRMAN: I wish it were generally understood what is the variation. As between the lowest valuation on the part of the appellants and the highest on that of the parishes, there is a difference of £600,000, or, if the rates were only 5s. in the pound, of a possible rateable liability of £150,000 a year. If we take the highest valuation on the part of the appellants, and the lowest on that of the respondents, there is a difference which, calculating the rates at 5s. 2d. in the pound, would result in £56,000 a year. There is another question I wish to ask. Some of the mains fed by these stations within the area extend out of the area in which we are exercising jurisdiction. I want to know whether this has been taken into consideration, or whether, after we have found the value, it may be sprung upon us that there should have been deductions in respect of those. This is a fundamental question; and it occurred to me that it should be cleared up. We might be distributing among the respondent parishes the receipts of the Company, a portion of which would be rightly applicable to property for which they have to pay rates out of the area.

Mr. DANCKWERTS: All the valuers have taken the whole of the concern as one, wherever situated.

Mr. POLAND: Your Lordship has the very difficult duty of dealing with all the property within your own jurisdiction; and to get at this you cannot help taking it as a whole.

The CHAIRMAN: Then I understand that the accounts do include those parishes which are external to the area, and that it is conceded on both sides that no injustice will be done by our apportioning the values accordingly.

Counsel present assented to this.

MISCELLANEOUS NEWS.

METROPOLIS GAS SUPPLY.

The Quality of the Gas in the Past Quarter.

The following is an abstract of the report of the Chief Gas Examiner for the Metropolis (Dr. A. W. Williamson, F.R.S.) as to the quality of the gas supplied by The Gaslight and Coke, the Commercial, and the South Metropolitan Companies, during the quarter ending the 31st ult. :—

I. *With respect to Illuminating Power.*—The average illuminating power, in standard sperm candles, at each of the testing-stations, was as follows :—

The Gaslight and Coke Company—

Fenchurch Street, E.C.	16'4
Cloth Fair, E.C.	16'5
Dorset Buildings, E.C.	16'4
Ladbroke Grove, W.	16'4
Devon's Road, E.	16'4
Carlyle Square, Chelsea, S.W.	16'2
Camden Street, N.W.	16'4
George Street, N.W.	16'2
Graham Road, E.	16'5
Kingsland Road, E.	16'2
Spring Gardens, S.W.	16'4
Grove Gardens, Regent's Park, N.W.	16'1
Hornsey Road, N.	16'5
Lambeth Road, S.E.	16'2
Millbank Street, S.W. (cannel gas)	21'1

Commercial Gas Company—

Parnell Road, E.	16'2
Wellclose Square, E.	16'2

South Metropolitan Gas Company—

Hill Street, S.E.	16'5
Foster Place, S.W.	16'1
Stoney Lane, S.E.	16'3
Lewisham Road, S.E.	17'1
Burrage Road, S.E.	16'1
Blackfriars Road, S.E.	16'3

It will be seen from these results that the average illuminating power of the gas has been higher than the parliamentary standard at all the testing-stations. At the Cloth Fair, Dorset Buildings, Ladbroke Grove, Devon's Road, Camden Street, Kingsland Road, and George's Street stations of The Gaslight and Coke Company, and the Lewisham Road station of the South Metropolitan Gas Company, the minimum illuminating power was equal to the requirements. At Millbank Street and Graham Road, it was better than the requirements of the Acts of Parliament; and it was below them at the Fenchurch Street, Carlyle Square, Spring Gardens, Grove Gardens, Lambeth Road, Hornsey Road, Wellclose Square, Parnell Road, Hill Street, Bedford Road, Stoney Lane, Blackfriars Road, and Burrage Road stations.

II. *As regards Purity.*—Sulphuretted hydrogen was reported by the Official Gas Examiner to have been present in the gas tested at the Wellclose Square station of the Commercial Gas Company on the 28th of December. The average amount of sulphur in other forms than this was considerably lower than the limit allowed (viz., 22 grains) at all the testing-stations of the three Gas Companies. With the exception of the Hill Street and Bedford Road stations of the South Metropolitan Gas Company, the maximum amount of sulphur present in the gas at all the testing-places was within the above-mentioned limit. Ammonia has been generally present in the gas throughout the quarter more or less frequently at all the testing-stations, but only in slight quantities. The limit allowed was not exceeded on any occasion during the quarter.

THE EXTENSION OF THE ROCHDALE CORPORATION GAS-WORKS.

At the recent Monthly Meeting of the Rochdale Town Council (as briefly mentioned in the JOURNAL last week), Alderman W. J. Petrie, in moving the adoption of the minutes of the Gas Committee, made an important statement on the present position of the gas-works, and the proposals for future extension. He first referred to the use of inclined retorts and the manufacture of oxygen for the purpose of purification. The inclined retorts, he said, saved time in charging and drawing; and the Engineer (Mr. T. B. Ball) calculated that the saving amounted to 9d. per ton in labour on the fuel used. These advantages were not unalloyed. There were some little drawbacks still in the process—such as the unequal heating of the retorts, which had bad effects in several ways. Fortunately they could gain practical experience from the inclined retorts they had in use, so that, when the time came to determine what kind of retorts to place in the new house, they would be able to decide of their own knowledge. As to the other process he had mentioned, they were now manufacturers of oxygen for use in purifying the gas. In one respect the system did not do all that was anticipated—it had not raised the illuminating power of the gas. The makers of the apparatus said that this was owing to the fact that it was not large enough; and it was now for the Committee to say whether it should be enlarged. The gas now contained only 10 grains of sulphur per 100 cubic feet of gas, whereas it used to contain 30 grains; and it was one of the purest, if not the purest, illuminating gas that was made in the country. With regard to the new works, the first intention of the Committee was to make all the extensions and improvements on the land now in the possession of the Corporation; but they found that, owing to the watery state of the land, it would be very costly to erect a new holder on it, besides so disturbing the land that there might be a collapse of a large portion of the works. When this became evident, the Committee looked round for a new site for the holder; and they fortunately found one only separated by a short distance from the present works. It contained an area of between 9000 and 10,000 square

yards; and they had been able to purchase it at a reasonable price, subject to parliamentary approval for its use for manufacturing purposes. It was excellently adapted for two large gasholders, which would each contain 1,500,000 cubic feet of gas. Then the ideas of the Committee developed; and they felt it would be desirable to seek powers for manufacturing on two or three other plots of land. Much more room was wanted for the storage of residuals; and larger mains were also required in the centre of the town. Proceeding, Alderman Petrie said they proposed to erect another retort-house, capable of holding 266 mouthpieces. The present works contained 417 mouthpieces; so that there would be an increase in the producing power of 64 per cent. Curiously the increase in the quantity of gas made was, within a fraction, exactly the same in the past decade as in the ten years preceding. From 1881 to 1891 the increase was 41·6 per cent.; while from 1871 to 1881, it was 41·7 per cent. If they might rely on a similar increase in the next ten years, two-thirds of the increased production would be absorbed; and they might reckon that the new works would last from 15 to 20 years. Summing up, he said that the cost of the proposed extensions was roughly estimated as follows: Gasholder, 150 feet in diameter and 100 feet high, £13,000; tank for the same, £9000; retort-house, coal-stores, and approaches, £13,500; retort-stack, hydraulic and foul mains, pipes, valves, and fittings, £12,000; boundary walls, paving, draining, levelling, &c., £2500; new sewers, diversion of drains, &c., £500; new exhausters, connections, and foundations, £1000; new smiths' and joiners' shops, £800; removal of meter shops, stores, &c., £1500; part cost of enlargement of mains (the other part to come from revenue), £2000; connections to present plant, valves, &c., £500; contingencies, £2700—making a total of £60,000. If they decided not to have inclined retorts, but to go in for mechanical charging machinery, there would be an additional cost of £6000. This appeared a large sum to add to the capital of the gas-works; but if they compared figures, they would see that it was nothing to be alarmed at. In 1881 the mortgage debt on the gas-works was £164,956, or £620 16s. of capital per million feet of gas made. In 1891 the debt was the same; but the production had so increased that the proportion was reduced to £438 14s. per million feet. If the £60,000 were added to capital account immediately, and there was no increase in production, the capital per million feet would be considerably less than it was ten years ago. After a brief discussion, the minutes were adopted.

THE BIDEFORD TOWN COUNCIL AND THE GAS COMPANY.

The Gas-Works Purchase Question—Opposition to the Company's Provisional Order.

A Meeting of the Bideford Town Council was held yesterday week to consider the grounds of opposition to the application of the Gas Company to the Board of Trade for a Provisional Order. The Directors of the Company met specially on Jan. 9 to consider the proposal of the Town Council that negotiations for the purchase of the gas-works should be entertained under clause 2 of the Electric Lighting Act; and, in view of this, they passed resolutions to the effect: (1) That they were advised that clause 2 of the Electric Lighting Act of 1882 had no application to the matters in question; and they renewed their offer to sell at a valuation in the usual way. At the same time, having regard to the peremptory need for the extension and protection of their works, they considered it was imperative upon them to proceed with the application in the absence of any definite agreement by the Council to purchase. (2) That to suspend their application until 1893 and cripple their undertaking for the whole year, they argued, would be not only impolitic, but unjust to their consumers. (3) As an evidence of their *bona fides*, the Directors were willing to allow their offer to remain open until Feb. 1 next, though they reminded the Council that they had notice of the intended application in the month of August last, since which date the public meeting of the ratepayers had been held, and ample opportunity afforded to the Council to decide upon the question of purchase. The Directors regretted that any attempt to treat for their works should have been left until the eleventh hour, when heavy expenses had been incurred, and the regulations of the Board of Trade complied with; and that to suspend or abandon their application now would, they observed, involve an unjustifiable sacrifice of the shareholders' money. After these resolutions had been read at the meeting of the Council, Mr. Marraway remarked that, since the Company would not suspend their application for a Provisional Order, the Corporation must not suspend their opposition. He suggested an amendment, which was agreed to, that the local authority proceed "with the approval of the ratepayers" to apply for an Order on their own account. The objections to the Company's Order were then carried unanimously, as follows: (1) That the Gas Company does not efficiently and properly supply the public and private consumers of the borough with gas. (2) That the prices charged by the said Company are excessive and unreasonable, and in excess of the rates provided by the legal settlement under which the Company was constituted. (3) That the local authority are of opinion that it is desirable that the lighting of the town, whether by gas or ultimately by electricity, should be in their control, as well as the water supply, which is already in their hands. (4) The said local authority intend and propose, with the approval of the ratepayers, before the next session, to apply themselves for a Provisional Order, or for a Private Act to obtain the control of the lighting of the town, and for this purpose to acquire the rights and property of the existing Company. (5) That if it be deemed expedient, an inquiry be held by the Board of Trade before a Provisional Order is granted. Two other resolutions were afterwards passed, and added to the objections—one being "That the general condition of many of the old gas-mains in the streets renders it necessary to frequently break up the streets, to the interference with traffic and destruction of metal;" and the other was to the effect that the control of the Council over the sewers in the streets should be undisturbed, as any interference by the Gas Company would be fraught with much danger from a sanitary point of view, prejudicial to the health of the town. At a later stage in the proceedings, it was decided that a premium of £25 should be offered for a report on the practicability and cost of installing the electric light in Bideford.

GAS AND WATER AFFAIRS IN BRUSSELS.

Our readers are aware that the question of the price charged for gas in Brussels has lately been very much under discussion, both in the Municipal Council and among the citizens. A bold proposition was brought forward a few months ago by M. Richald to abolish differential prices, and make the charge 12c. per cubic metre (about 2s. 8½d. per 1000 cubic feet) all round, irrespective of the purpose for which the gas was to be used. To compensate for the deficiency in the municipal revenues which would follow this reduction, it was suggested to impose a lighting-tax, to be levied upon the householders according to the frontage of their premises upon the public thoroughfares. These proposals, it will be remembered, were rejected in favour of one introduced by M. Allard, retaining the charge for gas employed for lighting purposes at 14 c., and making the figure 10c. for that used for cooking, motive power, &c., provided the consumer took the supply through a separate service-pipe and meter. The Brussels Municipality (or rather the Gas Committee of that body) have been conspicuous among gas-supplying corporations for their efforts to extend the use of gas for other than lighting purposes. Petroleum is a very powerful competitor with gas as an illuminant in the city, as every visitor to Brussels knows perfectly well. And it is not consumed in the cheap, dangerous lamps which are too frequently the cause of fatal accidents in this country, but in well-made, artistic appliances, which are much favoured by shopkeepers. The Committee have therefore endeavoured, by every possible means, to encourage the more liberal use of gas for both lighting and heating; and the proposed reduction in price to 12c. was the natural sequel of their previous efforts. As this was rejected, the adoption of the other proposition was the only possible course under the circumstances. This question of price will in all probability crop up again; for the Committee will not be able to relax their exertions to make the gas-works pay their way. Writing on this subject recently, a Brussels correspondent remarked that progressive reductions in price are absolutely necessary in Belgium; in fact, if these had not been conceded in Brussels, the financial condition of the municipal gas undertaking, owing to the falling off in the revenues, would have been much worse than it now is. Notwithstanding the severe competition of petroleum already referred to, he considers the future will be good for gas; everything indicating that its consumption will go on increasing without interruption. This extended use of gas should be encouraged by reductions in price judiciously made. Heating and cooking by gas have now become quite general in the city, owing to the hiring-out system in operation there. The municipal authorities charge a very moderate rental for the stoves, which they fix free of expense to the consumer, who is, of course, relieved of all the outlay necessary for a purchase outright. Stimulated by the action of the Gas Committee, the makers of gas appliances have adopted some very appropriate patterns of stoves; and consequently the consumers benefit to a very large extent from these combined efforts. Already important installations of gas cooking appliances are in operation in the principal hospitals of Brussels and Liège, as well as in several large popular establishments. The initiative in the placing of these stoves was due to the Gas Committee. In addition to lending gas-stoves on hire, many gas managers in Belgium adopt this plan with high-power burners; the object being, of course, to extend a system of lighting which every day gives evidence of possessing many advantages.

Reference has already been made in the JOURNAL to the monthly conferences held by the members of the Belgian Association of Gas Managers. At the most recent of these gatherings, M. Boscheron, Engineer of the Liège Gas-Works, the President of the Association, discoursed on the heating of gas-retort furnaces. The Committee of the Association have been somewhat warmly discussing the relative merits of blue and white flames employed in gas cooking and heating appliances. This much-debated question was worth dealing with in a public meeting, so that those who had a direct interest in it—viz., the makers of gas-stoves—might have gathered some information from the various views expressed. The Committee preferred, however, to conduct their proceedings with closed doors; other considerations besides purely scientific ones probably being taken into account. At the permanent exhibition of gas appliances on the Boulevard du Nord, stoves having burners giving blue flames are the more numerous; and they are patronized by the Gas Company at St. Josse-ten-Noode, one of the suburbs of the city. The Municipality of Brussels appear to give the preference to white flames; and the magnificent collection of stoves of this class to be seen at their dépôt in the Rue du Chêne certainly justifies their choice. Referring to this question, the correspondent already mentioned remarks that if the blue flame is in its proper place in a roaster or kitchener, it must be confessed that for ordinary household affairs it frequently gives rise to disadvantages which enable its rival to easily bear away the palm. In a general way, a stove pleases when it lights up well; but regarded from the points of view of consumption, hygiene, and cleanliness, it must be acknowledged that there are some good stoves, in which the heat is obtained by reflection from flames that are in part directly luminous, which go a long way towards meeting the desired object.

Important as is the gas question in Brussels, that of the water supply of the city is much more so; the health of the public and the municipal exchequer being both affected thereby. The city proper contains 180,000 inhabitants; and its suburbs, 350,000. Many years ago, the Municipality and the outside districts entered into an agreement under which the former should supply water to the combined area. But this arrangement, which formerly answered very well, is no longer adequate to the requirements of the increasing population in the outskirts, and these people complain of the short supply of water they receive, and of the high price they have to pay for what does reach them. At the commencement, the Municipality distributed 10,000 cubic metres (about 2½ million gallons) of water per day. At the present time, 35,000 cubic metres—drawn from wells or from the drainage area—are sent out; and 20,000 or 30,000 cubic metres more are needed to adequately meet the demands of what would be regarded as a good distribution. The city water, which is perfect for culinary purposes, is unsuited for industrial use. As the latter constitutes two-thirds of the total consumption,

only 25,000 cubic metres of potable water are required for Brussels itself; the remainder being furnished by water of rather lower quality. According to the Municipal Council, all that is required is to procure an additional supply by drawing from a river or a stream. The 28,500 consumers take, on an average, 20,000 cubic metres of water for domestic purposes—a quantity which is evidently inadequate, since it comes to only about 70 litres (15½ gallons) per head per day. There should be provided at least twice this quantity for a more numerous population than that which now exists. As to the charge, this is felt to be too high; for an annual minimum of 27 frs., plus 12 frs. for the hire of the meter, comes to 65c. per cubic metre, or about 3d. per 100 gallons. The outside districts interested, tired of waiting for a supply more proportionate to the bulk of the population, and at a more reasonable figure, have formed a federation with the object of procuring for themselves what they require. Several projects are to the front. The Modove scheme would furnish daily from 75,000 to 85,000 cubic metres of water, which, with the quantity now available, would be equal to the 150 litres already mentioned, supposing the expected increase of population should take place. The net price at the central reservoir would be 4c. per cubic metre; and the total cost of the scheme, 15,000,000 frs. Each commune would agree to take a minimum quantity of 150 litres per inhabitant; and the water would be sold so as to yield a profit, which would be applicable for the public service. The new combination, while furnishing a much more considerable volume of water than that now available, will not entail on the consumers a greater outlay than 375,000 frs. The project is one of double canalization, conformably to the principle adopted by the city; and this system will probably allow of a very material reduction in the price charged. The Société Intercommunale des Eaux of Brussels are also bestirring themselves. The Society is a legally constituted body, and comprises among its shareholders the most prominent members of the Councils of the four principal communes. Application was made to the Government for the nomination of one of the Engineers of the Ponts et Chaussées to the position of Director-General of the Society; but the Government declined. Several gentlemen connected with industrial undertakings have therefore put up for the post; and the decision of the Board is now awaited.

ELECTRIC LIGHTING FOR PORTSMOUTH.

A New Scheme.

In compliance with the instructions of the Electric Lighting Committee, Professor William Garnett has submitted to the Portsmouth Town Council an estimate of capital and current expenditure and receipts for the lighting of the district specified in Schedule B of their Provisional Order, and of the Esplanade between the two piers. The estimate is based upon the assumption that alternating currents at a pressure of 2000 volts will be employed for the transmission of energy through the main leads, and that "turbo-electric" generators, with surface condensers, will be employed. The first portion of the report refers to the conductors to be used; and then it states that, for the purpose of public lighting in the streets, instead of arc lamps, placed at distances of 50 yards or more, the Professor prefers to employ "high-efficiency" incandescent lamps of 150-candle power, fixed at distances of about 30 yards. These lamps would be supplied directly from low-tension conductors; and two of them would require about the same power as a single arc lamp. They would need to be more frequently renewed than ordinary incandescent lamps; and this has been taken into account in the estimate of annual expenditure. The capital required for an installation of 8800 private lamps and 200 public lamps is estimated at a little more than £38,000; and Professor Garnett reminds the Committee that it is desirable that borrowing powers should be obtained for a much larger sum, in order to enable extensions to be made to the system from time to time, as the public may demand, without renewed application to the Local Government Board. The cost of the site is an item not included in the capital estimate. So long as the number of private lamps wired is less than the equivalent of 8800 60-Watt lamps, the income, says the report, will be less than the amount estimated, and the expenses will also be less, but not in the same proportion. There appears, however, to be a reasonable margin to meet this difference; and if the public lighting is undertaken at once, the installation may be expected to pay its working expenses and interest on capital actually invested as soon as the number of private lamps wired exceeds 5000. Professor Garnett's estimate of the capital needed for high speed generating plant and incandescent lamps for public lighting is £38,285. He places the annual receipts for private and public lighting at £10,800; and the expenditure, including interest on £40,000 at 3½ per cent., at £7572.

At the last meeting of the Town Council, the Electric Lighting Committee recommended that the resolution of the Council passed on Sept. 8 last, so far as it referred to the adoption of Mr. J. N. Shoolbred's scheme,* be rescinded, but that this should not apply to so much of the resolution as referred to the borrowing of £60,000. They further recommended that the scheme and report of Professor Garnett be adopted, and that he be appointed Consulting Engineer, and that Messrs. Waller and Mandeville be appointed Superintendent Engineers; the fee for the Consulting and Superintendent Engineers to be £1500 together. With a view to carry out the scheme embodied in Professor Garnett's report, the Committee recommended that they be authorized to acquire a site for the central station. Alderman Ellis moved the adoption of the report, and briefly related the circumstances under which the Committee abandoned the plan submitted by Mr. Shoolbred for the one that was now presented. He said that Mr. Shoolbred had given an estimate of the annual income to be derived from the electric light and also the expenditure. But before a definite arrangement had been arrived at, a doubt arose as to whether he had not overestimated the revenue; and the Committee invited him to meet them and prove that his figures were correct. He failed to satisfy them; and they had no alternative than to dispense with his services—it being clear that he had not taken into consideration the nature of the town.

Professor Garnett was called in for consultation; and he expressed an opinion that Mr. Shoolbred's estimate of £10,000 was £2300 more than could be reasonably anticipated, it being unlikely that they could earn more than £1 for each lamp wired. Moreover, it would be impossible to extend the light beyond the area contained in the Provisional Order without ruinous cost. Mr. Beal having seconded the resolution, Mr. Miller observed that only four months ago the Committee assured the Council that, in making a selection of Mr. Shoolbred's system, they were perfectly right and safe; and he asked what justification had they now in making a similar representation with regard to Professor Garnett's plan? He moved, as an amendment, that the consideration of the report be deferred to an adjourned meeting of the Council. Mr. Fulljames seconded the amendment. The Mayor remarked that the Committee had adopted Mr. Shoolbred's scheme on the strength of a report received from a deputation which visited Bradford. The deputation, of which he was one, were delighted with what they saw of the installation in operation there; but they overlooked the fact that Bradford was a compact town, with all the business houses in one centre, whereas Portsmouth was a scattered borough, for which the low-tension system was wholly unfitted. On the amendment being put, it was carried by 16 votes to 12.

STOCKTON AND MIDDLESBROUGH WATER BOARD.

The Progress of the Undertaking.

At last Tuesday's meeting of the Middlesbrough County Council, Alderman Bell, in moving the adoption of the report of the Water Board, made an interesting statement regarding the work of the latter body and the prospects of their undertaking. Referring, in the first place, to the question of the rateable value of the undertaking, he said that it had been greatly increased. The Board had contested the assessments over and over again, sometimes with favourable results, and sometimes with unfavourable; but now the rates paid by them had been advanced by 50 per cent. When they came into possession of the undertaking, they found themselves in receipt of a revenue of £40,000 per annum; and this had increased until it now reached upwards of £60,000. This increase was entirely due to the growth of the district and the enlarged demand for water. At that time the net sum received by the Board in respect of every 1000 gallons of water was 3·98d; but at present they were receiving slightly more than 4½d. The members might think it odd that the increase of the revenue was due to the growth of the district and not to the increase in the charge; but this, nevertheless, was the case, because when the Board came into possession, they found that a very large proportion of the water pumped never reached the consumer, but was wasted, and the increase in the revenue was due entirely to the saving of that waste. With regard to the supply of water for manufacturing purposes, the Board inherited from the Water Company a very anomalous position—that of being obliged to supply water at 3d. per 1000 gallons if a certain quantity was taken, under which condition small consumers could by running hundreds of thousands of gallons to waste actually get their water cheaper than by taking only the smaller quantity; and the Board became aware of cases where this course was being pursued. They had, however, revised the scale with the best results. The cheapest water they sold was at 3d. per 1000 gallons; and upon this they had a balance of 1½d. towards interest and redemption. Turning to the domestic supply, he remarked that when the Board first became possessed of the works, they derived something under 4d. per 1000 gallons, and now they were deriving 7·02d. This advance in the profit was not owing to an increased charge to the consumers, but was the result of economy in the working of the undertaking; and this was one of the strongest testimonies to the way in which the affairs of the Board had been administered. As to the future of the undertaking, at the present moment they were on the eve of bringing the supply from Hury, which had only been prevented by the unpropitious weather. The Blackton reservoir was also progressing rapidly; and he had no fear, with the steady growth of the district, that the water undertaking during the next 15 years would be a continually improving property. In conclusion, he said that the water supply of the district was quite unique—two-thirds of it being required for manufacturing purposes; and he was one of those who believed that a not unimportant element in their prosperity was the fact that they possessed so admirable a supply of water for manufacturing purposes. The report was adopted.

The Purchase of Water-Mains by the Kirkleatham Local Board.

On Wednesday, the 6th inst., arbitration proceedings were commenced at the Surveyors' Institute, Great George Street, S.W., to determine the amount to be paid by the Kirkleatham Local Board to the Stockton and Middlesbrough Water Board for the water-mains and privileges of the latter body in the Kirkleatham district. Mr. Henry Lord was the arbitrator appointed by the Local Government Board. The Water Board were represented by Mr. Balfour Browne, Q.C.; and Mr. Bagallay and Mr. Wood appeared for the Local Board. Among the witnesses examined for the Water Authority were Mr. D. D. Wilson (the General Manager), Mr. T. Fenwick, and Mr. Mansergh; and on the other side, Mr. W. I. Anson and Mr. C. Hawksley. The case arose out of the compulsory sale under the Act of 1876 by the Joint Boards to the Kirkleatham Local Board of all pipes, mains, fittings, &c., in Kirkleatham. The Joint Board's claim, based on revenue, amounted to £29,000, and the sum offered by the Local Board was something over £4000, calculated on structural value; the real point at issue being the proper interpretation of section 4 of the Act. The proceedings were continued on Thursday, Friday, and Saturday, and concluded on Monday, when the Arbitrator reserved his award.

Extensions at the Bradford Corporation Gas-Works.—The minutes of the Gas and Electricity Supply Committee which were adopted at the meeting of the Bradford Town Council last Tuesday, contained a resolution recommending the acceptance of tenders for the construction of the roofing of a new retort-house at the Birkshall Gas-Works, amounting in the aggregate to the sum of £6166.

* See JOURNAL, Vol. LVIII., pp. 500, 535.

THE PURIFICATION OF WATER.

In the course of an address delivered by Professor LEEDS before the Chamber of Commerce of Rochester (N.Y.), he made the following remarks on the subject of the treatment of water by filtration.

I know of no method by which it is possible to render waters organically pure except by filtering; and I know of no practical method of bringing about this result except by the American system of mechanical filtration and purification. As these statements appear strong and unqualified, I think it is important that I should briefly review the history of our knowledge and practice during the course of the past ten years, in relation to this subject.

Some six years ago, there was, I think, but one city in the United States which attempted to filter its water, and that was Poughkeepsie on the Hudson. At the present day there are more than a hundred; and the practice is increasing very rapidly. In England and on the Continent of Europe the practice of filtration is well-nigh universal. Some five years ago, Jersey City and Newark, in New Jersey, requested me to visit the various water supplies (in England more especially), to study this matter of filtration of their waters; and I found that all the great cities, with the exception of Glasgow, filtered their water. The most conspicuous example is London, with its population of 5½ million people. Its water supply is almost entirely taken from the River Thames, and that river receives the drainage of a very great population. The towns are compelled, by Act of Parliament, to purify their sewage to a certain point; but a great deal of filth finds its way into the Thames. By Act of Parliament, the several Water Companies that supply London are compelled to filter their water; and to effect this object they have filter-basins which cover more than 100 acres in area. Their method of filtration is to run the water into large reservoirs containing sand. The sand that does the filtering is about 2 feet in depth, and is supported on a substratum of coarse stone. As the filth is removed, it accumulates in a thin layer upon the top of the sand; and when the water—which filters only under the pressure of the 4 feet or thereabouts of water standing in the reservoir—filters too slowly, they are compelled to send a force of men into the basin, shovel off the top layer of sand and dirt, remove it, wash it, and restore it to the filter-bed. The same plan is followed in Berlin and other cities on the Continent.

It is easy to see how the men remove the dirt, the gravel, and the suspended matter; but how do these shallow basins of sand remove the living organisms—those organisms with which we are all so familiar under the name of bacteria, and which, when they produce typhoid and other fevers, are known as disease germs? This operation was a complete mystery until within the last four or five years. But few people had ever seen or examined bacteria before that period; and the method by which they were removed from the waters was a profound mystery. It has now been shown that the bacteria remove the bacteria. The bacteria in the waters are comparatively few of a dangerous character; the great bulk of them are our greatest friends. It is through their aid, together with the oxygen of the air, that the filth in the water is destroyed. They feed upon it, and they feed upon each other. Since that knowledge has been obtained, the object now is to cultivate the bacteria. In order to make the filter-bed do its work effectively, it is necessary that the growth of the bacteria shall be facilitated until a bed becomes populated with an incredible number of millions of them. As the result of their activity, they multiply themselves in vast numbers; and they form, at the top of the filter-beds and between particles of sand, a sort of jelly or slime—a bacteria jelly; and it is by the aid of this jelly that the bacteria in the unfiltered water are removed. The bacteria come down into the pores of the filter, when they are caught by this jelly and are consumed. And if the rate of movement of the water is slow enough, it is possible to begin with water like that of the River Spree, which is a portion of the supply of Berlin, containing 100,000 bacteria to the cubic centimetre, and after passing through one of the filter-beds, the water which comes out will contain but 40 or 50 bacteria. This takes place when the rate of filtration is such that a million gallons of water pass through these filter-beds per acre in 24 hours. If the rate is diminished until only 300,000 gallons pass through in that interval, the bacteria can be diminished until there are only 5 or 10 per cubic centimetre. But this rate is too slow to permit of the economical use of the filter-beds; and the consequence is that the authorities of Berlin require that the water shall pass through the beds at the rate of a million gallons per acre in 24 hours. The interesting fact is thus brought out that some of the foulest water—that most polluted with sewage—is filtered in this way at the present day in the capital of Germany. The filtered water is submitted to the most searching criticism of Professor Koch, to whose labour our knowledge on this subject is mostly due.

The foreign filter-beds, excellent as they are, have never been introduced practically in the United States. Moreover, there is no prospect that they will be. The amount of water filtered per acre is so small that the first cost is a large one. In the second place, the climate of Europe and of England is altogether different from that of America. The filter-beds freeze up, even in London; and the Water Engineers are sometimes greatly troubled. In the next place, in England, even in that temperate climate, a great quantity of *algæ* develop in the filter-beds. In the United States, with the severe winters and the great trouble experienced from the growth of *algæ*, engineers are unwilling to undertake such method of filtration. This being the case, their attention has been directed to find some way of effecting a result which will satisfy our own needs; and the system I shall bring to your notice in reference to your immediate wants is the American plan.

The filter is simply a case constructed of boiler-iron, 5, 10, or 20 feet in diameter, made strong enough to stand any pressure to which it is subjected. It contains a bed of sand 3½ or 4 feet in depth. The water is sent through the filter under pressure, and flows out of the bottom by a series of valves so constructed that they permit the water to pass, but entirely detain the sand. After a time, when the filth accumulates on the surface and through the bed of the sand, the operation is reversed—a current of filtered water under pressure is sent up from below, the sand is washed, and the impurities pass out from a waste-pipe. Then filtration is resumed. In practice, after

working for ten hours, a filter can be purified by washing in ten minutes' time.

That it is possible, by such a method, to renovate the sand and dirt, you will probably have no difficulty in admitting; but what will such a filter do with reference to the bacteria? If it is necessary to pass water at so slow a rate where the pressure is as light as that given by a head of 4 feet, as is the case in the foreign filter-bed, how is it possible to pass the vastly greater quantity through one of these American filters? One of the filters of which I have been speaking, 10 feet in diameter, under a pressure of 15 lbs. to the square inch, will filter successfully 250,000 gallons per diem. In order to effect this result, it is necessary to have something which will take the place of the bacteria jelly I have described. And the most successful substitute is a jelly made of hydrate of alumina. It is obtained in this way: All natural water contains in solution carbonate of lime, to which its hardness is due. When sulphate of alumina is introduced into the water, it is decomposed by the carbonate of lime, and sulphate of alum is formed, and hydrate of alumina is set free. It is a perfectly white translucent jelly. It forms on the surface of the filter-bed in contact with the grains of sand; and when the smallest particle of silt or the bacteria come in contact with it, they are caught by it and held. It is possible to entirely remove the bacteria from water by use of this jelly. These filters, worked in the manner described, have been repeatedly tested; and this point has been most carefully established.

The question is now whether the bacteria are to be removed by a bacteria jelly or by an alumina jelly. There are some who think that no chemical substitute whatsoever can rightly be employed in the purification of water. It appears to me that to adopt such a sentiment is to renounce the advantages which the very elaborate study of this question has given to us. It is said that hydrate of alumina, which is one-fourth alum, is very pernicious to health. If alum ever went into the water supply, I would concede the point that it is not a proper thing to use; but it does not go into the filtered water. The alum is so perfectly decomposed that I never have been able to find it in the filtered water. The hydrate of alumina is left behind; and the alumina which goes into the water in a minute amount is also present in natural water itself. If an analysis of river water is examined, it will be found that the water contains naturally some alumina. It is the alumina in the soil which makes spring water so bright; it is the alumina in the soil which makes the water of driven wells filtered water. All that is proposed in this method is to take advantage of Nature's methods.

An "Electric Explosion" in Liverpool.—An incident, which caused the greatest consternation, and which, but for the promptitude of the police, might have been attended with much more serious consequences than it was, occurred in Liverpool on Monday afternoon of last week. It seems from the account of those who witnessed the affair that a loud explosion took place, and in a short time jets of flame were seen to spring up between the pavement near the end of Parker Street. The force of the flame gradually increased and the pavement was broken, some of the pieces being shot high into the air. The occurrence was for a time unaccountable. A police sergeant who was on duty, at once went to the scene of the fire, and came to the conclusion that it resulted from the electric wires that were laid in tubes under the pavement for electric lighting purposes. This proved to be correct. He at once communicated with the electric lighting depôt, and asked for men to disconnect the wires. In the meantime a police constable threw a quantity of sand over the flags between which the flames were issuing; and this prevented them from shooting up into the air, which they had been doing to the height of 2 or 3 feet, and appeared to be rapidly increasing in volume. As soon as the employees of the Electric Lighting Company arrived, a disconnection was made, and the flames were completely extinguished. The fire is supposed to have originated by two of the electric wires coming into contact, generating a great heat, and setting fire to the tar and rope in which the wires in the tubes are encased.

Welsh Rivers and English Water Schemes.—The Rev. O. A. Nares, Vicar of Kerry, Montgomeryshire, who recently elicited some important letters from Welsh members of Parliament on the preservation of Welsh rivers (*ante* p. 36), has published a reply to them. He says that of the four letters received on this subject, three confirm more or less his contention that the interests of Wales should be amply protected when the scheme for diverting the Elan and Claerwen to Birmingham comes before the Legislature. The argument on the export of minerals from Wales, he maintains, is not applicable to the sources of Welsh water. The latter are very few, and if lost irrecoverable; the former are practically unlimited. No one, he remarks, grudges England the full advantage of the Severn and the Wye when they leave Welsh territory; but Wales owns the sources of both rivers, and will insist on them and their tributaries being preserved for the benefit of Wales. No compensation for the loss of private rights over those springs will benefit Wales in the future. The letter continues: "Mr. Rendel quotes the precedent of Liverpool. Beyond the expenditure incurred by the formation of the reservoir in Wales, the county of Montgomery has secured no advantage from the water-works. The county rate is not increased in proportion to that outlay; and the floods last month caused as much damage as ever in the lower valley of the Vyrnwy. An accident to the embankment, either from insecurity or earthquake, is a constant source of danger; and if Welshmen want to drink its water, they must take it below Llanwddyn, where it becomes more or less polluted. Liverpool values that supply at three millions of pounds; and Wales may some day require to have it back at the price, and will be refused. I therefore positively assert that the diversion of the Vyrnwy has been an irretrievable national loss. The populations of English towns are so rapidly increasing, that their own natural water supplies are exhausted. They must either drink their rivers, none of which are free from impurities, or incur the serious cost of pumping water from wells. They have found what they want in the Welsh hills, and believe that Welshmen are so shortsighted as to barter their splendid advantages for a mere song, compared with the millions of pounds they are prepared to spend for the exclusive possession of the springs."

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

The Inverness Police Commission resolved last Monday to proceed with the extension of the Corporation gas-works, at a cost of about £10,000. The principal items of the extension will be the construction of a new gasholder of 380,000 cubic feet capacity, and the enlargement of the purifier plant. Thirteen years ago the storage capacity of the works was 180,000 cubic feet. The daily output at the busiest season now averages 280,000 cubic feet; so that an extension is imperatively necessary. It is proposed to throw aside two small holders which are used up, leaving the storage capacity at 510,000 cubic feet. The gas-works are by no means overburdened with debt. The total sum borrowed in connection with them was £40,360; and of that £7898 has been repaid—leaving £32,482 still due. Adding £10,000 to that sum, will raise the indebtedness of the Commissioners to about £42,500; which, at 4 per cent., would make an annual charge of £1690 for interest. This is surely not too much for a town like Inverness to bear; being, on an output of 40 million cubic feet a year, only something like 10d. per 1000 cubic feet—certainly no more than is paid in Edinburgh.

The Inverness Commissioners, or some of them, are still engaging in their wild-goose chase after reports which will satisfy them that the establishment of an electric lighting station would be an advisable thing. The latest which they have procured is in the form of a letter, dated Jan. 9, by Mr. F. Nell, of 16, Mark Lane, London, one of the engineers whom they are consulting. In it Mr. Nell says: "I note that the average consumption per hour (of gas), between the hours of 6 and 10 p.m., has been equal to 28,000 cubic feet, although the greatest consumption has possibly reached 37,500 cubic feet, one-eighth of the entire day's production of 300,000 cubic feet. This consumption (37,500 feet) is equal to 7500 five-foot burners, which are taken as equivalent to 16-candle lights. An equivalent number of 16-candle power incandescent lamps would require 750-horse power for generating the electricity. Therefore, the 520-horse power estimated in the report should provide two-thirds of the light required in the town." There is either a cool assumption or a palpable fallacy in this quotation. Inverness gas, as tested under the statutory condition of burning five cubic feet per hour, is of 25-candle power; and yet this "man of skill" takes a burner of that same capacity as only equal to 16 candles. He must have been judging Inverness gas by the London standard. Suppose his figures were corrected by adding the one-third to the duty of the gas which he robs it of, the horse power required to be an equivalent to it in electricity would be over 1000; and then the 520-horse power estimated in the report would only provide about one-half the light required in the town. This is probably too favourable as estimate for the electric light. Provost Ross, who should know better than I do, told the Commissioners that the proposals of the engineers would only provide light for one-seventh of the population. Another gentleman pointed out that, by abstracting water from the Caledonian Canal, they would lower the flow in the River Ness, which would lead to trouble with the proprietors of fishings. These and other considerations led the Commissioners to adopt a cautious policy; and they resolved, in the first instance, to ascertain whether the Canal Commissioners would give the necessary water.

Messrs. Hanna, Donald, and Wilson, of Paisley, have secured the contract for constructing a new gasholder at the Alloa Corporation Gas-Works, at a cost of between £5000 and £6000. Mr. Drysdale, of Glasgow, is to construct the tank.

The Dundee Police Commissioners are promoting a Police Bill in Parliament, one of the purposes of which is to give power to deal with the lighting of common stairs. At present the proprietors of properties which are entered by common stairs may be compelled to fit up gas-pipes, but not to supply gas for consumption. The Commissioners propose to retain the present powers as regards fittings, and to take powers to themselves to supply gas, at a charge not exceeding 15s. per burner per annum, to be levied from proprietors, who may recover the amount they pay from their tenants. The Commissioners would light and extinguish the lamps by their own servants.

Another gas explosion falls to be recorded, this time in Dundee; and the notable thing about it is that it occurred while the workmen of the Gas Commissioners were engaged in searching for a leak of gas. The explosion took place at two o'clock in the morning, in a two-storey house in the Lochee suburb. Eight persons were injured, two of them—an old woman who was in one of the dwellings in the tenement, and a police constable who was standing outside—rather severely. The workmen were at the time digging for the service-pipe, and were using a safety-lamp. It is supposed that the explosion was caused by a lamp inside the building.

Mr. Andrew Ross, late of the Paisley Gas-Works, who was appointed Manager of the Tain Gas-Works in the beginning of December, has already tendered his resignation. The reason for this step is not stated; but there must have been something very disappointing in the service when Mr. Ross could only hold the post for a month or so. The Gas Commissioners have resolved to fill up the vacancy from the list of candidates from among whom Mr. Ross was selected.

At the last meeting of the Hamilton Town Council, there was submitted a report which had been prepared by Mr. Gillespie, late of the Barrowfield Iron-Works, regarding the proposed extension of the gas-works. It had already been discussed by the Gas Committee; and they had agreed to delay further consideration of it. The Committee had also resolved to have inquiries instituted as to the practicability of introducing electric lighting into the town as a municipal concern, and as to the method and machinery by which it could be introduced. The Manager's report showed that the cost of making gas last month was 1s. 3³/₄d. per 1000 cubic feet; and the average illuminating power, 27·7 standard candles. Provost Archibald moved the adoption of the minutes of the Gas Committee. Ex-Bailie Tainsh, a former Convener of the Gas Committee, inquired if any better quality of coal was being supplied at the gas-works; and, in reply, the Provost said he understood that the coal in use was very much the same as had been used for a number of years. Mr. Tainsh would have it, however, that the quality was very inferior; but if that were so, how could inferior

coal, in ordinary working, possibly give gas of such a high average illuminating power as 27·7 standard candles? Mr. Tainsh's complaints seemed to excite practically very little interest amongst his colleagues, for the report of the Committee was adopted without any division being taken.

The placing of the Glasgow gasholder with the Glasgow firm rather than with the Paisley firm, has not given universal satisfaction outside any more than inside the Town Council. The "outside" objectors find a spokesman in the shape of an embryo Town Councillor, who states the case for them in one of the daily papers. He says: "By all fair means keep the city work to city ratepayers, so long as it can be done as well and as cheap, but such citizens must at the same time be made to feel that no preference should be expected; and, if any, it should rather be in favour of the Corporation, the work costing less to such a contractor than to the stranger or outsider." He goes on to say: "The 'time' clause was, in my opinion, of no real moment, and not in the essence of such a contract, for were the quality of Glasgow gas as it ought to be, the present gasholder accommodation is ample for many years to come. The increased storage clamoured for is to accommodate the additional bulk of low illuminating power gas, and which the public may blame itself for tolerating. The successful offerer can give more guarantee for the fulfilment of the contract than the other, who was £1200 lower; and, as previous jobs have proved, the firm is quite as capable and more likely to complete the work than the other." He finishes up by saying: "The question of a member of Council sitting upon a Committee having the power to give the contract to the firm of which he is said to be a partner, and a relative of the principals, and to which firm he is likely to supply the iron and steel required in the job, is surely, altogether too transparent to find justification." To me it seems that the authorship of this plain-spoken letter of complaint could be traced home to a local gentleman who has been long and intimately identified with the gas industry; and that is partly my excuse for giving it prominence in the JOURNAL. It would have been more satisfactory, however, if the writer had attached his name to the letter.

The Town Council of Paisley held an ordinary meeting as the Gas Commissioners on Tuesday evening; and in the course of the proceedings, ex-Provost Cochran raised a question as to the disposal of the gas surplus of the last financial year, which amounted to £8000. His opinion was that a sum of £4000 should go towards the reduction of the money borrowed, and the other £4000 towards the improving of the town. He thought that they should there and then come to an agreement as to what they should do with the gas surplus. The old Provost is a keen supporter of the policy of making town improvements out of gas profits; and he would keep up the price of gas unnecessarily high, so as to be able to get a haul out of the surplus every year for that purpose. The Convener of the Gas Committee (Councillor M'Farlane), who believes in the common-sense policy of having "every herring to hang by its own tail," explained that it had been agreed by the Council to hold the matter over for a time. But that explanation did not satisfy the ex-Provost, who forthwith gave notice of motion that at the next meeting of the Council they dispose of the gas surplus for two objects—to reduce the debt on the money borrowed, and to apply a part of it to the improvement of the town. It is confidently anticipated that he will get the support of the present Provost (Mr. MGown), who was long a Convener of the Gas Committee, and who agrees with Provost Cochran in depending to some extent on the surplus gas profits for the improvement of the town.

The Glasgow pig-iron market has again been very idle this week; but a few lots of Scotch iron have changed hands at 47s. per ton cash, at which there are still buyers. In hematite and Cleveland warrants, a little business has been done at between 47s. 10¹/₂d. and 47s. 6¹/₂d. per ton for the former, and between 38s. 2d. and 38s. per ton cash for the latter; the closing quotations being, respectively, 47s. 7d. and 38s. 0¹/₂d. per ton cash. There are now 76 blast-furnaces in actual operation—48 making ordinary iron, 22 working on hematite ore, and 6 making basic iron. At this time last year only 6 furnaces were blowing.

Water Supply and Electric Lighting at St. Helens.—General C. Phipps Carey, R.E., one of the Local Government Board Inspectors, held an inquiry yesterday week at St. Helens, into an application by the Town Council for sanction to borrow £2100 for works of water supply (principally for additional water-mains), and £1700 for the electric lighting and ventilating of the Town Hall. The case for the Corporation was presented by the Town Clerk (Mr. J. Jeeves); and there was no opposition.

The Managership of the Colne Gas-Works.—In the JOURNAL last week a paragraph appeared on the above subject, in which it was stated that Mr. G. Dyson, a member of the Colne Local Board, had been appointed Manager of the gas-works. The statement was given on the authority of one of our correspondents; but we received a telegram yesterday afternoon (too late for inquiries to be made into the matter) from Mr. H. Simmonds, the Manager, to the effect that the reported change is without foundation, and asking us to make the necessary correction.

The Dangers of Fire-Plugs.—In the Queen's Bench Division of the High Court of Justice last Wednesday, an action was brought by a Mr. Magney and his wife, against the East London Water-Works Company, to recover compensation for injuries suffered in consequence of a street accident caused, as they alleged, by the Company's negligence. The plaintiffs were dealers in crockery ware and in coals, and on the night of Sunday, Jan. 25 last year, they were driving along Mercer Street, Cable Street, E., when the pony put its foot into a water-plug hole and fell. Mr. Magney was thrown on to the road, his wife on to the front of the cart; and both were a good deal hurt. The pony was permanently lamed. The case for the plaintiffs was that there was want of care on the part of the Company in leaving the plug-hole uncovered. On the other side, it was said that the Company had affixed firmly a proper cover to the hole, and that some person had wrongfully interfered with it, or it had become damaged by frost. The jury heard evidence on both sides; and, in the end, they gave a verdict for the defendants.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, Jan. 16.

Sulphate of Ammonia.—The demand has been good; and the market is advancing steadily. It may be taken as a healthy symptom, and a proof of the soundness of the position, that there is no spurt, nor yet any excitement; and all purchases seem to be made simply to supply pressing requirements. It is quite evident now that the bulk of the consumers have been waiting for an illusory cheaper market, and they have come on the market with a fairly good grace, and, of course, prices are still low. The quotations were close on £11 towards the end of January last year; they were quite £12 at the same period in 1890; and at £12 10s. in January, 1889. Both France and Germany are operating, paying present full values. But Spain has been especially active; and a large quantity has been sold to that country. As some of the buyers have secured their most urgent requirements, spot parcels are perhaps not now quite so eagerly competed for. There is, however, comparatively so little offering, that a relapse cannot be thought of; while a continuance of the demand will have the effect of gradually pushing up prices further. The advance will, however, be in a measure regulated by the state of the weather—i.e., its severity or a return to a milder temperature. To-day's figures are £10 10s. to £10 12s. 6d.; and about 5s. per ton advance quoted for Feb.-April delivery. The nitrate market is firmer. The lowest price now is 9s. 4½d. per cwt.; and there is a good demand.

LONDON, Jan. 16.

Tar Products.—A somewhat better feeling obtains in the markets. Buyers have at last made up their minds that benzol is worth buying at to-day's price. Pitch, too, is in good request; but 3s. to 5s. per ton less is offered for next season's delivery. Solvent naphtha also is better; and forward business is being booked at 2d. above the price quoted below. Creosote, common oils, carbolic acid, anthracene, and naphthalene are all weak and unsaleable. Business has been done at the following prices: Tar, 20s. Pitch, 33s. 9d. Benzol, 90's., 2s. 2d.; 50's., 1s. 8½d. Toluol, 1s. 3d. Solvent naphtha, 1s. 1½d. Crude benzol naphtha, 30 per cent., 10d. Creosote, ½d. to 1d. Crude naphthalene, 35s. Crude carbolic, 60's, 1s. 1d.; crystals, 5d. Cresol, 8½d. Anthracene (nominal), "A" quality, 1s. 1d.; "B," 9d.

Sulphate of Ammonia.—This market is also stronger; and there is a good deal of inquiry for early spring delivery. Large sales have taken place, at prices ranging from £10 10s. to £10 15s., less 3½ per cent. Gas liquor (10 oz.) is quoted at 6s. 6d. to 8s. per ton, according to position.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—There is no specially new feature to notice with regard to the coal trade of this district. The better qualities, suitable for house-fire purposes, continue in active demand at full rates, with temporarily a scarcity of supplies owing to the recent stoppages of the pits; but the lower qualities, for iron making, steam, and general manufacturing purposes, continue only in moderate request, with supplies plentiful and prices barely maintained. At the pit mouth, best Wigan Arley coals average 12s. 6d.; Pemberton four-feet and second qualities of Arley, 10s. 6d. to 11s.; common house-fire coals, 9s. to 9s. 6d.; and steam and forge coals, 8s. to 8s. 6d. For shipment, there has been a fair demand with good qualities of steam coals delivered at the ports on the Mersey at about 9s. 9d. to 10s. per ton. The chief item of interest is a decided improvement as regards engine-fuel, supplies of which have been moving off much more freely; and with an absence of the recent competition with cheap surplus quantities, rather better figures have been obtainable in many cases—medium sorts showing an advance of about 3d. per ton upon recent quotations. At the pit mouth, burgy averages 6s. to 6s. 6d. for ordinary qualities, to 7s. for special sorts; best slack, 5s. to 5s. 6d.; medium qualities, 4s. 3d. to 4s. 9d.; and common sorts, about 3s. to 3s. 6d. per ton.

Northern Coal Trade.—There has been in the last few days more activity in the coal trade of the North; and with a fuller production, a better trade has been done. Best Northumbrian steam coal has been very freely sold at prices that vary from 10s. to 10s. 6d. per ton, f.o.b. Second qualities are scarcely so steady, at about a shilling per ton less; and small steam coal is also weaker, at from 3s. 6d. to 5s. per ton, according to quality. For best Durham gas coals there is a very large local demand; and the cold weather has kept the consumption of that class of coal above even the usually heavy requirements of this season. The price varies from 9s. to 9s. 6d., though there have been sales below the former price. Very heavy shipments of gas coals are being made to London just now, and also to some of the Mediterranean ports. Bunker coals are quiet; but the prices vary very much—from 8s. 6d. per ton upwards, the best Durham screened being 12s. per ton. Manufacturing coal is quiet, at rather lower prices. In coke, best blast-furnace kinds are firmer, and have been sold at higher prices, though the general quotation is 16s. 6d. per ton, f.o.b. For gas coke, the abundant supply is forcing down prices; and contracts as low as 8s per ton are now spoken of.

West of Scotland.—The coal trade in the West of Scotland continues quiet, and some difficulty has been experienced in obtaining supplies of coals for the loading of vessels now in harbour. There has been a spurt in the demand for household coal, in consequence of the severe weather; and prices are firm. For prompt delivery, buyers are conceding late rates; but there has been no forward business done as yet. Both foreigners and dealers are holding off, to see what effect the troubles in Fife may have; while the reduction in price there and in several parts of England may, it is also thought, influence the course of trade in the Glasgow district. The following are the prices at Glasgow Harbour: Splint, 9s. 3d. to 9s. 6d. per ton; main coal, 8s.; steam, 10s. to 10s. 6d.; ell, 8s. 9d. to 9s.—all f.o.b.

Electric Lighting for Chester.—The Chester Town Council last Wednesday adopted a recommendation of the Watch Committee, that a sum not exceeding £20,000 be voted for providing a first installation of the electric light for the borough.

Additional Storage Accommodation at the Carlisle Gas-Works.—In consequence of the increase in the consumption of gas at Carlisle, the Engineer of the Corporation Gas-Works (Mr. J. Hepworth) has received instructions from the Gas Committee to prepare plans and specifications for the extension of the No. 4 gasholder.

Suggested Purchase of the Sevenoaks Water-Works by the Local Board.—At a recent meeting, the Sevenoaks Local Board resolved to oppose the Provisional Order which the Water Company are making application for to the Board of Trade; and the Clerk was also instructed to write to the Company and ask whether they are prepared to sell their property.

Stroud Water Company.—An extraordinary meeting of this Company was held last Tuesday, at 11, Queen Victoria Street, E.C., for the purpose of authorizing the issue of a further £10,000 of 4½ per cent. debentures. Mr. Owen F. Jones, who presided, in explaining the object of the meeting, said that the sum would be raised in debentures of £100 each, bearing interest at not more than 4½ per cent. The whole amount would not be issued at once; but only such proportions as might be necessary to pay off the balance of existing Lloyd's bonds and other liabilities of the Company. They now owed upon Lloyd's bonds between £6000 and £7000. He proposed a resolution sanctioning the issue of the debentures; and this was unanimously agreed to.

The Hartley Reservoir of the Plymouth Corporation.—According to a statement presented by the Borough Treasurer at the meeting of the Plymouth Borough Council last Wednesday, the Hartley water reservoir has been an expensive piece of work. It appears that in 1859, £1814 was spent on land for the reservoir; and between that year and 1862, a sum of £7908 was expended in constructing it. Two years later, it cost £1166 in trying to stop a leakage. In 1882, an outlay of £3015 was incurred in reconstructing the reservoir; and last year the eastern wall was repaired at a cost of £402. These various items amount to £14,305. At the meeting on Wednesday, the Water Committee submitted a report, recommending that the northern wall be now re-erected at an estimated cost of £1700; but the report was referred back to them, with instructions to inquire into the works necessary to put the reservoir into a thoroughly satisfactory condition.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 104.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon invest-ment.
£			p. c.					£ s. d.
GAS COMPANIES.								
590,000	10	15 Oct.	10½	Alliance & Dublin 10 p. c.	10	16-17	..	6 3 6
100,000	100	"	7½	Do. 7 p. c.	10	11½-12½	..	6 0 0
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105-107	..	4 13 5
100,000	20	27 Nov.	8	Bahia, Limited	20	12-14	..	11 8 6
200,000	5	12 Nov.	7½	Bombay, Limited	5	6½-7	..	5 7 1
40,000	5	"	7½	Do. New	4	4½-5½	..	5 14 1
380,000	Stock	13 Aug.	12½	Brentford Consolidated . . .	100	210-220	..	5 11 4
125,000	"	"	9½	Do. New	100	157-162	..	5 14 2
220,000	"	16 Sept	11½	Brighton & Hove Original .	20	40-42	..	5 9 6
888,500	Stock	16 Sept.	5	Bristol	100	98-103	..	4 17 1
320,000	20	15 Oct.	11½	British	20	42-44	..	5 2 3
50,000	10	28 Aug.	11½	Bromley, Ordinary 10 p. c.	10	18-20	..	5 15 0
50,380	10	"	8½	Do. 7 p. c.	10	13-15	..	5 13 4
328,750	10	"	—	Buenos Ayres (New) Limited	10	5½-6½	..	—
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	90-95	..	6 6 4
150,000	20	13 Aug.	8	Cagliari, Limited	20	24-26	..	6 3 1
550,000	Stock	15 Oct.	13½	Commercial, Old Stock . . .	100	240-250	..	5 10 0
165,000	"	"	10½	Do. New do.	100	190-195	+2½	5 10 3
130,000	"	30 Dec.	4½	Do. 4½ p. c. Deb. do.	100	117-122	..	3 13 9
800,000	Stock	30 Dec.	13	Continental Union, Limited.	100	225-235	+5	5 10 8
200,000	"	"	10	Do. 7 p. c. Pref.	100	185-195	..	5 2 7
75,000	Stock	16 Sept.	10	Crystal Palace District . . .	100	190-200	..	5 0 0
486,090	10	15 July	10	European, Limited	10	19-20	..	5 0 0
354,060	10	"	10	Do. Partly paid	7½	14-15	..	5 0 0
5,470,640	Stock	13 Aug.	13	Gaslight & Coke, A, Ordinary	100	218-223	-4½	5 16 7
100,000	"	"	4	Do. B, 4 p. c. max.	100	95-98	+1	4 1 7
665,000	"	"	10	Do. C, D, & E, 10 p. c. Pf.	100	248-253	..	3 19 1
30,000	"	"	5	Do. F, 5 p. c. Prt.	100	118-123	..	4 1 4
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	172-177	..	4 4 9
1,300,000	"	"	7	Do. H, 7 p. c. max.	100	152-157	-1	4 9 2
463,000	"	"	10	Do. J, 10 p. c. Prt.	100	245-250	..	4 0 0
476,000	"	"	—	Do. K, 6 p. c. Prt.	100	145-150	..	4 0 0
1,061,150	"	11 Dec.	4	Do. 4 p. c. Deb. Stk.	100	110-114	..	3 10 2
294,850	"	"	4½	Do. 4½ p. c. do.	100	118-123	..	3 13 2
908,000	"	"	6	Do. 6 p. c. do.	100	160-165	..	3 12 9
3,800,000	Stock	12 Nov.	12	Imperial Continental	100	224-229	+3	5 4 9
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4-4½	..	6 13 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5p. c. Deb.	100	109-111	..	4 10 1
541,920	20	27 Nov.	6½	Monte Video, Limited. . . .	20	15-16	..	8 2 6
150,000	5	27 Nov.	10	Oriental, Limited	5	8½-9	..	5 11 1
60,000	5	30 Sept.	7	Ottoman, Limited	5	4-5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited.	10	2½-3½	..	—
People's Gas of Chicago—								
420,000	100	3 Nov.	6	1st Mtg. Bds.	100	94-99	..	6 1 3
500,000	100	1 Dec.	6	2nd Do.	100	93-98	..	6 2 5
150,000	10	15 Oct.	10	San Paulo, Limited	10	10-12	-½	8 6 8
500,000	Stock	28 Aug.	15½	South Metropolitan, A Stock	100	265-275	..	5 12 9
1,350,000	"	"	12	Do. B do.	100	222-227	..	5 5 8
200,000	"	"	13	Do. C do.	100	225-235	..	5 10 8
700,000	"	30 Dec.	5	Do. 5 p. c. Deb. Stk.	100	138-143	..	3 10 0
600,000	Stock	16 Sept.	11½	Tottenham & Edm'ton, Orig.	100	—	..	—
WATER COMPANIES.								
729,331	Stock	30 Dec.	10	Chelsea, Ordinary	100	260-265	+2½	3 15 6
1,720,560	Stock	15 Oct.	8	East London, Ordinary . . .	100	206-211	+2	3 15 11
544,440	"	30 Dec.	4½	Do. 4½ p. c. Deb. Stk. . . .	100	136-140	..	3 4 3
700,000	50	11 Dec.	8	Grand Junction	50	99-104	+1	3 16 11
708,000	Stock	13 Aug.	10½	Kent	100	270-275	..	3 16 4
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max. . . .	100	225-235	+5	4 0 10
406,200	100	"	7½	Do. 7½ p. c. max.	100	189-194	..	3 17 4
260,000	Stock	30 Sept.	4	Do. 4 p. c. Deb. Stk.	100	120-123	..	3 5 0
500,000	100	13 Aug.	12½	New River, New Shares . . .	100	335-345	..	3 10 4
1,000,000	Stock	30 July	4	Do. 4 p. c. Deb. Stk.	100	125-127	..	3 3 0
902,300	Stock	30 Dec.	6½	S'thwk & V'xhall, 10p. c. max.	100	149-154	..	4 4 5
126,500	100	"	6½	Do. D 7½ p. c. do.	100	140-145	..	4 9 8
1,155,066	Stock	11 Dec.	10	West Middlesex.	100	245-255	..	3 18 5

Messrs. C. Wilson and Sons, of Leeds, have opened show-rooms for their various types of gas cooking-stoves and other appliances at No. 76, Queen Victoria Street, E.C., and at No. 32 Rue de Bondy, Paris.

Advance of Gas Workers' Wages at Hull.—As the result of demands put forward by the workmen employed by the British Gas-light Company at Hull, the Directors have made certain concessions in regard to their remuneration. The wages of the cinder men are advanced from 4s. 4d. to 4s. 8d. per shift of eight hours, and the men are to be paid time-and-a-half instead of time-and-a-quarter for Sunday work, double time for Christmas Day (instead of a gratuity of 2s. 6d. being given to each man), also for Good Friday and two former holidays granted to men who had been twelve months in the Company's service. In lieu of these two holidays, the men will be paid for Whit Monday and the August Bank Holiday; in other words, they will get four holidays instead of two, and be paid single time if not at work those days. These are the Leeds terms; and at a meeting held by the men last Wednesday, the Directors and the Manager (Mr. A. Dougall) were thanked for the courteous manner in which their application had been received and dealt with.

The Artesian Well in the City.—At the meeting of the Commissioners of Sewers last Tuesday, the Engineer (Mr. W. Haywood) presented a report on the works which had been carried on at the artesian well since the last meeting. It set forth that, when the depth of 512 feet had been arrived at, the character of the chalk changed; and he ordered the boring to be stopped at a depth of 513 feet. By means of the present pumps, 70,000 gallons of water daily could be raised, which was more than three times the quantity required for the artisans' dwellings. He thought the well was capable of raising 100,000 gallons in 24 hours. He further recommended that, in order to serve the artisans' dwellings, pumps and a gas-engine should be set up, and pipes laid down; and he estimated that the total cost of supplying 20 gallons of water per head per day would be £1690, which did not include the cost of a duplicate engine. The present cost of the supply from the New River was £80 a year; but the new supply would cost about £150 a year, not including depreciation of machinery. Mr. Pannell asked if the surplus supply could be dealt with in any way. The Solicitor said they could do nothing but give the water away. The Commissioners had no power to break up streets for the purpose of supplying water or to invest the ratepayers' money in lead pipes, &c. Mr. Morton asked how it was that the Commissioners could lay water-pipes and break up the streets for the citizens. The Solicitor said it was done under the Commissioners' own Act of Parliament for lighting and cleansing the streets. Mr. Wallace then moved that the report should be referred to the Streets Committee; and this was adopted. It was also agreed to give the Engineer instructions to complete the well in all particulars.

The Coal Production of the United States Last Year.—The production of anthracite coal in the United States last year amounted to 42,839,779 tons; while that of bituminous coal was 98,000,000 tons—being both considerably larger than in 1890.

Petroleum and Gas in France.—At the present time, the members of both the Chamber of Deputies and the Senate in Paris are displaying great anxiety to prohibit the importation of refined petroleum into France. Although, according to the Paris correspondent of the *Daily News*, this is ostensibly due to a desire to protect French refineries, it is really in the interest of shareholders in the Paris and provincial gas companies. "If," says that authority, "petroleum were as cheap in France as it is in England, gas shares would come down with a jump from their present high prices to fairly moderate ones." While 9d. per gallon is the charge for petroleum in England, in Paris it is no less than 8d. per quart.

The Gas Supply of Middlesbrough.—In moving the adoption of the minutes of the Gas Committee at the meeting of the Middlesbrough County Council last Tuesday, Alderman Bell referred to complaints which had been made as to the defective supply of gas in the borough. He said that, from a report which their Engineer (Mr. D. Terrace) had made on the subject, it did not seem to him possible to demonstrate that the defective lighting was attributable to any change in the conditions at the gas-works; and the gas, so far as he had been able to judge, was as good as it had ever been. He was not prepared to assert that the pressure all over the town was as satisfactory as it might be—indeed, he was perfectly ready to admit that the Gas Committee, in view of the many changes contemplated, had not kept pace with the growth of the town, and that in some districts there was hardly so great a volume of gas as would satisfy the wants of the consumers. The Council were, however, asked that day to sanction the laying of a new main from the gasholder on the Marshes, which would, he hoped, give a much more adequate volume of gas to the south part of the town, and would thereby relieve the whole of the other mains. In the course of a short discussion on the subject, Alderman Bulmer expressed the opinion that they had never had better gas than at present; and great credit was due to Mr. Terrace, for they had been able to lay off 25 beds of retorts, and had still supplied the wants of the town. During the past year they had sold 1,500,000 cubic feet of gas more than in the previous year; and they had actually obtained 500 cubic feet of gas out of every ton of coal beyond what they did in the preceding year. Alderman Bell further remarked that the make of gas had increased during the year by 5 per cent., which was quite in proportion with the growth of the borough. He undertook that no endeavour should be wanting to give a satisfactory supply throughout the town. The minutes, including that authorizing the laying of the new main, were then confirmed.

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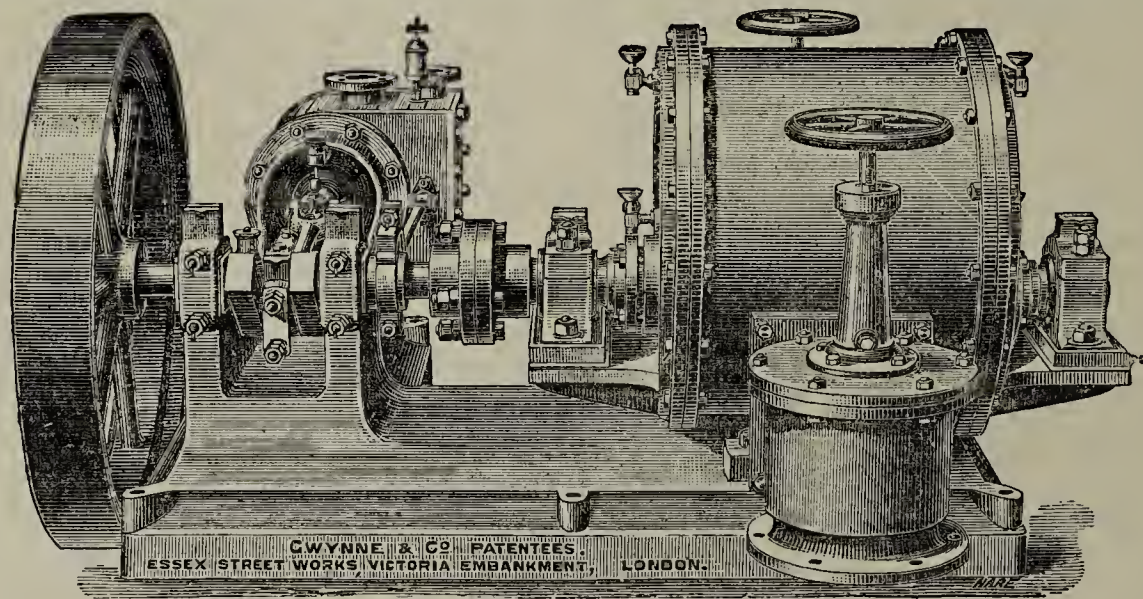
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NOTICE TO SUBSCRIBERS

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Subscribers who desire to avail themselves of the reduction in the Subscription to the JOURNAL (21s.) by paying in advance for the Year 1892, are reminded that this can only be done during the month of January.

THE

JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JANUARY 26, 1892.

The Chartered Dividend.

THE announcement was made after last Friday's meeting of the Board of The Gaslight and Coke Company, that a dividend after the rate of 12 per cent. on the ordinary stock of the Company would be recommended to the proprietors at the forthcoming general meeting. This is a drop of 1 per cent. for the half year, which the proprietors will not like. The question remains, as to what extent the reserve has been drawn upon to pay even this reduced rate of dividend. All comments upon the financial condition of the Company must, however, be reserved until the accounts relating to the past half-year's working have appeared; but it would be affectation to pretend that anybody expects that these will present a satisfactory

aspect, in face of the recent serious rise in the price of gas, which has been marked with murmurings of discontent both loud and deep from all classes of the Company's consumers, public and private. The circumstance of some of these complaints going outside the mark, and losing their point in irrational vituperation against the action of a band of "irresponsible monopolists," as the Directors are styled in some published protests against the rise in price, is not to be taken as an excuse for neglecting these symptoms of popular dissatisfaction. Some of the newspaper critics of the Chartered Board appear to think that they have withered the subjects of their injurious remarks by merely calling them "monopolists;" while a few Vestries have vapoured about patronizing electric lighting. It has also been urged that such a serious tax upon the Chartered Company's district as is involved in an increase in the price of gas by 4d. per 1000 cubic feet ought not to be levied without the consent of the Board of Trade. Again, the assertion is widely offered that the recent increase in price is made arbitrarily, merely in order that a few "bloated capitalists" may continue to divide enormous profits. All these expressions of the popular discontent, with others of like quality that need not be stated here, but which will recur to readers of the London newspapers, can be dealt with gaily by such accomplished masters of verbal fence as Colonel Makins, M.P., the Governor of the Company, and the Secretary and General Manager, Mr. John Orwell Phillips, who so recently had an "innings" in the columns of the *Daily News*, and therewithal claimed to have scored a win for his Company "off his own bat." We take the liberty of reminding these gentlemen, with all due respect, that this sort of thing may be "magnificent;" but it is "not war." A victory of words over a not very incisive critic, or an easy bedazzlement of an amiable newspaper reporter, will not meet the case as it can be presented by anyone who knows the open secret of good gas management. The motive with which competent critics will scan the forthcoming accounts, and watch the proceedings at the general meeting on the 5th prox., is no more nor less than the justifiable desire to ascertain whether the actual condition of the largest gas undertaking in the world is explainable by circumstances, or reflects in any way upon the quality of its management. The Administration of the Chartered Company has on former occasions betrayed a restiveness under criticism which is no indication of strength. The Governor has uttered remarks, which he evidently meant to be scornful, respecting the judgments of "irresponsible critics" upon the Company's management; and we have had to remind him that the Chartered Board are no more exempt from criticism than any other public or quasi-public body. For the present, it will be sufficient to enumerate the following counts in the indictment which public opinion is now bringing against the Horseferry Road Administration, and of which it must be admitted that they are solid enough and grave enough to deserve the most devoted attention of any Board of Gas Directors who might be similarly challenged. These are: First, that they cannot sell gas of the same quality under 7d. and 9d. per 1000 cubic feet respectively in excess of the prices asked by their smaller neighbours. Secondly, even at this advanced price they cannot earn the dividends they declare.

The explanation of these facts, the former of which is the chief concern of the public, as the latter is of the proprietors whose trustees the Directors are, must be sought among the various considerations which are to be classified under the heads of circumstances and management. The circumstances affecting the business of gas supply in London do not apply only to one of the Metropolitan Gas Companies. They affect all; and if they do not work the same results in all, that is a question of internal constitution and management. Constitution is, after all, an affair of administration or management, for the arrangements of a gas company are not unalterable by superior power; and we opine that, if the public were told that there is something in the constitution of a gas undertaking which has the practical effect of preventing its managers from selling gas as cheaply as might be, there would soon be a movement for demolishing the obstacle, whatever its nature. In the present instance, the constitutional conclusion that forces itself upon an observer of Gaslight and Coke affairs is that amalgamation has apparently failed of its sole public justification—keeping down the price of gas to the lowest possible figure. If it is denied that amalgamation, as

a principle, is discredited by the present peculiar condition of the Chartered district with regard to the price of gas, there is no escape from the alternative explanation that the trouble must be due to special causes—that is to say, to bad management.

The forthcoming accounts will be diligently searched for the evidence for and against this ultimate conclusion, which they must disclose under the headings of capital outlay and working expenses. But the accounts are, after all, only the record of the life that the organism has lived. They do not disclose the causes which have made them what they are, the continued operation or the cessation of which in the future is of even greater moment than their past results. Hence the most interesting subject of discussion at the present time, with regard to the affairs of The Gaslight and Coke Company, is not what the half-year's accounts may disclose, but how they are brought about. For it is notorious that there have been shifts and changes among the head-quarters and distributed staffs; and there is a notion abroad that these changes indicate the existence of grave troubles in and about the organization. When speaking of the affairs of the Company, the Governor, as well as every other responsible spokesman for the Administration, has shown an apparently incurable tendency to overwhelm inquirers with big figures descriptive of the scale of the Company's operations. "Do you know how much gas we make, how many men we employ, how much coal we buy every year?" This is the burden of the Horseferry Road apologists. It is necessary, therefore, to remind all whom it may concern, on the eve of the general meeting, that these glorifications of mere bulk are wholly beside the mark. A big gas undertaking may be as easily mismanaged as—more easily perhaps than—a small one. It is perfectly idle to think that a dissatisfied critic can be buried, argumentatively, under a vast heap of coal. He will still ask: "Is your gas economically made? are your men profitably employed? and do you buy your coal as cheaply as you might?" If one of these questions cannot be satisfactorily answered, then the bulk of the operations to which it refers only aggravates the evil. If we were to urge the Chartered Board to forget the magnitude of their business, the advice would be taken in a wrong sense; but what has bulk to do with such questions as, "How is your capital being laid out? what is the average production of your carbonizing plant per mouthpiece? how much coal do your men handle for their wages? how does your fuel account stand? what is your true make per ton? are your works fairly proportioned and well arranged? and is your general system of business good?" These are subjects of consideration which cannot be set aside by picturesquely comparing the revenue of The Gaslight and Coke Company to that of the Kingdom of Greece, or by constructing an imaginary Eiffel Tower of the daily output of the Company's stations. Let us conclude this essay in "irresponsible criticism" with a respectful intimation to Colonel Makins that the only effectual way for the Board of which he is the official head to shake off hostile critics of their administration of the undertaking, is to rise superior to censure. It will not do to assert *ore rotundo* that "all is for the best in the best of all possible" gas companies, when the gas bills of London exhibit such very startling contrasts as they do between East and West, and North and South.

Law Reforms.

THE whole of the business community is interested in the measures now being discussed with the object of restoring the efficiency of the High Court of Justice in regard to the determination of commercial actions; and we therefore make no apology for alluding here to the suggestions to this effect contained in the report of a Joint Committee appointed by the Bar Committee and the Incorporated Law Society, which was recently submitted to the Lord Chancellor and the Judges. The reproach of dilatoriness does not apply to this Committee; for its members were only nominated on the 7th and 11th ult., and they reported within little more than a month, notwithstanding the intervention of the Christmas vacation. Well may all suitors marvel at the disparity between this celerity and the sluggishness with which the legal profession usually deals with the affairs of third parties. The recommendations of the

Joint Committee, moreover, are as incisive and business-like in character as their production has been prompt. It cannot be doubted that they were carefully considered at the Grand Council of the Judges which was held yesterday week; and something is sure to transpire at no distant date to indicate the views of the occupants of the Bench respecting these practical suggestions of the solicitors and barristers. In brief, the gist of the proposals is that a separate list, to be styled the "Commercial List," should be established for the entry of commercial actions for trial in London and Middlesex; and that this list should be disposed of, apart from all other work of the Queen's Bench Division of the High Court, either by a Judge of this Division specially assigned by the Lord Chancellor for the purpose, or by one permanently added to the Probate, Divorce, and Admiralty Division for the trial of commercial actions. Questions relating to patents, commercial contracts, dealings with or in relation to mercantile property of any kind, and similar matters, would naturally come into this classification. It is believed that in practice there would be very rarely any difficulty in deciding what is properly a commercial or mercantile action. Either party should have the right of entering causes in this list; and the actions would be heard by the Judge, sitting with or without assessors, and with or without a special jury. All the incidents of every suit would come under the cognizance of the Judge; and it is suggested that when the Commercial Court has been constituted, it will become a matter for further serious consideration whether or not the present system of pleadings, and the rules of evidence, might not wisely be modified in commercial actions. All this we cordially support. It is clear, as the Committee suggest, that commercial suitors "want a reduction of the expenses of litigation in the stages preliminary to the actual trial, a means of ascertaining with a tolerable degree of certainty when the trial will take place, and a speedier process in getting to the trial than is given to them now." They also want a better assurance that the bearings of their cases, when these involve technical points, are properly grasped by the Judge than they get by the present extravagant and unsatisfactory method of pitting expert against expert in the witness-box. If the recommendations of the Joint Committee did no more than aim a blow at the "expert witness" abuse, we should regard them favourably. They do more than this, however; and we esteem the general idea of a Commercial Court a very practical and most hopeful one. The lawyers have evidently not been blind to the fact that whereas the Admiralty Court commands the confidence of the mercantile community, the other Divisions of the High Court of Justice have lost, if they ever had, this testimony to their usefulness to the commercial world. Let us hope that the grievances of suitors will, as far as possible, be remedied, now that solicitors, advocates, and judges agree in admitting that the present system requires to be reformed.

Gaseous Fuel and Fog Prevention.

A CLEARLY-STATED contribution to the fog literature of *The Times* recently appeared, with the signature "R. Russell," which argued, in most conclusive fashion, that if fuel were burnt in London without the production of smoke, the excessive prevalence and noxious character of London fogs would be simultaneously abolished. This argument was put forward to meet the remarks of those who depend upon Mr. Aitken's experimental results for supporting the opinion that, even if all the fuel burnt in London were smokeless, the London fogs would be, in most essentials, as pernicious, if not as black, as ever. Mr. Russell demolishes this contention, which he describes as an illustration of the "danger of making large generalizations from interesting but inadequate experiments in the laboratory," by referring to the examples of the South Wales towns in which anthracite is burnt, and to the alteration produced in the atmosphere of Pittsburgh (Penn.) by the introduction of natural gas. He points out that the mischief of coal smoke is that it hinders the dissipation of natural fog, and prevents the ascent of low-lying strata with all their impurities, which naturally occurs when the sun is able to penetrate the mist and warm the earth. The products of combustion, with their specially mischievous solid and tarry particles, are consequently poured downwards, and beaten to a low level, with increasing density as the proportion of artificial matter increases. "Coal

"smoke alone prevents the dissipation of fog which usually takes place in clear anticyclonic weather in the neighbouring country." Mr. Russell winds up this part of his argument by dogmatically stating that "no large town exists which burns only smokeless fuel of any kind which is troubled with fog, mist, or cloud in the slightest degree above that of similar situations in the surrounding country." So far, good. But unfortunately for his reputation for consistency, this writer, with all his ability for stating a case, cannot finish his letter without falling into the common error of ignoring facts, and asserting that a certain arrangement, which he mentions, would have results of a particular kind, whereas it actually does nothing of the sort. How often does a good controversialist "let himself out," as the Yankees say, in this fashion! Given an "if," and we are fully assured that all sorts of consequences may be expected to follow; whereas we may be able to point to illustrations where the premiss exists, yet the predicted results fail to show themselves. In this case, Mr. Russell says, as though the statement admitted of no dispute, that "municipal control of heating systems, especially of gas supply, would give facilities for improvement which do not at present exist." Well, what of the examples of this control which have exhibited themselves to the community for many years—Manchester and Birmingham to wit? Have these Municipalities done anything to disestablish their local fogs by reducing the price of gas to its lowest manufacturing cost? Not at all. They have subsidized their ratepayers; and this is what the Progressives of the London County Council would do to-morrow if they could get possession of the revenues of the Metropolitan gas undertakings, and nobody would be one penny the better.

Deeds, not Words.

AN American gentleman, to whose projects in the department of water-gas manufacture we have paid some little attention—Mr. Henry C. Rew—has favoured us with a somewhat impassioned letter protesting against the slighting way in which he evidently considers that we have commented upon his "latest" suggestions in this line. Mr. Rew also transmits for our edification a copy of an American technical newspaper which we rarely see, but which is evidently one of the ordinary run of subsidized manufacturers' "organs" that flourish in the hotbed of M'Kinleyism, containing a description of a yet later scheme of his. He wishes to offer a reward of £1000 to anybody who can beat his methods; but he has forgotten to put up his stake. Anyhow, he desires to impress the world at large, through us, that he, Henry C. Rew, of Chicago, is somebody to be taken seriously, as befits the case of a man who can say absolutely the last word upon such an important subject as the manufacture of water gas. Well, it is not only for the behoof of Mr. Rew that we take the trouble to mention his claims in these columns, but quite as much for the sake of the somewhat numerous tribe of projectors—called in the great American language, we believe, by the expressive name of "process-cranks"—and their victims. We have in the course of every year to deal with a considerable number of this sort of geniuses, who never make anything beyond promises, but who are profuse of offers to stake their reputation—whatever this may stand for—or even their money (which they never show), upon the superiority of their schemes to all others that can, may, shall, or will be mentioned in the same breath with them. To hint, ever so gently, to a gentleman of this order that an ounce of performance is worth a ton of promises, is generally regarded as a deadly insult. Yet, necessarily painful as the effort very frequently is, we are obliged to adhere to this elementary method of testing unrealized professions. Now, in this case of Mr. Rew, who wants to bet £1000 upon the superiority of his "methods," is it unfair to ask where, and to what extent, these methods have objective existence? There are so many projectors who cackle before they have laid their egg, that one can never be too careful in making sure of the order in which these phenomena stand, especially when one is proposed as evidence of the other. The editor of a technical publication is regarded as the natural recipient of every schemer's protestations of ability to work wonders. He cannot help giving ear to these tales; but, however trusting and credulous he may be originally, he grows wary in the end. The existence of an editor of a technical journal who is not open to give

"bold advertisement" in his free and independent columns to anything and everything that may be brought to him with recommendations of a sterling or negotiable character, is likewise a fact incomprehensible to certain minds. The warning which we should be grateful if all our readers and correspondents would bear in mind, lies in the reminder that conductors of technical papers have an unconquerable predilection for accomplished facts. Let it be wrapped up never so cleverly, both newspaper writers and newspaper readers unerringly detect promise under the disguise of performance, and presumption arrayed as observation. Even when an editor sells himself to palm off the former for the latter, it avails nothing, for the least critical of readers can always see through the pretence. Wherefore, all projectors of great schemes and proclaimers of the standard of perfection in any technical matter should take heed that they deserve respect by their deeds, before claiming it for their words.

Title and Index to Volume LVIII.—The title-page and index to Vol. LVIII. of the JOURNAL (July to December, 1891) will be ready to-morrow; and, as usual, a copy will be forwarded post free by the Publisher, on receipt of a post-card from any subscriber.

The Use of Gas for Melting Snow.—Although the fall of snow during the present winter has been small in comparison with that of 1890-91, it has nevertheless brought forward the usual number of suggestions, more or less feasible, for getting rid of it. Among other propositions, the use of ordinary coal gas has been mooted; but its absurdity can be seen by comparing the known heating value of gas with the work to be accomplished. This has been done by Mr. Thomas Fletcher, F.C.S. He shows that 6 inches of average snow, when melted, becomes $\frac{1}{2}$ inch depth of water, 24 square feet of which will weigh 62 $\frac{1}{2}$ lbs., or 23 $\frac{1}{4}$ lbs. per square yard. At this rate the snow on a mile (1760 yards) of street 20 yards wide would, if 6 inches deep, weigh 823,680 lbs., or 363 $\frac{1}{4}$ tons. The heating power of London gas is 660 units per cubic foot; and of this we may take it that, as a maximum, 500 units could be utilized. It has been proved repeatedly and beyond question that 1 lb. of snow at freezing-point requires 150 units of heat to melt it and raise the temperature of the water obtained to 40° Fahr.; and this effect would be produced on 3 $\frac{1}{8}$ lbs. of snow by the consumption of a cubic foot of coal gas. From the above data, it will be found that to melt the snow in the assumed mile of street would require the consumption of 247,000 cubic feet of gas, costing, at 3s. per 1000 cubic feet, a little more than £37, or at the rate of £3256 per square mile. As there are a great many square miles of streets in many towns, and as the snowfall has already been nearly double that assumed, Mr. Fletcher says it will be seen that the problem is certainly not one to be solved by this method. Even assuming that the cost of gas and labour were not prohibitive, the fact that the ground itself is usually colder than 32° Fahr. must be taken into account; and the ground would also have to be warmed, or a thin surface of glassy ice, of the most slippery and dangerous kind, would remain after the snow was removed. This alone would condemn the project as unworthy of consideration.

Another Ammonia Engine.—Particulars have already been given in the JOURNAL of the Campbell ammonia engine. Another motor of this class, the invention of Mr. P. J. M'Mahon, is being tested in the grounds of the Chicago Exhibition, with the view of its utilization in drawing street cars. It is operated by anhydrous ammonia; and it consists of a double engine, of the same form and appearance as those used in small locomotives. The ammonia, as a liquid, is carried in a drum contained in an iron tank under a pressure ranging from 150 to 185 lbs. This drum connects with a similar drum, which serves the same purpose as the steam dome of a boiler—that is, to give dry gas. In a part of the iron tank separated from the ammonia is a certain quantity of water, into which the exhaust is discharged and absorbed. As the affinity between water and ammonia is great, the absorption is produced with considerable rapidity; and no back pressure, or practically none, takes place. The cylinders of the engine are enclosed in a tank, so that the gas escaping from leaks is at once absorbed. This arrangement also prevents freezing of the cylinders. When the gas has been used to such an extent that the pressure is insufficient to operate the motor, the car is run into the generating station, the spent liquor withdrawn, and the gas-tank filled again. The liquor is then pumped from the receiving-tank to the generator, where the application of heat serves to separate the gas from the water; the gas passing into a separator, where it is freed from the small amount of water carried over as steam, and then passes on to the condenser, which consists of a number of pipes, where a constant stream of water, flowing over the pipes, cools and condenses the gas to a liquid, which then passes into the supply-tank. The heat in the generator serves to expel the greater portion of the gas, so that nearly pure water is left; and this is withdrawn from the generator and stored in a tank until used to supply the absorption-tank on the motor. It is asserted that the cost of operating the motor is small; and improvements are being effected which will make the machine still more economical.

WATER AND SANITARY AFFAIRS.

THE precise form in which the inquiry is to be conducted by the forthcoming Royal Commission on the Water Supply of London is set forth in the letter from the President of the Local Government Board, addressed to Sir John Lubbock, and read at the meeting of the County Council last Tuesday. The Commission will have to inquire, in the first place, whether, taking into consideration the growth in the population of the Metropolis, and the districts within the limits of the Metropolitan Water Companies, and also the needs of the localities not supplied by any Metropolitan Company, but within the watersheds of the Thames and the Lea, the present sources of supply of these Companies are adequate in quantity and quality. In the next place, if the Commissioners consider these sources to be inadequate, they will have to enter into the question whether such supply as may be required can be obtained within the watersheds referred to, "having due regard to the claims of the districts outside the Metropolitan, but within these watersheds." Finally, if the two watersheds are unequal to the demand thus to be made upon them, the Commissioners will have to debate the alternative of going outside that area in order to obtain the requisite supply. At the outset, the sufficiency and suitability of "the present sources of supply" come under review. So far as quantity is concerned, there need be no doubt as to its adequate nature, as compared with the present population. As the population increases, the Companies will, of course, extend their works, and enlarge the volume of water sent through their mains. The next step in the inquiry is whether the watersheds have due capacity for supplying all demands. There is a coming generation, and there are localities not yet supplied by any Metropolitan Water Company, but which have an indefeasible claim on the water which may be obtained within their area. Still, we would observe, there is no proof forthcoming to show that the resources inherent in the watersheds are unequal to the supply of the requisite quantity of water, so that the entire population may enjoy an ample provision, allowing for all probable addition to the number of the inhabitants for many years to come. If the London Water Companies have at any time tapped the natural resources of a district, they have also given back an adequate supply through their pipes, while taking the surplus quantity for more general use. We must say that the instructions to be given to the Royal Commission, as recited in Mr. Ritchie's letter, constitute a very large order. Are the Royal Commissioners going as far as Banbury Cross with their investigations? If they are, they will still find themselves within the watershed of the River Thames. If they purpose taking a supply from some remote region, what is to be done with the supply which exists at home? Is it contemplated to supplement the existing sources, or to supersede them? How far will the Commissioners be expected to look into the future—forty, fifty, or a hundred years? and if they look so far, will their prescience be correct? A Ministerial statement in the House may be expected to throw further light on these topics. The subject seems widening out almost to the dimensions of a national inquiry, especially if some huge gravitation scheme is to be entertained.

Although the Royal Commissioners charged with the inquiry into the Metropolitan Water Supply will deal with the subject according to their own will, within the limits laid down in their instructions, it will yet be interesting to consider at this stage what are the facts they are likely to meet with. Concerning the quantity, a writer in the current number of the *Quarterly Review* goes carefully into the subject, and gives good reasons for accepting, "without hesitation," the total estimate of 300 million gallons per day as the quantity which may be obtained, on behalf of London and its environs, from the Thames and the Lea, supplemented by water from springs and wells. It is further calculated that when the constant supply becomes universal through the districts of the London Water Companies, 25 gallons per day will be sufficient per head of the population, including the use of water for all purposes. At this rate, 300 million gallons per day would suffice for the wants of 12 millions of people—a population which London and the surrounding parts are not likely to possess until at least sixty years have passed away.

Twenty large towns, where the constant service is given, show an average daily consumption, for domestic use, of 14 gallons per head. The addition to be made for purposes other than domestic varies in different towns from as low as two or three, up to nine or ten gallons per head. Respecting quality, the Duke of Richmond's Commission reported in 1869 that they saw no reason to believe that the water supplied by the Companies was otherwise than "generally good and wholesome." Speaking of the germ theory, and the objections founded upon it in reference to the London Water Supply, the Commissioners in 1869, after giving "respectful attention" to such objections, said: "We cannot admit them as sufficiently well established to form any conclusive argument for abandoning an otherwise unobjectionable source of water supply." Such having been the results arrived at in 1869, official evidence abounds to show that the quality of the supply has been materially improved since that date. An immense advance has been made in filtration; and other improvements have been effected. These and other facts are adverted to by the writer in the *Quarterly Review*, whose sober and temperate article cannot fail to have weight with every candid reader. The article has been called a "defence of the Water Companies;" but the defence is furnished by the authoritative and independent witnesses who are cited. The *Daily Chronicle* has endeavoured to make it appear that the Duke of Richmond's Commission "condemned" the Metropolitan Water Supply. How far this is true may be judged by the quotations we have made from the report of that Commission.

Electric v. Gas Lighting in Japan.—It is stated that the results of the electric lighting experiment which has been tried at Tokio have been so unsatisfactory that, at all events for the present, no further attempts will be made to carry on the scheme. It seems that the agreement entered into between the Municipality and the Electric Lighting Company stipulated for the lighting of the streets at a certain figure, much below the cost of gas; and complaint is now made that there is a very considerable falling off in the illuminating power of the lamps after midnight—the inference possibly being that the Company are working down to their contract price. It is further complained that the lighting is not so well distributed as with gas; the standards having been put up at such great distances from each other that there is a considerable amount of unlighted space between them. It is suggested in a local newspaper that the new system should be employed in the illumination of the more open spaces only; gas being retained for the narrow streets, which are decidedly in the majority in all Oriental cities, and require well-distributed lighting. But it looks as though the Municipality had now had enough of their experiment with electricity.

The Gas Examinership for the City of London.—We understand that Mr. H. Leicester Greville, F.I.C., Chemist to the Commercial Gas Company, is a candidate for the position of City Gas Examiner, vacant by the death of Mr. Charles Heisch. Mr. Greville, prior to his present position at the Commercial Gas Company, had ten years' official experience of gas testing at stations under the control of the late Mr. T. W. Keates and Mr. Heisch, and he has had altogether upwards of twenty years' almost unbroken experience in practical photometry. He has, in addition, been a more or less constant contributor to the literature of the subject. Another candidate for the appointment is Mr. W. C. Young, F.I.C., F.C.S. This gentleman is at present one of the Gas Examiners to the Corporation; and he also fills a similar position in connection with the local authorities of West Ham, Hastings, Bedford, and other places. His writings on the subject of photometry have appeared from time to time in our columns; his latest article being given in the first number for the current year. Professor Vivian B. Lewes, F.I.C., F.C.S., F.P.S., is also in the field. Having been principal assistant for several years to the Chief Gas Examiner for the Metropolis (Dr. A. W. Williamson, F.R.S.), and subsequently an Assistant Gas Examiner in the City for upwards of ten years, it was naturally to be expected that he would offer himself as a candidate for the vacant post. Professor Lewes's name has been much to the front of late years, as a lecturer and an author, in connection with gas and allied subjects. He is Professor of Chemistry at the Royal Naval College, Greenwich. Professor William Foster, M.A., Lecturer on Chemistry at the Middlesex Hospital, has likewise submitted himself as a candidate. Mr. Foster is so well known to our readers and the gas world generally, that it is unnecessary to enumerate his many qualifications for the position he seeks. Of the other candidates, Dr. Rideal was mentioned in the *JOURNAL* last week; and Dr. W. Newton, F.I.C., F.C.S., and Professor Otto Hehner, F.I.C., F.C.S., are both analytical chemists of considerable experience. With so much excellence to select from, the task of the Common Council will not be an easy one.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 166.)

THE Stock Markets continue in the dull and inanimate condition which we noted in our last issue. The even tenor of business last week was broken by the closing of the Exchange on Wednesday, and was to some extent interrupted by the darkness over the land on Thursday; but, apart from these incidents, there was nothing in the financial atmosphere to account for the stagnation of business. We can only suggest again the depressing effects of the influenza. Things would probably have been flatter but for the cheapening of money. The Bank rate was lowered on Thursday to 3 per cent. from the $3\frac{1}{2}$ per cent. rate at which it had stood since the 10th of December; and in the market almost any amount of money could be had on very low terms. As well as can be foreseen, the market is likely to remain easy for some time to come. The Gas Market has been very fairly active, especially in regard to the heavier issues. Interest naturally centred in Gaslights. On Friday, the announcement of the Directors was made that they would recommend a 12 per cent. dividend, as against the 13 per cent. rate of the corresponding period last year. This announcement was not accompanied by any statement of figures with regard to the amount carried forward; so that we have no clue to the working of the half year, and must possess our souls in patience until the accounts come out. Seeing what the prices of residuals have been, and taking other circumstances into account, it is impossible to form any sanguine anticipation about them. But be this as it may, the reduced rate of dividend is clearly a judicious step. The announcement had but little effect upon the market price; for the quotation, which had fallen 1 on Thursday, and again 1 on Friday, was unchanged on Saturday, and the closing price was fair. The "K" has improved 2; and the "H" was steady. [In our last issue, by a printer's error, it was stated that the "H" returns 3s. 8d. per cent. more for money than the "B;" for 3s. 8d. read $\frac{3}{8}$.] South Metropolitan were firm; and the "C" rose 5. A few bargains were marked in Commercials at middling figures. Suburban and Provincials are unchanged. Of the Continentals, Imperial was firm and active; but Continental Union receded 5 upon realizations of the recent liberal rise. Cagliari is 1 better. Of South Americans, Buenos Ayres rose $\frac{1}{2}$; but San Paulo was $\frac{1}{2}$ worse. The only other move was a smart advance in Chicago bonds. The Water Companies were more active, and, on the whole, steady. Grand Junction advanced 4 per cent.; but Kent fell 2.

The daily operations were: The Gas Market was quiet on the opening day; but prices were very good, though quotations did not move. Grand Junction Water rose 2. Tuesday was also a quiet day, and fully as firm. Gaslight "K" rose 2; Cagliari, 1; and Chicagos, $1\frac{1}{2}$ and $2\frac{1}{2}$ respectively. Kent Water fell 2. The House was closed on account of the Royal Funeral on Wednesday. Thursday was active. Gaslight "A" was a little weaker, and fell 1. Buenos Ayres advanced $\frac{1}{4}$. On Friday, Gaslight "A" was put down 1 more; but business was done at 221. Continental Union also fell 5; but South Metropolitan "C" improved 5. Business on Saturday was all in Gaslight "A" and Imperial Continental; both quotations standing steady. Chicagos advanced 2 each. Buenos Ayres rose $\frac{1}{4}$; and ditto debentures, 2.

ELECTRIC LIGHTING MEMORANDA.

The Danger of Fire in Electric Lighting Stations—Electricity in Mining—The Working of the City and South London Railway—Electrical Fittings on the Hire-Purchase System.

IN connection with the decision of Mr. Justice Kekewich in the Grosvenor Gallery case, which practically branded the transformer stations of the high-pressure alternating system of electrical distribution as dangerous nuisances, not to be permitted in populous neighbourhoods, it may be interesting to notice the recent occurrence in Chicago of a fire at an electric light company's generating station, which had results very similar to those of the Grosvenor Gallery catastrophe. It will be remembered that the fire at the Grosvenor Gallery station, which aroused in neighbouring residents the determination to seek the aid of the law in banishing such an establishment from their midst, was caused by a "short-circuit" at a switch. Similarly, the Chicago conflagration started with a "short-circuit" somewhere in the mains leading to the dynamos. Nobody knows what was the immediate cause of this well-known electrical phenomenon in this instance; but it is certain that the insulating material of the cables instantly ignited from the flash of the improvised arc, and as all the wires in the circuit became red hot in a moment, the wooden casings and other combustible surroundings were burnt. The fire spread along the paraffined and gum-

coated wires with wonderful rapidity. The newspaper description of the occurrence says that "in an instant there was a flash, followed by a loud sputtering noise; and almost before the men at work in the room could escape, it was in flames." Stores of paraffin and cork for insulating purposes were upon the same premises; and consequently the fire was of unusual fierceness. This Company served about 3000 arc lamps in various parts of Chicago, besides supplying power for electric motors; but they did no incandescent lighting. The undertaking was therefore of considerable magnitude. The fire furnishes another significant commentary upon the claims of electricians for immunity from the ravages of what the newspapers used to call "the devouring element."

It is always pleasant to record something to the credit of electrical science, as a set-off to the vast bulk of electricians' unfulfilled prophecies; and therefore we read with much satisfaction the recently published testimony of Mr. Ernest Scott as to the efficiency of electrical appliances in mining. Mr. Scott stated before the Institution of Engineers and Shipbuilders, that already upwards of fifty mines in the United Kingdom are supplied with electrical machinery; and he claimed that by this means mines which have been commercially unworkable owing to their depth, or the great distance of the working face from the pit head, can now be turned into profitable undertakings. This is good news for all who are interested in obtaining cheap coal; for the longer the old pits can be kept going at a profit, and the easier new and deep seams can be worked for the market, the less will be the chance of good coal getting into few hands, and its production falling under the control of "rings." Let us hope that Mr. Scott's testimony in this regard is not that of one who "makes the wish the father to the thought," and that what he says can be done by electrical mining machinery is, in point of fact, actually performed. We do not question the witness's veracity, of course; but experience illustrates the necessity for caution in accepting claims on behalf of new electrical developments.

The remark with which the preceding paragraph concludes suggests mention of the fact that the working of the City and South London Railway, which is supposed to be a successful technical, if not a prosperous commercial, application of electrical locomotion, is continually giving rise to complaints. Nobody seems to know what is the matter with the Company's arrangements; but the fact remains that delays and interruptions of the train service are far too common to please the travelling public, while the manner of running of the trains is frequently such as to seriously discompose nervous passengers. Breaks-down in the tunnels between the stations are, to say the least of it, far more numerous upon this electrically-worked line than they are with ordinary railways; and passengers, who are apt to measure the extent of the risk in railway travelling by their own discomfort, are often heard to prophesy that there will be a "terrible accident" some day between the Monument and Stockwell. It is difficult to understand how this can be; for the electrical railway, even if it equals the old "atmospheric" system of railway working in its demands upon the patience of its patrons, seems to be at least as free from the ordinary hazards of steam locomotion.

A speculation entitled the "Electric Fittings Hiring and Maintenance Company, Limited," is being promoted, having for its object the creation of a hire-purchase system of fitting houses for electric lighting. There is, of course, nothing new in the fundamental idea, which is in common application among manufacturers of pianos, railway waggons, and other portable property which "comes expensive," as the popular phrase goes, to the purchaser. And it may be conceded that there is no particular reason why a system of commercial dealing which, although condemned as wasteful by purists in economy, nevertheless produces a good deal of trade, should not be applied to the wiring and fitting of houses for electric lighting. Granting this, it is a somewhat remarkable fact that the prospects of the proposed venture have not been well spoken of by anybody, least of all by the electrical journals, which might be supposed to be in sympathy with any reasonable project for removing the disabilities under which the electric lighting industry labours. Our contemporary the *Electrical Review* notices the scheme, only to remark that it does not believe the expense of fitting and wiring houses retards the adoption of electric lighting to the extent implied. There is a good deal to be said upon both sides of this question. The expense of wiring a house in which the occupier has only a temporary interest, doubtless does deter many a resident in districts served by central station companies from patronizing the latter; but we doubt whether the intervention of a hire-purchase fittings company would prove, in the majority of cases, an acceptable way out of the difficulty. In some instances, the obstacle to the introduction of electric lighting into a house may be want of funds to pay the wiring contractor's bill; but in these cases the connection might be regarded as of doubtful advantage to the supply company. On the other hand, it is easy to understand that no hire purchasing arrangement would meet the case of a gentleman of means living in a hired house. After all, experience shows that the hire-purchase system appeals only to those who are short of ready money; and it is extremely doubtful whether householders in this position would constitute eligible customers for an electric lighting undertaking. We seriously doubt whether such a speculation as the one in question could justify its existence for any lengthened period.

GAS BILLS FOR 1892.

THE following are the principal features of the Private Bills relating to gas supply which await the attention of Parliament during the coming session.

The Rhymney Valley Gas and Water Bill is for the incorporation of a Company with a capital of £50,000, whereof £20,000, with the usual proportion of borrowed money, is classified as gas capital, for the supply of portions of the parishes of Gelligaer and Llanfabon, in Glamorganshire, and the parishes of Bedwellty and Mynyddislwyn and the township of Bedwas Upper, in Monmouthshire. The incorporated Company propose to purchase the undertakings of the Bargoed and the Hengoed Gas and Water Companies, Limited. Gas of 15-candle power is to be supplied at the maximum price of 6s. per 1000 cubic feet. This is the only new statutory gas undertaking in the list for the year.

The Barry and Cadoxton Gas and Water Bill contains provisions for increasing the gas capital of the Company by £32,000, with the usual borrowing powers. The Bristol Gas Bill is to enable the Company to acquire compulsorily additional lands for storage purposes, and to sell superfluous lands. Other ground for extraordinary purposes, not exceeding 15 acres, is to be purchased by agreement. The East Grinstead Gas and Water Bill is to enable the Company to deal in gas-fittings, to require prepayment for gas in certain instances, to limit the calculated period of error in the case of defective meters, to acquire additional lands adjoining their existing gas-works, and to apply for electric lighting powers. The Liverpool United Gaslight Company have a short Bill for the acquisition of lands and the erection of additional works for storage purposes, and also for conferring powers on the Company to make and deal in meters, fittings, &c. The Gas-Works Clauses Act, 1871, is to be incorporated with the Act, subject to certain provisions. The Ormskirk Gas Bill is to authorize the Company, who were incorporated in 1853, and have not been in Parliament since, to extend their limits of supply, to acquire new lands, and to raise £20,000 of new capital under the usual conditions, with the customary borrowing powers. Gas of 13-candle power is proposed to be supplied; and there is no suggestion as to limitation of selling price or sliding scale. The Oxford Gas Bill is to extend the Company's limits of supply, so as to include the whole of the City, and the parish of Wolvercote. An acquisition of land by the Company is to be confirmed, and certain minor provisions of the Act of 1869 are to be amended. From and after June 30, the capital of the Company is to be reckoned as £143,892, subject to being increased under the new Act by £100,000, whereof the sum of £47,112 is to be 5 per cent. preference stock and the remainder to be a consolidated 5 per cent. ordinary stock. This stock is to be rateably apportioned among holders of the Company's existing stocks, of which it is to be the equivalent in all respects. The standard prices proposed in the Bill are 3s. 2d. and 3s. 8d. for gas consumed within and outside the City boundaries respectively. The sliding scale is asked for, with 5s. per cent. rise or fall for 1d. in the price of gas. The usual borrowing powers are asked for on the new capital; and it is also desired to borrow upon the premium capital. The Pontypool Gas and Water Bill deals wholly with the Company's water undertaking. The Southend Gas Bill is to authorize the issue of additional share capital not exceeding £45,000, to carry the usual borrowing powers, and to be entitled to a 7 per cent. dividend. The Company desire to construct a jetty and a single line of tram-rails for the convenience of their works; also to acquire additional lands. The proposed standard price of gas is 4s. 6d. per 1000 cubic feet. The Stamford and St. Martin's Stamford Baron Gas Bill is to repeal an Act of George the Fourth which incorporated a local Company with a share capital of £5625. Prior to the year 1827, this capital was increased, by contributions from the original shareholders, to £11,250; and since this period upwards of £10,000, derived from the divisible profits, has been similarly expended upon the works and undertaking of the Company. The district of supply has also grown; and, according to a recent valuation, the works and undertaking, together with the working capital, are worth £22,000. The net earnings of the Company for the last ten years have averaged £1500 per annum; and they are not restricted as to price or quality of gas. The Bill contemplates an extension of the limits of supply, and fixes the capital of the Company at £30,250, whereof all but £10,000 is to be styled original capital; and both classes of capital are to carry a 7 per cent. dividend. The proposed price of 15-candle gas is 4s. per 1000 cubic feet, with the sliding scale after the usual rate.

The Cleator Union Local Board Gas Bill is to authorize the transfer of the local Gas Company's undertaking to the Board, in accordance with the terms of a scheduled agreement, whereby the Company arrange to sell their property for £16,000, besides stock in trade. It is stipulated that on the day of transfer "the Company shall have in their gasholder 45,000 cubic feet of gas of at least equal quality as [*sic*] that now supplied by them." The total share capital of the Company is £12,500, all paid up; and they have no mortgage debt. The Local Board desire to borrow, for the purposes of the Act, £14,000, in addition to the sum which will become payable to the Company. The maximum price of gas is to be 4s. 7d. per 1000 cubic feet, and its

illuminating power 15 candles. Provision is made for the sale of a portion of the undertaking to the Arlecdon and Frizington Local Board. The Ilkley Local Board Bill contains provisions to enable the Board to purchase the undertaking of the Ilkley Gas Company. The gas limits are to be extended so as to comprise the parish or township of Denton, in the West Riding of York. It is proposed that, any time within three years after the passing of the Act, the Board may serve the Company with notice to sell their undertaking for such price as may be agreed upon or determined by arbitration. Power is desired to deal in fittings and to make a communication between the gas-works and the Midland Railway; also to borrow such money as may be required for purchasing the undertaking. The Southborough Local Board (Gas) Bill is to empower the Urban Sanitary Authority for the district of Southborough, in Kent, to acquire the undertaking of the local Gas Company, incorporated by Provisional Order in 1891, whose works are declared to be ill-adapted and badly situated to meet the present and increasing demand for gas within the district. Power is to be taken to sell portions of the undertaking to other sanitary authorities, to supply neighbouring sanitary authorities with gas in bulk, and to agree with the Tunbridge Wells Gas Company for acquiring the rights of the Company within the district of the Local Board. The price to be charged to consumers for gas is not to exceed 4s. 8d. per 1000 cubic feet. A sum not exceeding £30,000 is to be borrowed for the purpose of carrying out the Local Board's scheme.

The Sutton Coldfield Corporation Electricity and Gas Bill occupies a class by itself. It contemplates the purchase by the Corporation of the undertaking of the local Gas Company, and also a portion of the Birmingham Corporation gas undertaking, together with the establishment of an electric lighting undertaking. An agreement for the sale and purchase of the gas undertaking has been arrived at between the Company and the Corporation, and is scheduled in the Bill. The price agreed on between the parties is £7000, besides the value of the stock-in-trade; and there are to be 80,000 cubic feet of gas in the holders on the day of transfer. Terms of purchase are to be agreed upon, or settled in the usual way, for the transfer to the Corporation of the local portion of the undertaking of the Birmingham Gas Department. The maximum price of gas is to be 4s. 6d. per 1000 cubic feet, and its illuminating power 16 candles. The electric lighting powers desired by the Corporation are of the usual character; and the sum of £10,000 is the total named as the capital required for this purpose. In addition to the purchase-moneys, a sum of £30,000 is to be borrowed for gas-works purposes.

The Swinton and Pendlebury Local Board Bill provides for the purchase of a portion of the gas undertaking of the Salford Corporation, in accordance with and subject to the provisions of the Act of 1891. Particulars of the mode of valuation are given. Power is required for the acquisition of lands and the erection of gas-works. The maximum price of gas to be charged by the Local Board is to be 4s. per 1000 cubic feet, and the illuminating power is fixed at 14 candles. The sum of £100,000 is to be borrowed for the construction of gas-works, and so much more as may be required for the purchase of the undertaking and the settlement of the scheme.

The Blackburn Corporation Bill contains a proviso for the application of section 47 of the Gas-Works Clauses Act, 1847, and section 18 of the Gas-Works Clauses Act, 1871, to meters and fittings belonging to the Corporation, "notwithstanding that such meters or fittings, as the case may be, shall not have been let for hire or for remuneration in money." The gas limits are also to be extended to include the township of Billington. The Blackpool Improvement Bill includes a clause providing for the acquisition of the portion of the undertaking of the St. Anne's-on-the-Sca Gas Company situated within the borough. The Leeds Corporation (Consolidation and Improvement) Bill is an *omnibus* measure for dealing with all the multifarious statutes under which the borough is administered. Part 8 is devoted to gas, and is to re-enact the general powers of the Corporation in respect of gas supply. The limits are defined; but outlying portions of the undertaking are to be saleable to local authorities interested. Gas of 18-candle power is to be supplied at the maximum price of 3s. 9d. per 1000 cubic feet. Rebates not exceeding 20 per cent. are to be allowable to gas consumers. Gas is to be tested at the instance of any five consumers. A new clause is proposed for authorizing the Corporation to inspect gas-fittings in new buildings before giving a supply. Contravention of the Act is to be visited by cutting off the gas. The sum of £250,000 is to be borrowed for gas-works purposes; and permission is sought to establish a gas depreciation fund. The London County Council (Subways) Bill is to compel owners of pipes, &c., usually laid underground to make use of street subways where such exist, and to pay rent for the same. The Middlesbrough Corporation Bill is to enable the Corporation to enlarge their gas-works and make a new street in connection therewith. All expenditure upon gas-stoves, &c., is to be ratified. New lands are to be acquired for gas purposes; and the sum of £50,000 is to be borrowed for the same. The Newcastle-upon-Tyne Improvement Bill contains a clause under which the Newcastle-upon-Tyne Corporation and the Gas Company are to be empowered to enter into and fulfil agreements with regard to the testing of gas at places other than the Company's works.

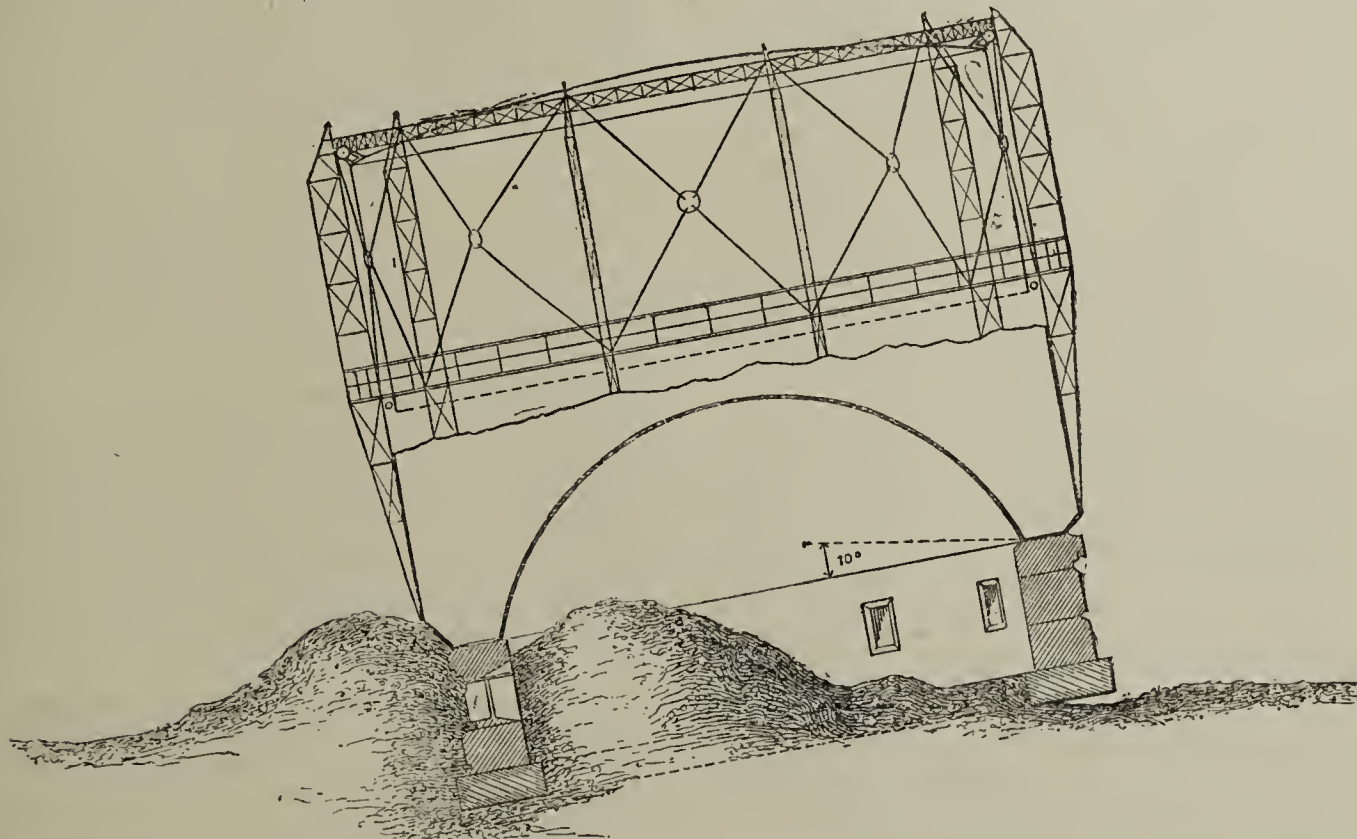
NOTES.

The Foggiest Months of the Year.

The statistics collected by the Royal Meteorological Society confirm the experience of gas managers upon the point of December being the foggiest month of the year. The popular notion is that November is the month of fogs; but this general impression is not supported by the figures. According to a paper recently read before the Society by Mr. F. J. Brodie, upon the prevalence of fog in London during the twenty years 1871 to 1890 inclusive, it appears that the number of fogs in November is, if anything, slightly less than in October or January, and decidedly less than in December, which month has the worst climate of the whole year. Moreover, the latter part of the winter is not only less foggy than the earlier part, but is noticeably clearer than the autumn months. In February, so far as the records of the past twenty years show, the average number of days with fog is only 6.6, as against 8.9 in January, 10.2 in December, 9.2 in October, and 8.8 in November. Thus it appears that one-third of the month of December is foggy, on the average. The effect of the general lighting up of house fires in October is very noteworthy. This is not the first time, either, that statistics have contradicted the popular notion of the badness of the weather of the month of February, which usually shares public reprobation with November on this score.

A Gasholder Catastrophe.

The accompanying illustration, which is reproduced from the *Journal für Gasbeleuchtung*, represents the settlement, as it appeared in November last, of a gasholder erected at Constance in the course of the previous year. The drawing explains itself; but it was reported in our German contemporary that the tank sank in consequence of the bad subsoil and an insufficient foundation. The occurrence so wrought upon the nervous temperament of the Engineer (Herr August Raupp), that in a moment of despair



he committed suicide. The settlement began on Oct. 31, and the sketch from which the engraving was made was taken three days later. It is noteworthy that the concrete ring of the substructure settled without showing any other failure than a crack in the sill of the door giving access to the vault under the tank. The whole structure went together so gently that not a pane of glass in any of the ten vault windows was cracked. The settlement of the foundation squeezed up the earth as shown. The diameter of the tank was 24 metres; and the foundations were 3 metres in height, of which the concrete measured 1 metre in thickness, and the rest was a sandstone wall. The tank was 15 metres deep. The water weighed 1770 tonnes; the ironwork, 140 tonnes; and the masonry, 673 tonnes. The total weight upon the subsoil was 2583 tonnes, distributed so as to throw a pressure of 18 tonnes per square metre upon the ground covered by the concrete. The subsoil is first loam, underneath which is alluvial mud, plainly in communication with the water of the Bodensee; so that a yielding slush is formed, which was the occasion of the catastrophe. At first the tank settled equally, and maintained a fair level; but eventually it lunged over quite suddenly in the position shown.

Another Fuel-Gas Process.

Another fuel-gas process, the invention of Dr. Alphonse Hennin, has been developed in Illinois, according to a report in the *Iron Age*; the product being described as containing 60 per cent. of combustible matter, and at the same time yielding larger quantities of ammonia and tar than have ever before been secured by any process. The Springfield Iron Company have now in operation two large producers 10 feet in diameter upon Dr. Hennin's system, and are building three more of the same size. The plant, when completed, is expected to make from

5 to 6 million cubic feet of the gas per day. The producers appear to be of the ordinary description; being cylinders made of wrought iron, and lined with fire-brick. The fuel is fed into a hopper at the top of the producer; and the bed of fire is supported on a grate at the bottom. The combustion is maintained by blasts of steam and air, which are introduced radially through tuyeres just above the grate. The novelty of the invention is described as consisting in the regulation of the relative proportions of steam and air so as to maintain in the lower part of the producer an incandescent zone or bed of fuel, at a sufficient temperature to decompose practically all the steam admitted, and at the same time so regulating the supply of fresh fuel that the upper portion of the producer is kept at a temperature low enough to allow of the formation of ammonia, and prevent its decomposition.

Altering the Pressure of Gasholders.

Mr. George T. Thompson, of the Laclede Gas-Works, St. Louis, has invented a device for enabling the pressure exerted by a gasholder to be increased or diminished at will, without loss of time, and in a simple, convenient, and economical manner, whether or not the holder is provided with guide-framing. He effects his object by forming an annular gas and water tight box, which is attached to, or forms part of, the gasholder, to which it stands in the relation of an additional internal bottom box-curb. There may be another of these boxes near the top of the holder. The interior of the box communicates with the gas-containing portion of the holder by means of a vertical pipe rising higher than the water-line; and there is a valve communicating with the water in the tank. There is a flexible tubular attachment connecting the interior of the box with a pump outside the holder. All necessary connections and valves are provided to enable the internal box to be filled with water or emptied at will—thus altering the buoyancy of the holder; and the complete combination of the box with the

subsidiary arrangements is patented. The device is an ingenious attempt to deal with one of the practical difficulties of working the large holders required in modern gas-works, which rarely give pressure enough when working as single-lifts.

Society of Engineers.—The first ordinary meeting of this Society for the present year will be held at the Town Hall, Westminster, next Monday evening, when the Past-President (Mr. W. N. Colam) will present the premiums awarded for certain of the papers read during last session, and the new President (Mr. J. W. Wilson, jun.) will deliver his Inaugural Address.

Incorporated Institution of Gas Engineers.—The Secretary of this Institution (Mr. Thomas Cole) has issued a circular to the members, under date of the 20th inst., giving notice that the annual general meeting will be held at the Offices, 11, Victoria Street, Westminster, on Saturday of next week, the 6th prox., to transact the following business: "Election of Scrutineers; to receive report of Scrutineers; election of President, Vice President, and Members of Council; election of members; report of the Council and statement of accounts; reading of communications and papers; and other business." An intimation accompanies the notice to the effect that only formal business will be transacted at the meeting; and that after disposing of the first four items on the *agenda*—that is, after the election of officers and members—it is proposed to adjourn the further proceedings until May 11 and 12, for which occasion the Institution of Civil Engineers have granted the use of their hall in Great George Street, Westminster. Mr. Charles Hunt, of Birmingham, has been nominated for President, and Mr. John Methven for vice-President.

COMMUNICATED ARTICLE.

LIGHTING.

By W. H. Y. Webber.

PART III.—A CRITICAL EXAMINATION OF MODERN PRACTICE.

(Continued from p. 109.)

Out of London, the palm for brilliant street lighting would probably be awarded to Belfast. The case of Birmingham is not overlooked in making this statement; but is to be borne in mind that the Birmingham example, like that of Hyde Park Corner, is of a decorative cast, and is concentrated upon a particular area. The Belfast lighting is street lighting pure and simple; and nowhere has the advantage of municipal control of the gas undertaking been more strikingly illustrated in this manner. It is instructive to notice that in Belfast, as elsewhere, it was the electric arc lamp that convinced the Local Authority of the insufficiency of the gas lighting in common use. Mr. James Stelfox, the Engineer and Manager of the Corporation Gas-Works, informs the writer that the improvement of the street lighting of Belfast was brought about as follows: Some years ago, certain electric companies began to talk of lighting one of the principal thoroughfares of the city at so much per lamp per hour. It occurred to Mr. Stelfox that this was a very specious way of putting the proposal before the public, who had only the small hourly charge before them, and were therefore induced to ignore the gross yearly charge, to arrive at which required an effort in multiplication. He therefore, through the then Chairman of the Gas Committee (Sir John Savage), obtained permission to light Donegall Place, which is about 220 yards long, with gas upon the same basis of charge. It had been computed that six arc lamps would be required for the lighting of this line of thoroughfare, at a cost of 3d. per lamp per hour, or 1s. 6d. per hour for the whole. For the same money, Mr. Stelfox arranged to put in twenty 80-candle gas-lamps, with two 200-candle lamps at the end of the Place. This was done to show what could be effected at a profit by the Corporation Gas Department for the price asked by the electric light companies. As might be supposed, this special favour to Donegall Place created heart-burnings in the citizens whose interest lay in other thoroughfares. Thanks, however, to the public spirit of the Corporation, and the pertinacity of Mr. Stelfox, the improved lighting was in time extended. Owing to the length of the thoroughfares involved in the system, as at present exhibited nightly in this flourishing town, it is impracticable to give a plan of them. It is therefore necessary to rely upon letterpress description. The first line of lighting connects the two principal railway stations, and traces the main artery of traffic. The second branches from the first to the quays.

The first section of the first line commences at the Belfast and Northern Counties Railway Station; and proceeds along York Street to Donegall Street, being 1190 yards long, and exhibiting sixty-one 100-candle Bray lamps; the spacing therefore averaging about 40 yards on each side of the street. The lamp-columns are 14 ft. 6 in. high; so that the light is shown at a height of about 15 ft. 6 in. above the level of the street. Next comes a section consisting of the first portion of Royal Avenue, which has sixteen 80-candle lamps, with four 200-candle lamps at the corners next Donegall Street and North Street. The lamps average 18½ yards apart on each side of the street. The second section of Royal Avenue, from North Street to Castle Place, contains thirty-one 100-candle lamps at intervals of about 24 yards on each side of the street. In the centre of the crossing at Castle Place there is a large lamp of 400-candle power for the illumination of the Square. Donegall Place, as already remarked, has twenty-one 80-candle lamps, spaced 20 yards apart, with two 200-candle lamps additional at the crossings next the White Linen Hall. All these lamps are on tall posts, showing the light 15 ft. 6 in. from the ground. Two independent main routes from Donegall Place to the Great Northern Railway Station are lit with 100-candle lamps on 10 feet posts, at 40 yards intervals. From the central junction at Castle Place, and also from the junction of Royal Avenue and Donegall Street, other lines of lighting extend to the Quays and across the river to the County Down and Holywood and Bangor Railway Stations. The direct route from Castle Place to the station is 1250 yards in length, and this is lit by eighty-five 100-candle lamps, with one 200-candle lamp at the junction with Donegall Quay; the average spacing of the lamps being thus 30 yards on each side of the thoroughfare. The area in front of the Custom House is lit by seventeen 100-candle lamps on ordinary posts, and two 200-candle lamps. Along the Donegall Quay there are sixteen 100-candle lamps on tall columns, 20 yards apart. All this splendid street and quay lighting is continuous. Extending from the points at which the high-power lighting ends, the ordinary street lanterns are provided with 8 feet burners for some little distance, so as to diminish the effect of the break; and at many of the ordinary street crossings there are 200-candle lamps, and a few of still higher power.

The lighting upon the higher scale is not kept up after midnight. It should be explained that the use of 80 and 100 candle lamps upon ordinary 10 feet posts is only done to utilize the latter, and avoid the expense of all new lofty posts; but it is acknowledged that the latter are preferable for such high powers in streets. For a specimen of a gas-lit thoroughfare, Belfast can undoubtedly compete with any town in the world.

The lighting of the Brighton Esplanade by high-power "Whitehall" lamps is generally admired. The extent of the sea-front at Brighton lighted in this way by gas is 4000 yards, and reaches from West Brighton to Black Rock. The system comprises 157 "Whitehall" lamps, which burn at the rate of 5 cubic feet per hour for the first half hour of lighting; then they increase to 30 feet, or (say) 100 candle power, until 11 p.m.; after which they are again reduced to 5 cubic feet per hour for the rest of the night. In addition to these, there are 23 lamps burning a maximum of 15 cubic feet per hour. The average height of all the lamp-posts is 9 feet.

Some of the comparatively poor parish Vestries of the South of London, who have no "promenades," or "esplanades" to light, but are nevertheless compelled to provide for considerable heavy traffic along the main lines of communication, prefer to use 10-foot burners in "Balham" lanterns, which are ventilated through the top; thus assisting the steady burning of the flame. These lamps are exhibited upon ordinary posts, at distances of 30 to 40 yards. Street crossings are commonly lighted with lamps of 100 or 200-candle power on lofty columns.

Very recently, what is considered to be the best display of electric arc lighting yet seen has been started in Queen Victoria Street, City. It ought to be good, for it represents the practical outcome of some seven or eight years' planning, and some highly elaborate financial arrangements. The light is that of ordinary Brush lamps of 12 ampères, credited with 2000-candle power nominal, which means perhaps 1000-horse power maximum for the naked arc. These are exhibited at about 18 feet above the ground, in polygonal pyramidal lanterns, glazed with waved, etched, or crinkled glass, in order to break up the light without so much loss as is caused by the heavy opal glass in common use. The difficulty in this case is that glass which is sufficiently faceted to break up the rays of the arc also holds much dirt; so that, taking the practical impossibility of thorough cleaning into account, this style of glazing does not gain much upon the opal. The lamp-posts are, on an average, 50 yards apart.

From the foregoing examples, the student can draw conclusions as to what is held to constitute good street lighting in the United Kingdom at the present day.

(To be continued.)

The Wenham Lamp Patents.—We understand that the Wenham Company, Limited, have instituted proceedings against the Thomas Lighting Company, Limited, and also against the Lamp Manufacturing Company, Limited (Fullford's Lamp), for alleged infringement of Frank William Clark's patent of the 1st of July, 1881, No. 2869.

Institution of Mechanical Engineers.—The annual general meeting of this Institution will be held on the 4th and 5th prox., the President, Mr. Joseph Tomlinson, in the chair. On the first day, the annual report of the Council will be presented; and the annual election of the President, Vice-Presidents, and Members of Council will take place. There will be two papers read and discussed, one of which is entitled "Notes on Mechanical Features of the Liverpool Water-Works, and on the Supply of Power by Pressure from the Public Mains and by Other Means," by Mr. Joseph Parry.

The Liberty and Property Defence League, whose labours in maintaining freedom of contract, upholding proprietary rights, and resisting Socialistic legislation, we have had frequent occasion to notice with approval, have issued a report on their work during the past session. Two of the Bills to which the attention of the League was specially directed were the London Water (Meter) Bill and the Metropolitan Water Companies' Charges Bill. The Parliamentary Committee of the League objected to the former measure on the ground that the rights of the Water Companies, granted and confirmed by seventy different Acts of Parliament, were invaded, and because it would have an unsanitary effect in the poor quarters by restricting the free use of water. On representations from the associated Metropolitan Water Companies, the Committee took steps to assist in opposing the Bill. By the help of two members of the House of Commons, notices of motion for the rejection of the Bill were placed on the paper; and 2000 requests for opposition and objections were sent to members of Parliament, the Press, and societies federated with the League. The Bill was opposed on the second reading—the debate standing adjourned; and, as our readers are aware, it was subsequently dropped. As to the Charges Bill (which was to prevent any Metropolitan Water Company from increasing the water-rate on a tenement beyond the amount demanded in the previous financial year, except where there was a larger use of water, where the cost of supplying the water had increased, or where the occupier had contracted in writing to pay the increased rate), the Committee, objected to it on the ground that it proposed to change the bases of charge for water fixed by previous Acts, upon the faith of which the capital of the Companies had been subscribed; and also because, owing to variations in rateable value, the Companies might be compelled to lower a charge, but were prevented from raising it. On representations from the Companies the Committee took steps to assist in opposing the Bill at the proper stage; and it was opposed on the second reading. At the suggestion of the Government, however, it was referred to the Select Committee on the other Water Bills, who reported it; but it was not proceeded with further.

TECHNICAL RECORD.

COMPARATIVE PHOTOMETRIC TESTS OF LARGE GAS BURNERS AND LANTERNS FOR PUBLIC LIGHTING.

At the last Meeting of the German Association of Gas and Water Engineers, a paper on the above subject was read by Dr. N. H. Schilling, of Munich. A translation was in contemplation for our columns; but as one has already been made for the *American Gaslight Journal* by Mr. C. S. Davis, we reproduce it. A portion of the paper, dealing with the effect of mixing air with gas, was referred to in a "Note" in the *JOURNAL* for the 12th inst.; but the entire communication will be of interest in connection with the series of articles on "Lighting" which are now appearing in our pages.

In addressing you on this subject, I must recall to your minds the fact that it is one which has been many times discussed, and very ably so. But I thought it might prove instructive and interesting, in view of the photometric tests made by Inspector Ries and myself last year, on the one hand to complete those tests as far as might be necessary for an exact comparison of the more important regenerative lamps on a basis of separate tests, and a certain number of street lamps; and, on the other, to experimentally verify the method itself of testing. There is often very little difference between the luminous powers of several styles of lamps. Hence it seemed fitting to make the method of testing so exact that parallel tests made with the same lamp should show only the least possible differences.

In photometric tests of luminous sources of considerable intensity, an intermediate or comparative source of light is always necessary, for reference to the standard on the one side and to the luminous source to be measured on the other. This double measure entails the liability of double error in reading, as is well known. The errors in reading made in measuring the lamp with the standard burner easily amount, even when the test is made with the greatest care, to 4 per cent.—that is to say, to 0.04 of error for a reading of 1. In regulating the standard burner to a luminous unit, the mistakes made may, without any exaggeration, be estimated at 2 per cent. Then, again, by taking account of the errors made in reading the gas-meters, occasioned by the variations in the light unit employed, &c., there may be readily committed, for one single lamp, a total error of 6 per cent., which, for a lamp having a lighting power of 70 candles, would be equal to 4.2 candles. But, in reality, far more important mistakes are frequently made in parallel tests, for the lamps themselves are subject to grave variations; whereas the hypothesis is always made that the gas, on its part, has a luminous intensity absolutely constant. But as this is never the case, it has been proposed to employ, as a unit to which the standard burner may be referred, not only the light unit itself, but the normal Elster Argand burner, fed with the very same gas as the lamp to be tested. For it is freely admitted that a variation in the lighting power of gas does not change the ratio existing between the lamp and the normal Argand burner. It has seemed best to us to experimentally limit this hypothesis.

We have mixed with the gas different fixed quantities of air, in order to lower the quality, and then fed each of these mixtures, in one case to a regenerative lamp, and in another to a slit-burner lamp. The following table gives the photometric results obtained :—

Air Added in 100 Parts of Gas.	LUMINOSITY OF THE SLIT- BURNER LAMP.		LUMINOSITY OF THE REGENERA- TIVE LAMP.	
	In Hefner- Alteneck Light- Units.	In 100 Parts of Luminosity for an Addition of—	In Hefner- Alteneck Light- Units.	In 100 Parts of Luminosity for an Addition of—
0	18.97	100.0	70.06	100.0
2	16.22	85.5	58.35	83.3
4	13.88	73.2	51.96	74.2
6	11.85	62.4	45.29	64.7
8	9.82	51.8	36.57	52.2

We find from this table that the diminution in the percentage of the two burners, in proportion to the increasing quantity of the air intermixed, is almost the same. The mistakes are in the limits of the errors of observation.

The conditions under which another test was conducted are different. A regenerative lamp was measured by means of the Elster angular photometer, with an Argand burner as the standard of comparison. Furthermore, the same gas which supplied both burners was mixed with air, but always in exact quantities. Designating the lamp by L, and the standard burner by a, the ratio $\frac{L}{a}$ for the mixtures of air below has been :

0.0 per cent.	20.9
2.3 "	20.5
3.1 "	20.5
6.8 "	26.0
12.9 "	30.7

It follows from these figures that the two lamps were in a fixed ratio to each other until the air supply had exceeded

3.1 per cent. As may be foreseen, an even greater addition of air would not affect the ratio if it were not that the flame of the standard burner, whose consumption was only 1.90709 cubic feet, in consequence of the increase of air, burned with such feeble power that combustion could not take place under constant normal conditions. For the limits within which gas ordinarily varies, we may consider the exactness of our hypothesis as proved, by virtue of which all burners vary proportionally—that is to say, the ratios of the slit burner, the Argand burner, and the regenerative burner remain constant so long as these appliances are fed with the same gas.

The figures below show that the luminous intensity of an Argand burner, burning with a very small flame, diminishes very much more rapidly in case of an important fault in the consumption than when this intensity is calculated proportionately to the diminution of consumption. The standard Elster burner has given, for a consumption of 1.91769 cubic feet, 2.22 candles; of 1.61396 cubic feet, 1.32 candles; and of 1.31377 cubic feet, 0.54 candles. Instead of which the calculation in proportion to the diminution of consumption gives, for the consumption of 1.91769 cubic feet, 2.22 candles; of 1.61396 cubic feet, 1.87 candles; and of 1.31377 cubic feet, 1.52 candles. This surely tends to prove that, for such small flames, the chilling produced by the diffusion of air in combustion is very considerable, with the result that a normal development of constant light is no longer obtained.

A series of photometric observations has been made of such a kind that, both before and after each test of the lamp at the various angles, the standard burner has been regulated by the normal Argand burner, fed with the same gas. But it has even then, naturally enough, produced such differences that the standard burner gave higher values before than after the test. It was not shown that this variation was occasioned by the vitiation of the air and by the rising of the temperature in the chamber of the photometer; but this supposition has been confirmed by a test carried on for a period of two hours with the chamber of the photometer completely closed. The following table gives the results obtained :—

Time.	Ratio between the Normal Argand Burner and the Standard Burner. Moment of lighting.	Temperature of the Photo- metric Chamber.
4 h. 00 m. . . . .	..	15.6°
4 h. 35 m.	7.071	17.0°
5 h. 15 m.	7.127	19.0°
6 h. 00 m.	7.371	19.0°
6 h. 10 m.	7.525	19.5°

When it was a matter of comparing different lamps with each other, in the first place in regard to the relative luminous intensity existing between them, and in a less degree in regard to their absolute luminous intensity, we have modified the method of testing as follows: Neglecting to regulate every time the standard burner by the normal Argand burner, we have taken the former as unity, and referred the other lamps to that alone. It was adjusted once precisely and exactly by means of the Hefner-Alteneck lamp, and has given an absolutely constant light, with uniform consumption. The consumption has been fixed at 1.907 cubic feet for all the experiments, and kept fixed during the continuance of the tests.

Experience has taught that it is of value for this purpose not to use regulators, for they are not perfectly reliable and exact. The consumption has been adjusted as accurately as possible by hand with a micrometric screw, and tested every minute; and, in the calculation, account has been taken of slight errors—on an average about 54.

In order to refer all the tests to a gas of fixed luminous intensity, we have adopted as normal gas that which, at a rate of consumption of 3.53 cubic feet in a slit burner, should have a luminous intensity of ten Hefner-Alteneck lamps. However arbitrary this hypothesis may be, we may freely modify, to suit any other kind of gas, the results actually obtained with this gas, which should be regarded as normal.

The different principles applied in each city in testing gas are, perhaps, the fertile causes by reason of which the photometric tests made with large gas-burners and with different gases so often present such important variations. It is therefore highly to be recommended that all tests intended to determine the value of certain lamps, as in the actual case, should be referred to a "normal gas" precisely defined. It is for this purpose that we have re-tested in these trials those lamps which we previously examined, and which we have classified one by one. The luminosity obtained, in referring it to this normal gas, for the standard burner by several tests, with a very considerable degree of agreement, has been as follows :—

1st test	3.42 after 10 readings.
2nd "	3.45 " 20 "
3rd "	3.41 " 10 "
4th "	3.45 " 10 "
5th "	3.39 " 10 "
Average	3.42 Hefner-Alteneck light-units.

By this method errors have been, as far as possible, obviated; and many parallel tests have been made rapidly one after another. The trials, always conducted by two experimenters, have been made with every requisite precaution and care. I ought specially to mention that only those lamps having an approximately similar consumption of 10.595 feet have been compared.

The lamps that have been tested are: (1) Regenerative lamps: The Wenham, the Bandsept, the Stern, Siemens's reversible, the Westphalia, the Sylvia, and Siemens's flat burner. (2) Street lanterns: The Munich lamp with single-slit burner; a lamp with two adjoining slit burners; a lamp with Zwilling's burner; Krause's large burner lamp; the Munich large burner lamp; the Schülke large burner lamp.

It has appeared necessary to determine for the lamps the consumption in developing, by means of a known quantity of the gas (for example 3.53 cubic feet), the most favourable light effect. Consequently, each lamp has been measured, with a different consumption, at one and the same angle of 50°; and this luminosity referred to 3.53 cubic feet of gas. For each lamp a flame of fixed size may be taken as normal. If the effectiveness of the lamp were the same for every consumption, 3.53 cubic feet of gas ought always to furnish the same luminous intensity, whatever the effective consumption by the lamp. But experience has shown that the effectiveness varies greatly—following the height of the flame, and notably so in reversible lamps. This effectiveness is generally less with an inconsiderable flame,

and is greater in proportion to the increase of the flame. From this we may see how important it is to make regenerative lamps burn as much as possible with full flames; and this care ought especially to be exercised over reversible lamps. For example, the luminosity, given in Hefner-Alteneck light-units, of the Siemens lamp with different effective consumptions, is—

Normal Consumption of—		Reduced to a Consumption of 3.53 Cubic Feet.	
10.17115 cubic feet	..	21.8	
9.64140 "	..	17.2	
8.72381 "	..	13.6	

The amount of light obtained with 3.53 cubic feet of gas has then diminished 30 per cent. for a diminution of 1.377 cubic feet below the normal consumption. Taking as a basis these preliminary experiments, all the lamps have been studied with as great a consumption as possible, but under such conditions that the lamp burns with a flame practically of normal size, but without producing black smoke. Each lamp has undergone at least three similar tests, whose average value, especially with the larger angles, has diverged but slightly from those obtained in each particular test, as the following examples will show:—

	50 deg.	60 deg.	70 deg.	80 deg.	90 deg.
Test No. 1.	61.0	67.5	73.6	73.2	72.9
Test No. 2.	64.4	69.6	74.6	74.1	72.9
Test No. 3.	65.5	67.8	74.6	74.4	72.9
Average	63.6	68.3	73.3	73.9	72.8
Maximum difference above	2.9	1.9	0.5	0.8	
Maximum difference below	3.2	1.1	0.9	0.9	

Luminous Intensity in Hefner-Alteneck Light-Units Developed by 3.53 Cubic Feet of Gas burned in the Lamps and Lanterns Named.

	0 deg.	35 deg.	40 deg.	50 deg.	60 deg.	70 deg.	80 deg.	90 deg.
Wenham lamp	14.0	19.3	19.9	20.9	21.4	22.4	22.5	22.8
Bandsept lamp	16.9	18.3	18.9	19.9	20.3	21.2	21.7	21.4
Stern lamp	15.8	18.9	18.7	18.2	18.6	18.4	17.4	18.4
Siemens reversible lamp	15.9	17.4	18.1	19.5	19.8	20.3	19.7	19.6
Westphalia lamp	14.4	17.2	18.5	19.2	19.8	20.2	20.0	19.7
Sylvia lamp	12.9	17.2	18.0	18.9	19.5	19.6	19.3	19.0
Siemens flat burner	13.2	22.2	23.8	25.8	27.4	28.0	28.1	28.5
Schülke street lamp	—	18.7	16.4	16.4	14.8	12.8	10.7	—
Krause large-burner lamp	—	11.2	11.3	11.3	10.7	7.7	2.8	—
The Munich large-burner lamp	—	9.9	10.0	10.7	12.2	7.9	2.9	—
Lamp with Zwilling's burner	—	10.0	10.0	9.3	—	8.0	—	—
Lamp with two slit burners	—	9.6	9.6	8.6	—	8.2	6.9	—
Slit burner with free combustion	10.0	—	—	—	—	—	—	—

The agreement obtained in each separate test is as perfect as is possible with that method taken as a basis; and it should be regarded as absolutely all that is required for the object here sought.

The results given in the above table allow an immediate comparison with one another as well as with the slit burner. By fixing the luminous intensity of the latter for a consumption of 3.53 cubic feet at 1, we get, moving the decimal point one place to the left for all the numbers, those which show how many times the gas is better utilized in that lamp to which each number refers than in the slit burner. The table below shows, for example, the degree of utilization obtained, at an angle of 50°, in the regenerative lamps tested:—

Horizontal burner with slit tip	1.00
Wenham lamp	2.09
Bandsept lamp	1.99
Stern lamp	1.82
Siemens's reversible lamp	1.95
Westphalia lamp	1.92
Sylvia lamp	1.89
Siemens's flat burner	2.58

It results from these figures that, with the exception of the Siemens flat burner, all the lamps furnish almost the same mean effectiveness. In round numbers, the effectiveness of all these lamps is double that of the slit burner. The differences for the regenerative lamps taken separately are extremely small. Only the flat Siemens burner has given values showing a distinction at all marked. It is, in general, to be remarked that those lamps in which the flames burn from the outside to the inside in a circle around a reflecting cylinder, give a light much whiter than the others. The reflecting cylinders and the curving of the flame which they effect have in each light an action analogous to that of those parts called *rondelles de combustion* in the Argand burners or in oil-lamps, for they produce in the interior a mixture of gas and air for combustion.

To judge of the value of different regenerative lamps, it is necessary primarily to take into consideration the practical efficiency of the lamp, its cost, &c., since the utilization of the gas, with the exception of the flat burner, makes no essential differences. When a value is to be set on a light of whitish colour, the preference must be given to the reversible lamps. The brilliant whiteness of the light often gives novices an illusion of its very great clearness; and for this reason they often wrongly accord it the preference.

As to the subject of street lamps, all the large gas-burner lights spoken of above might easily be employed in public lamps. But they all present the inconvenient feature of developing the highest luminous intensity at 90° more or less (but always somewhere about this angle), with the result of shedding the greater part of their light on a point already superabundantly illuminated—that is to say, the foot of the lamp-post. The Schülke lamp, while the utilization of the gas is as thorough as in the others, does not have this inconvenience, but projects its luminous

intensity in a horizontal plane. It gives uniformly a distribution of light more suitable for lighting streets than those large burner lamps properly so called.

In the other street lanterns, the utilization of gas is less satisfactory. In order that a public lamp may be employed under favourable conditions, it is necessary to have, in addition to a perfect combustion of gas, a simple method of fixing, by which means the light may be readily accessible. More stress should be attached to the latter condition than to the former, for it is usually preferable to give up a previous thorough heating of the gas, provided that the workings of the light shall be the simplest possible. It is originally to this idea that the Munich lamp owes its existence.

The employment of apparatus with increasingly strong lighting power for public uses is constantly becoming more extensive; and it is absolutely incontestable that they are getting to be indispensable for the illumination of broad streets and large areas. It is to be hoped that the gas industry will succeed in producing uniformly throughout this domain such appliances as shall, whether by the principle of pre-heating or some other, solve the existing problem by obtaining a source of light of powerful intensity in the most simple form, and one in which also the gas may be utilized advantageously.

Mr. A. C. Townsend, of the Birmingham Corporation Gas Offices, was last Saturday week presented with a handsome set of bronzes by his colleagues, as a mark of esteem, on the occasion of his leaving after fourteen years' service.

New Coal-Field in Staffordshire.—According to the *Daily News*, an important discovery of two new coal-fields is reported near Newcastle-under-Lyme. The area is 200 acres. The yield is estimated at 13½ million tons of coal, or equal to an output of 1000 tons per day for the next 45 years.

John Wilkes, Sons, and Mapplebeck, Limited.—In another part of the JOURNAL will be found the prospectus of the above-named Company, which has been formed with a nominal capital of £250,000, in £5 shares, to acquire the business of Messrs. John Wilkes and Sons and Messrs. John Wilkes, Mapplebeck, and Co., of Birmingham. The trades carried on by these firms are those of metal rollers, copper smelters, refiners, manufacturers of brass and copper, sheets, tubes, wire, &c. The undertakings have been converted into a limited liability Company for family reasons, consequent upon the death of Mr. John Wilkes; and both concerns are taken over as from the 1st inst. The purchase-money is £285,500, made up as follows: Works, £103,700; stock-in-trade, &c., £115,463; goodwill, £66,337. The whole of this has been paid to the vendors in debentures and shares. The stock now offered to the public comprises, as will be seen, ordinary and preference shares and debentures, applications for which will have to be sent in by the 29th inst.

FUEL GAS: ITS PRODUCTION AND DISTRIBUTION.

A Paper read by Mr. Arthur Kitson before the Franklin Institute.

(Continued from p. 113.)

We are now in a position to understand the advantage of using steam mixed with the air, and see how it is made available. Steam enables us to lower the furnace temperature, and consequently reduce the sensible heat of the gases, at the same time conserving the thermal energy for future use. By injecting a mixture of steam and air, we require less air than where it is used alone, since the steam provides a certain quantity of the oxygen necessary to convert the carbon into carbon monoxide. The air maintains the furnace temperature essential for decomposing the steam in the presence of the red-hot coal; the oxygen of the steam unites with the coal to form carbon monoxide, and the hydrogen remains free. You will, therefore, see the enormous advantage the use of steam thus affords. Instead of free nitrogen, we get free hydrogen, which is not only a highly heating and combustible gas, but exceedingly light, and confers low specific gravity upon the gaseous products with which it is associated—a feature of considerable advantage where the gases have to be carried some distance before they are burned. Of course, the use of steam entails a consumption of the heat-energy of the furnace; and it becomes a rather nice point to so proportion the steam and air that the fuel can maintain sufficient heat to carry on the chemical transformation of the steam to combustible gases, and reduce at the same time the quantity of air to a minimum. The less the amount of air used, the less the proportion of inert nitrogen in our fuel gas—a point to be aimed at; and the greater the proportion of steam, the greater will be the heating power of our gas, providing always the requisite furnace heat be maintained to decompose the steam effectively. If we ascertain the heat generated in the furnace, and that expended in effecting the chemical transformation of a given weight of steam into combustible gases, the furnace temperature can be known; and this will guide us in determining what amount of steam may be used with success.

Having given the following data, let us calculate the results: 800 lbs. of steam supplied from a boiler at 300° Fahr.; 2240 lbs. of anthracite or coke, containing 240 lbs. of ash; 10,013 lbs. of air. We will allow for a loss of 20 per cent. of steam that will, in all probability, escape decomposition in the furnace; also for 10 per cent. of carbon burned to carbonic acid:—

Heat Production.		British Thermal Units.
1800 lbs. of carbon burned to CO	= 1800 × 4,400 . . .	= 7,920,000
200 lbs. of carbon burned to CO ²	= 200 × 14,500 . . .	= 2,900,000
Heat carried in by steam 800 × 300° × 0.475	. . . . .	= 114,000
		10,934,000

Allow 20 per cent. of steam as wasted in escaping through the furnace without undergoing decomposition:

Heat Expended.		British Thermal Units.
160 lbs. heated from 300° Fahr. to (say) 1300° Fahr., 160 × 1000 × 0.475	. . . . .	= 76,000
Conversion of 640 lbs. of steam at 300° Fahr. (640 ÷ 9) × 53,900.	. . . . .	= 3,832,290
Allow 10 per cent. loss in furnace by radiation, &c.	. . . . .	= 1,093,400
		5,001,690

Then 10,934,000 — 5,001,690 = 5,932,310 heat-units contained in the furnace.

Our furnace heat is determined as follows:—

CO ₂	. . . . .	= 732 lbs. × 0.2164 = 158.405
CO	. . . . .	= 4194 „ × 0.2480 = 1,040.212
N	. . . . .	= 7660 „ × 0.2440 = 1,869.040
H	. . . . .	= 71.11 „ × 3.4046 = 241.774
		12,658.11
		3,309.431

And 3,309.431 ÷ 12,657.11 = 0.261, being the average specific heat; and 5,932,310 ÷ (12,657.11 × 0.261) = 800° Fahr., being the average furnace heat. The proportion of gases by volume will be as follows:—

Cubic Feet.		
H	. . . . .	12,700
CO	. . . . .	53,700
CO ₂	. . . . .	6,000
N	. . . . .	97,900
		170,300

Combustible, about 39 per cent.
Non-combustible, 61 per cent.

Now, this temperature is much higher than is necessary for decomposing steam, and shows that our proportion of steam to air is too small for economical work. We may, therefore, increase the weight of steam with advantage. Let us increase the weight of steam one-third; making it 1200 lbs. We have then: Coal, 2240 lbs.; carbon, 2000 lbs.; steam, 1200 lbs.; air, 8810 lbs.

In these tables, I have not allowed for an excess of air, which is of course, essential in practice, and which will somewhat modify the results theoretically obtained.

Heat Produced.		British Thermal Units.
1800 lbs. (C to CO)	= 1800 × 4,404 . . .	= 7,920,000
200 lbs. (C to CO ₂)	= 200 × 14,500 . . .	= 2,900,000
Heat carried in by steam 1200 × 300° × 0.475	. . . . .	= 171,000
		10,991,000

Heat Expended.

British Thermal Units.

20 per cent. escaped steam, 240° × 800 lbs. × 0.485	= 91,200
Conversion of 960 lbs. of steam (960 ÷ 9) × 53,900	= 5,748,900
10 per cent. loss by radiation	= 1,099,100

6,939,200

Then, 10,991,000 — 6,939,200 = 4,051,800 heat-units in the furnace.

Then to ascertain the furnace temperature:

CO ₂	= 733.00 lbs. × 0.2164	= 158.621
CO	= 4,194.00 „ × 0.2479	= 1040.212
N	= 6,740.00 „ × 0.2440	= 1644.560
H	= 106.66 „ × 3.4046	= 362.644
		11,773.66
		3206.037

Then 3,206.037 ÷ 11,773.66 = 0.272, the average specific heat; and 4,051,800 ÷ (11,744 × 0.2723) = 1280° Fahr., being the average furnace heat.

The amounts of the gaseous products by volume in this case are:

Cubic Feet.		
H	. . . . .	= 19,000
CO	. . . . .	= 53,700
CO ₂	. . . . .	= 6,000
N	. . . . .	= 85,800

Combustible, 44 per cent.
Non-Combustible, 56 per cent.

The total heat-units are as follows:—

H	= 106.66 lbs. × 62,000	= 6,612,920
CO	= 4194 lbs. × 4,325	= 18,139,050
		24,571,970

And 24,751,970 ÷ 164,500 = 151 British thermal units per cubic foot, which is nearly half the value of uncarburetted water gas.

Are these results the best attainable? I do not think so. In a properly constructed furnace, we ought to be able to obtain and maintain 50 per cent. of combustible gases from the total products. With care we can work at a lower temperature than that last obtained, because experience shows that gases do not leave at furnace heat. Supposing they leave at 800° Fahr., then the furnace temperature is increased: (480 × 0.272) ÷ 0.22 = 589° Fahr.; the temperature becoming 1869° Fahr. A large percentage of the heat ordinarily lost through the brickwork, as well as the sensible heat of the products may be utilized by heating the steam and air before they enter the furnace.

Of course, these calculations are based on theoretically perfect combustion, and no excess of air has been allowed. Under the best conditions, it is possible to decompose 1500 lbs. of steam to every ton of coal, providing the steam is furnished from an independent source, and to obtain approximately the following results:

	Weight, Pounds.	Volume, Cub. Ft.	Heat-Units.
Combustible . . .	{ Hydrogen . . . 166	29,800	10,333,292
	{ Carbonic oxide 4,194	53,700	18,139,050
Non-combustible	{ Nitrogen . . . 5,179	65,500	—
	{ Carbonic acid 733	6,000	—
		10,272	155,000
			28,472,342

This equals nearly 54 per cent. combustible products, and gives 183 heat-units to the cubic foot. Can this quality be generated continuously? Experience shows that it can, providing the steam and air are supplied at a sufficiently high temperature. With steam furnished from a separate boiler, at (say) 500° Fahr., no difficulty will be found in producing this quality of gas.

There is still the fuel requisite for supplying the steam to be calculated and allowed for in these results. To produce 1500 lbs. of steam from water at atmospheric temperature, and raise it to 500° Fahr., would necessitate a consumption of from one-eighth to one-quarter of a ton of coal; so that our results are reduced to 130,000 cubic feet of gas, containing 183 heat-units to the foot, or 23,500,000 heat-units to the ton of coal.

The question now naturally arises whether it is possible to generate the steam in the same furnace, and still maintain the quality of the gas. To do this we have only the waste heat of the furnace—i.e., the sensible heat carried off by the gaseous products—and that radiated through the brickwork, to work with, since we cannot lower the temperature of the furnace without seriously affecting the quality of the gas. As shown, we need 2,500,000 British thermal units. Suppose the gases leave the generator at 500° Fahr. above the atmosphere. There are 10,250 lbs. × 600° × 0.272 = 1,600,000 British thermal units carried away by the gaseous products from a ton of fuel; and allowing 10 per cent. loss for radiation, &c., 1,090,000 units—making a total of about 3,750,000 heat-units. If it were practicable to utilize entirely this waste heat in producing and superheating the steam, the perfection of the gasification of coal would be reached; for there would be contained in the combustion of the gases 95 per cent. of the heat-units in the coal itself. By placing a superheater in the take-off pipe, and a superheating coil in the brickwork, a considerable amount of this waste heat becomes available.

Allowing for all contingencies, I believe it is possible to obtain, from 2240 lbs. of anthracite, from 150,000 to 160,000 cubic feet of semi-water gas, averaging 165 heat-units to the foot, which will contain 25 million units of potential heat, or about 83 per cent. of the heat energy of the coal itself. This system possesses, in my judgment, the best solution of the fuel-gas question. The cost of its production is trifling; and the labour attached to its manufacture (usually a considerable element in

the cost of gas) is very slight. With coal at \$3 per ton, its cost of production should not exceed $2\frac{1}{2}$ c. per 1000 cubic feet. In other words, we ought to obtain a million heat units at a cost of 15 c. At the present price of Philadelphia city gas, this same quantity of heat costs \$2.30.

The objections that are urged against the use of gas of this quality are that the presence of so much inert matter necessitates the use of larger pipes, and that combustion is maintained with difficulty. The first of these objections only applies where it is absolutely necessary to use the pipes already existing and hitherto employed for illuminating gas. If new pipes have to be put down, it is not so great an undertaking to lay a 9-inch pipe instead of a 6-inch, for instance, and should not prove a serious obstacle. But the same objection would hold good as against water gas. This gas contains only one-third the heating value of natural gas, and one-half that of coal gas. If a certain sized pipe were just sufficient to carry natural or coal gas, it would be too small for water gas, unless the pressure were considerably increased; and this would necessitate better laid mains and better joints than we are now accustomed to.

When gas becomes generally used for fuel, no such sizes of mains as those now employed for the supply of illuminating gas will furnish anything like the demand. Moreover, in the method of distribution I shall presently describe, this objection vanishes. The question becomes a mere arithmetical problem: Does the interest on the investment required to provide larger mains equal, exceed, or is it less than the value of the extra heat-units supplied? This is a simple problem; and its solution is an answer to this question. It is merely a question of dollars and cents.

The other objection urged is that there is difficulty in maintaining combustion. This objection is confined almost entirely to the gas known as producer gas—that made in blasting the furnace in the water-gas process, in which the combustible products do not exceed 35 per cent. With the gas I have described, combustion is readily maintained, especially when it is heated prior to ignition—a condition easily obtained for all ordinary purposes.

Water gas, made by what is known as the alternate method, consisting in alternating the steam and air blast, will furnish, under the best conditions, not more than 40,000 cubic feet of gas, containing 300 heat-units per foot—a total of 12,000,000 cubic feet to the ton of coal. It is composed almost entirely of carbon monoxide and hydrogen. The producer gas—that given off in blasting the furnace with air—is of too little heating value to convey long distances, and must be burned in large quantities to be effective. It is advantageous to use this under the boilers for furnishing steam.

The thermal intensity of water gas is very high, while its calorific value is less than half that of coal gas. Its success as a fuel depends solely on one point—the cost of distribution. It can be produced cheaply enough to warrant its introduction; but, unfortunately, the expense incurred in getting it from the holder to the consumer is generally greater than that of manufacturing and putting it into the holder. It is already in use for fuel in several cities, and is sold, I understand, at 40c. and 50c. per 1000 cubic feet. The latter figure is too much. Coal gas at \$1.25—the price charged in New York City—is just as cheap for ordinary domestic purposes. To compete successfully with coal, water gas containing 300 heat-units to the foot should be sold at 20 c. per 1000 cubic feet, at which price there will be no difficulty in selling all that a company can produce in every city, except where natural gas is already supplied.

To recapitulate: Of the three methods for converting coal into gas for fuel—viz., by natural or forced draught without steam, by forced draught with steam, and by steam and air alternately, resulting in the generation of producer gas, semi-water gas and water gas respectively—semi-water gas contains 80 to 85 per cent. of the heating value of coal, and is the cheapest gas if supplied within a reasonable distance from the place of production. Producer gas must be burned hot as it issues from the producer, to be advantageous. Water gas contains only about two-fifths of the heating value of the coal from which it is produced, and is, *per se*, the most expensive of the three systems. Not the least of the advantages which semi-water gas, or “steam-jet” producer gas, as it is sometimes called, possesses over water or coal gas, is the ease and simplicity of its production. It can be made in a furnace not much larger than some that are in use for heating dwellings; it requires no storage, is automatic in its production, and can be made in quantities varying from 500 cubic feet to an indefinite quantity per hour.

(To be continued.)

The Association of Sulphate of Ammonia Manufacturers.—The Honorary Secretary of this Association (Mr. G. E. Davis) has forwarded to us a copy of the report of the proceedings at the annual general meeting of members, held in Manchester last month, under the presidency of Mr. J. Hepworth, of Carlisle, together with the report of the Council, bye-laws, list of members, and specimens of the literature bearing upon the use of sulphate of ammonia which the Association are prepared to supply to gas managers for distribution. The pamphlet has been printed for private circulation.

REGISTER OF PATENTS.

Gas-Engines.—Robinson, H., of Manchester. No. 1083; Jan. 21, 1891. [8d.]

This invention relates to “improvements in engines in which the piston is propelled by the ignition and expansion of an explosive mixture of gas and air, or other supporter of combustion.”

The piston of the engine is arranged to be propelled, as usual, at every second revolution of the crank-shaft, by means of an eccentric, or cam, or equivalent—preferably upon the crank-shaft of the engine; while a rod from the eccentric operates the exhaust-valve of the engine at the required times in the following manner: There is a wheel mounted on an axis in such a manner that the rod rests by gravity against teeth or cavities formed on the wheel. The pitch of these teeth may be a little less than the travel of the rod; and upon the rod a projection is formed in such a manner that it engages with the teeth. A spring may be used to bear upon the wheel, or a pawl or retaining catch may be employed; the object being to prevent the rotation of the wheel except in one direction. The rod moved at each revolution of the engine engages with the teeth of the wheel, and moves it onward—preferably one tooth or cavity at each revolution of the engine. The teeth are formed of different depths; and the rod is held in various positions, according to the depth or shape of the tooth upon which it is acting. The exhaust-valve of the engine is preferably placed with its axis about in line with the rod, which can thus act directly upon the exhaust-valve stalk, or elongation of the valve-stalk, when the rod is in contact with certain of the teeth. When, however, other teeth are in contact with the rod, they cause it to work in such a position that it misses the valve-stalk, and so no opening of the valve takes place. In the well-known cycle, consisting of an ignition at every second revolution of the engine, every alternate tooth or cavity on the wheel is of the form necessary to bring the eccentric rod into position to actuate the exhaust.

Preventing the Bursting of Water-Pipes through Frost.—Minshaw, J. H., of Battersea, Surrey. No. 2745; Feb. 14, 1891. [6d.]

This combination fitting (to be used in frosty weather, so as to prevent the bursting of water-supply or service pipes) is constructed with a stopcock in the centre, and two receiving or outlet sockets near each end. Into these sockets either draw-off taps or plugs are inserted before the combination stopcock is fixed in the service or supply-pipe near to the water-main in any house or building. Then, in the event of frosty weather, the water supply can be cut off, and the dead water be drained out of the pipes by unscrewing and taking out the plug at the side of the stopcock; or a draw-off tap may be inserted in the receiving or outlet socket in place of the plug, so as to prevent the pipes from freezing.

Actuating Gas-Taps.—Pain, A. C., of Edgbaston, Birmingham. No. 3021; Feb. 19, 1891. [8d.]

This invention refers to an appliance for actuating a gas-tap, in which a cord, wire, or other flexible connection is held taut by a spring arranged in opposition to a second spring in such manner that, when the cord is moved within a certain range, it remains in whatever position it may be left, and so sets the gas-tap in any desired position.

Regulator for Gas-Engines.—Fielding, J., of Gloucester. No. 3074; Feb. 20, 1891. [6d.]

When a gas motor engine receives its supply of gas from the main which supplies gas-jets, it is always found necessary to provide means for preventing the pulsation caused by the intermittent demand of the engine. According to the present invention, apparatus for this purpose consists of two or more chambers fitted with flexible diaphragms through which the gas is led to the engine; suitable regulating valves or plugs being provided in the passages running from one chamber to the other, the areas of such passages gradually increasing from the inlet to the outlet. Preferably such an apparatus consists of a short iron cylinder open at both ends, with a division-plate somewhat nearer one end than the other; the ends being closed by elastic rubber sheets or diaphragms, secured by rings and bolts. The cylinder thus forms two separate chambers, one having a greater capacity than the other. The gas supply from the main is led into the smaller chamber; and the engine supply is taken from the larger. A regulated passage connects the two chambers; its area being so reduced that a constant flow is required to supply sufficient gas for the engine. As, however, the engine only draws its supply intermittently, the larger chamber acts as a reservoir, while the flexible diaphragm in the smaller chamber maintains an equable pressure in the main. The efficiency of the regulator will, of course, be increased by the addition of other chambers and diaphragms.

Gas Motor Engines.—Fiddes, A. and F. A., of Bristol. No. 10,333; June 18, 1891. [11d.]

This invention has for its object the filling of the space or chamber in the cylinder beyond the stroke of the working piston with a combustible charge, so as to increase the power of the engine; and also to make use of the unexpended energy which remains after the working piston has completed its working or combustion stroke, to still further increase the power of the engine. The patentees have found it advantageous to fill the combustion or compression chamber referred to above with a fresh combustible mixture at or about the same time as the charge is being drawn in by the working piston. They thus gain greatly increased power according to the length of the stroke of the piston-valve and of the chamber referred to above, through having this space or chamber charged with combustible gases instead of burnt gases or smoke.

In the space or chamber beyond the working stroke of the piston is placed a piston-valve with a piston-rod attached to a connecting-rod, worked by a cam or cams on a counter-shaft driven by the crank-shaft at half the speed of the latter. The back end of the cylinder is provided with a hole, rather larger than the piston-rod, which admits air, so as to allow the piston-valve to work freely. Round the inside

edge of the hole, a valve-seating is turned; and round the piston-rod or the piston-valve is a corresponding seating, so that, when the piston-valve is drawn back by the cam or cams to the seating, it forms the valve, and makes it air-tight.

The cycle of operations of the engine is as follows: The working piston and the piston-valve meet at the exhaust port without quite touching; the working piston then makes its outstroke; and the piston-valve makes its backward stroke into the seating before-mentioned—each piston drawing in its respective charge, so as to entirely fill the cylinder with a combustible mixture. The piston-valve remains in its place during the time the working piston is making its in or compressing stroke, and also while it is making its outward or working stroke. When the piston has completed its out-stroke, the exhaust-valve opens; and both pistons then advance together, and nearly meet at the exhaust port. The operation is again repeated by the piston and piston-valve separating and drawing in their respective charges, as described.

On the front of the cylinder a cover is fitted, so that, between the cover and the front of the working piston, a chamber is formed in which to receive the shock or force of the unexpended energy left after the working stroke before mentioned, which is conveyed from the exhaust-valve by a passage. The products of combustion then pass out into the open air through a port in the cylinder. By another arrangement, the unexpended force referred to passes into a separate auxiliary cylinder or exhaust chamber, with a working piston in it connected to a clutch or ratchet on the crank-shaft, so as to assist the propelling power of the engine.

Gas-Motors.—King, J. T.; communicated from Connelley, J. S., of Plainfield, New Jersey, U.S.A. No. 14,002; Aug. 19, 1891. [8d.]

This invention relates to a gas-engine having a primary cylinder and a second charging cylinder, each provided with a piston, and being connected, and the primary cylinder being provided with a suction-operated valve for the inlet of the explosive charge, and with the piston adapted to open and close communication between the two cylinders, when the communication is established a suction is created, and the valve opened thereby.

In his specification, the patentee remarks that, in the use of engines having a primary cylinder and second or charging cylinder, the action of the second cylinder and piston is noisy—so much so as to unfit the engines for use for many purposes. The reason for this is found to be as follows: It is impossible to make the connection between the piston and piston-rod of the second cylinder, and between the piston rod and crank, so exact that there shall be no loose motion of the parts; and when the piston is being started on its outstroke by the revolution of the main-shaft, the joints of the parts are separated to the fullest extent. It has been the practice heretofore not to admit the charge into the second cylinder until after the piston has thus commenced its outstroke; and the effect of the sudden force exerted on the piston by the entrance of the gases, is to force the parts quickly together with a jarring noise. One object of the present invention is to obviate this difficulty; and this is accomplished by so relating the positions of the cylinders with reference to their cranks, and the location of the exhaust port of the primary cylinder, that the exhaust from the primary cylinder into the second cylinder occurs just as the second piston is at the end of its instroke, and before the parts have been separated or loosened by the draft of the crank on the piston. The exhaust then, on entering the second cylinder, finds the joints of the parts all closed together, by the pushing of the crank on the piston, and therefore operated without any jar. As a useful auxiliary to this part of the invention, the patentee prefers to employ a cushioning device at the inner end of the second cylinder, which, as the piston reaches the end of its stroke, ensures the closing together of the joints, and holds them together until the charge has acted on the piston with its outward propulsion.

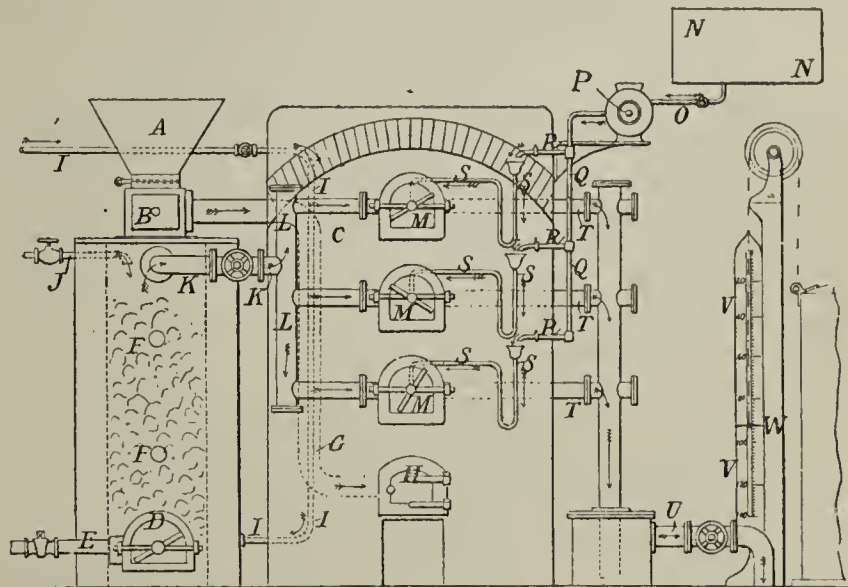
These parts of the invention are of use even when the engine is so used—opening of the exhaust-valve at the moment of the escape of the gases from the primary cylinder—that no effective power is transmitted to the second cylinder, which is employed only for the indraught of the next explosive charge. In such a case, the escape of the gases from the primary cylinder produces a blow on the piston of the second cylinder, which, though not sufficient to act appreciably to propel it, is enough to make the disagreeable noise above referred to if these improvements were not employed. They are also of material use when the parts are so arranged that the exhaust-valve in the second cylinder is closed at the time of the admission of the charge from the primary cylinder, in which case the charge will act propulsively on the piston of the second cylinder.

Another feature of the invention relates to the exhaust-valve, through which the exploded gases are discharged from the cylinders. Heretofore it has been the practice to employ an exhaust-valve communicating with the primary and second cylinders, and operated mechanically, so that it shall be closed at the time the discharge from the primary cylinder to the second cylinder occurs, and open during the back-stroke of the second piston. This would answer well enough if there were an explosion at every outstroke of the primary piston; but, as is well known, it is the general practice in operating gas-engines to employ a governor, so constructed and geared with the valve which admits the gas for the explosive charge that, when the engine runs above its normal speed, the valve shall be closed temporarily. The primary piston may thus make two or three successive strokes without explosions; and in such case, if no special device be used to prevent it, the second piston must, on its outstroke, create a vacuum which would seriously retard the motion of the engine. In order to prevent this, it has been common to employ a snifting-valve located at the rear of the second cylinder, and adapted to open when a partial vacuum is produced by the cause just mentioned. There are, however, serious objections to the use of a snifting-valve. If it is made to open easily, there is danger that it will open when suction is created in the cylinders by the normal action of the piston at the end of its stroke, in drawing in the explosive charge of gas and air; and this, of course, would interfere with the indraught of the charge. If it is made difficult to open, so as to overcome this danger, it is at the serious loss of power of the engine, which, on idle strokes, must part with considerable

energy in overcoming the suction which occurs before the valve opens. Besides this, snifting-valves in any case are objectionable, because it is practically impossible to provide efficient and noiseless means for closing them with sufficient rapidity. These matters are provided for by employing an exhaust-valve, which is open in the first and last parts of the outstroke of the second piston. Of course, by this construction, power is lost by reason of the partial escape of the exploded gases while still under tension; but this is much more than overbalanced by the great saving of power which arises from the prevention of the difficulties usually incident to snifting-valves.

Manufacture and Storage of Illuminating and Heating Gas.—Fourness, H., of Manchester. No. 15,469; Sept. 12, 1891. [8d.]

This invention relates to the manufacture and storage of gas composed of a mixture of water gas and oil gas; means being provided whereby the gas carburetted in the producer can be additionally enriched in its passage through a fixing chamber or retort, and whereby the producer can be cleared of explosive mixtures previous to blowing in air to re-heat the coke or contents of the producer. The invention further relates to details of the apparatus, and means whereby gases can be mixed in the storage vessel or holder in certain fixed and easily ascertainable proportions.



The illustration represents a front view of complete apparatus for carrying the invention into effect.

The producer is constructed in the ordinary manner—that is to say, it consists of an outer casing of metal, lined with fire-brick or other refractory material. At the top there is a hopper A, through which the coke or the other material employed is fed into the interior. At the foot of the hopper is a sliding damper, which is opened to admit the coke to the producer, and closed when a sufficiency has been placed therein. Beneath the damper is a sliding-valve B, which is also drawn out when the coke is being supplied, and is kept drawn out after the damper has been shut, to allow the producer gas to pass along the pipe C to the flue G and furnace H when the coke is being blown up. In the illustration, the damper and the valve are shown closed, as in the case when carburetted water gas is being produced. At the foot of the producer, there is a combustion port D, in which lighted fuel is placed, and is blown up by an air blast through the pipe E, which is connected to a fan or other air-forcing means. Thus the coke in the producer can be rendered incandescent; a couple of spy-holes F enabling the operator to judge when it is sufficiently hot. During the process of rendering the coke incandescent, the producer gas evolved is led through the producer gas-pipe E to a flue G in the side of the brick retort-setting, through which it is passed to the furnace H beneath the retorts, and is therein consumed, so as to reduce the consumption of fuel in the retort-furnace, and utilize the producer gas. When the coke is rendered thoroughly incandescent, the valve B is closed, so as to cut off the supply of producer gas to the furnace H; and the blast is at the same time cut off.

To produce water gas, steam from any suitable generator is led by a pipe I preferably through the flue G, so as to superheat the steam, and then direct into the bottom part of the producer among the incandescent coke. The steam, in rising through the incandescent coke, becomes decomposed and forms water gas. At the same time a supply of crude heavy oil of the cheapest description is sent through the pipe J, and let fall upon the top of the hot coke. The pipe J is preferably formed with a syphon bend, to prevent the crude oil from being at times forced back. The crude oil begins to vaporize as soon as it touches the hot coke; and it is entirely vaporized as it permeates downward, except the very heavy carbonaceous residuum which adheres to the coke. As the water gas rises upward, it meets and mixes with the oil gas or vaporized crude oil. The mixture of oil and water gas is next led through the pipe K to the pipe L, from which branches project to the several retorts M.

As already stated, the retorts are heated by a furnace H; and their function is to fix and render stable the mixture of water and oil gas which is caused to enter them from the producer. The patentee remarks that the retorts are empty, and do not contain any of the usual checker work or broken bricks, or materials ordinarily supposed to be essential to the fixing operation. In vaporizing the crude heavy oils which it is his purpose to utilize on account of their cheapness, he finds that, as a rule, the mixture on leaving the producer is deficient in richness; and an important part of the invention therefore refers to means whereby he claims to be enabled to make good this deficiency in richness by vaporizing in the retort a further supply of lighter oil, in order to confer the necessary illuminating power upon the mixture—the whole being fixed by the hot retorts, so as to constitute a stable gas of a high illuminating power. These means are as follows: There is a cistern N containing a quantity of light oil, which is led by a pipe O (governed by a stop-valve), through an oil-meter P, to a stand-pipe Q, from which taps R extend to fillers

mounted on syphon bends S, by which the oil is run into the front of the retorts; the pipe S extending a short distance along the interior of each retort, and terminating in an open end. The heat of the retort vaporizes the oil in the tube; and the vapour issues from the end of the pipe into the retort, where it thoroughly mixes with the carburetted water gas already admitted from the producer. As it passes through the retort, the enriched gas is exposed to the full heat; and it is thus fixed and changed into a stable gas, which "can be stored or carried for distances in pipes without deteriorating." To further improve its quality, the gas as it leaves the back of the retorts through pipes T is led to the stand-pipe and hydraulic main, where it is further purified, and thence through the pipe U to the holder. A standard V (marked with figures representing feet of gas) is erected close to the holder; and an index W, raised and lowered by the holder, indicates the exact quantity of gas in the latter.

A noteworthy feature of his apparatus, the patentee here remarks, is that, owing to the particular arrangement, he is enabled to avert the explosions which sometimes take place in producers in which the water gas is also carburetted by the admission of oil. These explosions are caused by the admission of air to blow up the coke again into a state of incandescence at a time when oil vapours are still present in the producer. According to his proposed method, when the coke is becoming too cold to properly decompose the steam or vaporize the oil, instead of shutting the connection to the retorts by screwing down the stop-valve X, and then opening the producer gas-pipe E, previous to turning on the blast, he simply stops the supply of crude oil, and continues to blow steam through the producer and into the retorts. By this means the carbon and oil vapours are entirely carried off; and the coke is cleansed from a good deal of the carbonaceous residuum, besides the retorts being also cleansed by the blow-through. The water gas as it passes through the retorts is sufficiently enriched from the light oil pipes S to prevent it from having a deteriorating effect upon the gas in the holder. Indeed, were it not for the presence of these secondary and subsidiary light oil vaporizing-pipes, it would not thus be possible to blow pure water through the retorts to the holder without seriously affecting the quality of the gas in the holder. Having thus cleared the producer of oil vapours, the blast can now with safety be turned on; and this is done after closing the valve X, so as to cut off the way to the retorts, and opening the valve B to allow the producer gas to find its way to the furnace. When the coke has been thus sufficiently re-heated, the oil and steam are again turned on, and the process of gas making resumed.

Ovens and Retorts for the Manufacture of Coke and Illuminating Gas.—Creswick, W., of Walton, near Wakefield. No. 17,222; Oct. 9, 1891. [11d.]

This invention relates to means for utilizing the heated gases passing off from coke-ovens for the purpose of carbonizing coal in closed retorts, so constructed that gas and bye-products (ammonia, tar, &c.) are generated in the roasting of such coal, and are collected for use elsewhere.

To effect this the patentee provides a series of ovens with exit apertures into a large receiving flue or chamber, and also a range of retorts around any of which heated gases can be led from the receiving-flue, and allowed to pass to an exit-flue. The filling and emptying of the retorts is done through charging openings at the top, or through openings at the front in the ordinary way.

Assuming the work to be in operation, the process is (shortly) this: When the coal in any of the ovens is sufficiently carbonized, the dampers are closed, the coke withdrawn, and another charge of coal introduced. The door of the oven is then shut; and the coal will in all probability take fire from the heat of the previous charge, or from that of the neighbouring ovens (if not, it will have to be assisted in the usual way by fire). On this taking place, the damper (if closed) is opened to allow the gas to escape; and a "suitable" quantity of air is admitted into the oven from the outside, so as to consume the gases from the heated coal, and to facilitate its carbonization. These gases become incandescent, and, actuated by a partial vacuum, pass from the oven in a course directed by means of regulator-dampers around the retorts. When the coal is fully carbonized, the valve on the gas-pipe is closed; the air-tight mouthpiece is removed from the door, and the coke is withdrawn. Another charge of coal is then introduced, either through the aperture at the top of the retort or through the door; and the air-tight mouthpiece and the covering of the aperture are replaced, and the carbonizing of the charge goes on. The regulator on the gas-pipe is now opened; and the liberated gases and bye-products from the heated charge of coal in the retorts, actuated by a partial vacuum, or by the pressure of the gas (or by both) in the retorts, pass out of the retorts or ovens by the pipe leading through a water-sealed joint, and are then dealt with in any convenient manner.

According to a second arrangement of ovens and retorts, the patentee proposes to employ coke-ovens in which coal is carbonized, and its volatile constituents mixed with a judicious quantity of air, which takes the form of gas and becomes incandescent. This gas is allowed to escape, through suitable apertures governed by regulators, into a flue or chamber; and thence, through other apertures governed by regulators, it is made to pass into chambers, in which ordinary gas-retorts are fixed in the usual way, and around which it plays. Thence, by means of passages (again governed by regulators), it passes into the main flue.

Regenerative Gas-Lamp for Railway-Carriages.—Collins, I. J., of City Road, London. No. 19,226; Nov. 6, 1891. [6d.]

This invention refers to the construction of an external casing and shields for a regenerative gas-lamp to be placed in the roof of a railway-carriage; the lamp which the casing, &c., is specially designed to suit being that described in patent No. 10,447 of 1889. The opening through the carriage roof is surrounded by an angle-iron ring, shouldered at its upper edge to receive the outer casing. The gas-pipe stretches from side to side of the lamp, and has, at its middle within the lamp, a T with a branch descending to the burner. Within the outer casing there is an inner casing narrowed in at the top, and with a reduced tubular part extending to about the height of the

chimney. Above the chimney is a cover, with an internal conical deflector. The outer and inner casings are both perforated with holes for the admission and emission of air and products of combustion; and the upper holes of the outer casing are further shielded by a cylindrical casing. Air enters by the holes in the lower part of the outer casing. A portion of it goes to supply the lamp (entering the regenerative heating chamber by triangular openings in the central shaft), and also a small chamber above the burner itself; and the excess—caused to enter by wind gusts, or by the rapid passage of the casing through the air—finds its way upwards, and out with the products of combustion through the shielded outlets at the upper part of the casing.

Heating Attachment for Lamp and Gas-Burners.—Johnson, J. Y.; communicated from R. S. Merrill, of Boston, U.S.A. No. 19,485; Nov. 10, 1891. [6d.]

This heating attachment for lamp or gas-burners consists of a drum or chamber, with a central opening in its bottom to receive the chimney of the lamp or gas-burner, and provided with clasps or holders for keeping it in place thereon, and with openings in its top, at or near the periphery or rim of the drum or chamber, to allow a free passage of the heated air and products of combustion from the lamp or burner.

APPLICATIONS FOR LETTERS PATENT.

- 520.—HIGGINSON, J., jun., "Gas-engines." Jan. 11.
- 524.—WILKINSON, J., "Working gas-engines." Jan. 11.
- 535.—WILSON, G. M. S., "Manufacture of gas." Jan. 11.
- 587.—THWAITES, R. G., "Preventing water and gas pipes from freezing." Jan. 12.
- 589.—PHILLIPS, J., "Preventing pipes bursting during frost." Jan. 12.
- 719.—ALTMANN, A., "Gas-pressure governors or regulators." Jan. 13.
- 743.—BRAY, G., "Lamps." Jan. 14.
- 765.—FOX, S., "Furnaces for the application of water gas for heating and welding purposes." Jan. 14.
- 773.—FALK, STADELMANN, AND CO., LTD., "Lamps." A communication from S. Falk. Jan. 14.
- 829.—HALL, J. W., "Gas-producer and other furnaces." Jan. 15.
- 836.—STRATHERN, A. M. and A. G., "Governing or regulating the pressure or flow of illuminating gas or other fluids." Jan. 15.
- 845.—NEWTON, H. E., "Gas-furnaces." A communication from R. N. Oakman, jun. Jan. 15.
- 864.—RUSCOE, J., "Charging gas-retorts." Jan. 15.
- 926.—SIMON, R., "Gas and like engines." Jan. 16.

Another Electric Fire in Liverpool.—There was a repetition last Wednesday morning, though on a smaller scale, of the "electric fire" which took place a few days ago in one of the supply-boxes of the Liverpool Electric Supply Company. Shortly before ten o'clock, a considerable volume of smoke was discovered issuing from a supply-box inserted in the pavement at the corner of Dale Street and Hatton Garden. The Electric Lighting Company were at once informed of it; and a workman was sent to open the box and cool the overheated wires—his explanation of the occurrence being that the wires had "just got a little warm."

Complaints as to Inadequate Gas Supply at Manchester.—Despite the assurance given, at a recent meeting of the Manchester City Council, that there would not again be any occasion for complaint as to the diminution of the gas supply, there has been (says the *Manchester Guardian* on the 18th inst.) a good deal of grumbling within the past week in consequence of the insufficiency of the supply. Not only people who make use of gas for illuminating purposes, but those who use it as a motor and for cooking purposes, appear to be exceedingly discontented with the treatment they are receiving in this respect at the hands of the gas authorities. It has been stated from time to time that the gas-making plant is being extended, and that a considerable increase in the holder capacity of the works is in contemplation. It is difficult to understand why such arrangements should have been so long delayed, and why they are not being pushed forward more rapidly now that they have been entered upon.

The Remuneration of the Manager of the Coventry Gas-Works.—Last Wednesday the Gas Committee of the Coventry Corporation held a meeting to consider the remuneration of their Manager (Mr. G. Winstanley). Mr. Winstanley has been Manager for about six years, at a salary of £500 a year, and a commission of 1d. per 1000 cubic feet of gas manufactured above 180 million cubic feet per annum. His average annual emolument during the whole period has been £618. But owing to the increased consumption, it was more than £900 last year; and at the present rate of progress, it would have exceeded £1200 before the existing arrangement with him had expired. A resolution was moved that Mr. Winstanley be paid a fixed salary of £850 a year, to which an amendment was proposed that it be £750. The latter, however, was lost by a large majority; and the resolution was carried. It was stated that Mr. Winstanley derives no pecuniary benefit whatever from the use of his patents at the gas-works.

Stoke Corporation Gas Supply.—At the meeting of the Stoke Town Council last Thursday, the Gas Committee recommended that Mr. Alfred Lass be called in, to give his opinion as to the cost of production and the selling price of gas, and as to whether any profit was made on the supply to the North Staffordshire Railway Company during the year 1890-1; statistics given by Mr. Geen (a member of the Council) and the Gas Manager on the matter being contradictory. Mr. Geen, who was absent, wrote asking the Council to request Mr. Lass to report—(1) As to the cost of gas manufactured and "delivered at the doors of the ratepayers;" (2) the quantity of gas sold and so delivered; (3) the average selling prices; (4) the quantity of gas sold and delivered to the Railway Company at 2s. 3d. per 1000 cubic feet; (5) what profit, if any, was made on the same; (6) what sum, if any, should have been set aside on account of depreciation, sinking funds, and bad debts; and (7) how much, if any, of the sums charged to capital during the three years ended March 31, 1891, should have been charged to revenue. A discussion followed; and the Committee's report, with the addition of Mr. Geen's suggestions, was adopted.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

Standards of Light.

SIR,—Following up my letter of last week on the above subject, I have, in the first place, one slight correction to make—viz., No. 1 of my recommendations should read: "That the future standard should be of the type of the pentane Argand, &c.," in place of "That the future standard should be the pentane Argand, &c."

I will now deal *seriatim* with my recommendations.

With regard to No. 1, I find, as the result of many experiments, that an Argand burner in which the light from the upper portion of the flame is cut off by a screen, is the most reliable as a standard for general work. Even with ordinary gas, the flame may be turned up or down, above or below its normal 3 inches, to an extent far beyond the possible errors of a reasonably careful operator, without materially affecting the light emitted by the portion of the flame used as a standard. With carburetted gas, and with a strictly defined mode of operation, as recommended by Mr. Vernon Harcourt for his table photometer, the standard is even more reliable; but the possible effects on ratio between height of flame and illuminating power, in the event of gas companies introducing water gas, has to be considered. Mainly for this reason, I prefer a special burner of the type proposed by Mr. Dibdin, in which fully carburetted air is employed. Air as a gaseous medium for carrying the vapour of pentane is reliable, as being of constant composition. Pentane is equally reliable; and the special form of burner manufactured by Mr. Sugg for this standard gives a peculiar form of flame tapering at the apex, and therefore more easy of accurate adjustment as to light. That it is desirable to have a 16-candle standard for testing 16-candle gas, I advocate for the reason that an equi-distance between the photometer screen and the two lights would overcome any error introduced through the partial opacity of the air, as during the prevalence of fog. Also that the standard and the gas to be tested both being approximately of equal illuminating power, and both being flames produced in similar types of burner, photometrical errors arising from varying hygrometric and barometric effects on flame intensity would be minimized.

With regard to recommendation No. 2, after long experience in the working of the Harcourt table photometer, I prefer it, apart from its other conveniences, for the reason that it at once abolishes all possible dispute as to conditions of ventilation, which so much affect any form of enclosed apparatus.

Recommendation No. 3 is made for the reason that not only does temperature affect the hygrometric condition of the air, and may thus interfere with the luminosity of flame, but I have found, with ordinary experimental wet meters, that rapid changes in the temperature of the water sensibly affect the light of the gas—a result I attribute to the varying capacity of water to absorb hydrocarbons with corresponding variations of temperature. The necessity of defining conditions as to the size of room and ventilation is essential to secure uniformity in conditions of testing, which at present is, unfortunately, "conspicuous by its absence."

Recommendation No. 4 requires little comment. All your readers who have followed photometrical questions must be acquainted with Mr. Methven's experiments as to the effect of varying proportions of aqueous vapour in air on the luminosity of flame. The fact that the luminosity of a given flame will vary with the density of the surrounding air is also well known.

Recommendation No. 5, I regard as very important. In the first place, a constant 16-candle flame is necessary, if we require equi-distance between the screen and the two flames, where a 16-candle standard is employed. In the second place, it is well known (I sent the account of certain experiments of my own to the JOURNAL some years ago) that the Sugg "London" Argand is specially constructed for 16-candle gas, and that, where the candle power is less, the burner does not do justice to the gas. The development of a light of 16-candle power from ordinary coal gas in a particular form of burner may be stated roughly to depend on the ratio between the hydrocarbons present and the air supply. The latter is regulated by the general construction of the burner and the height and diameter of the chimney. It must therefore be obvious that conditions of air supply suitable for the development of the light of 16-candle gas would be excessive as applied to (say) 15-candle gas. Let anyone try the experiment of testing a gas giving a light of 15 candles in the standard burner at the rigid 5-foot consumption, then *turn up the gas* to a height of about 3½ inches, then take the gas consumption and the illuminating power, and calculate the value of 5 feet. The result will be at least 15.5 candles. This result is really due to a restoration of the ratio between the hydrocarbons in the gas and the air supply, by increasing the proportion of gas consumed. If the standard burner, at a rigid 5-foot consumption, so far damages low-quality gas as to possibly involve the gas companies in a heavy penalty, and considering the improved light that can now be obtained from gas by modern appliances, whereas the burner used in testing is of many years' standing, the claim for abandoning the present rigid 5-foot consumption is well sustained, and should be regarded as a moderate demand.

H. LEICESTER GREVILLE, F.I.C., &c.

Jan. 23, 1892.

SIR,—In the late Mr. F. W. Hartley's "Gas Analyst's Manual" occurs the following passage: "Many gas companies are still in an unfortunate position under the clauses of their Acts of Parliament, and of those of the Gas-Works Clauses Act Amendment Act, 1871, Schedule A of which recites that 'the burner to be used for testing shall be such as shall be prescribed.'" It is as necessary to have a universal standard burner at one end of the photometer as at the other; and I think this is the meaning that, in common justice, should be put upon it. It is an unpleasant fact that, although one may be supplying 16-candle gas by the old Act, he may be made to wince if the authorities insist on testing with the burner with "15 holes and a 7-inch chimney."

Jan. 20, 1892.

A COUNTRY MANAGER.

The Prevention of Freezing of Gasholder Lutes.

SIR,—I have received many communications on this subject; the evident intention of the writers being to utilize gas for the purpose. The practical difficulties in dealing with this fuel on a large scale are such that I cannot see how it can be applied to advantage. The wind, the large consumption necessary, and the connections, are all sources of difficulty and trouble; and the result would probably be only annoyance and failure.

A possible solution of the difficulty may be found in the use of a small portable boiler, made from a coil of 1½-inch steam-pipe (say, nine or ten coils on a 10-inch mandril); this coil being fixed in a sheet-iron casing, with cast-iron fire-bars about 4 inches below the bottom coil—the fuel being coke. If this were connected with the water-lute by ordinary fire-hose, with a hook end for the flow, and one for the return, a very rapid circulation would at once begin; and, as a matter of practice, it will be found that the water in a 14 in. by 10 in. lute in a holder 150 feet in diameter can be heated 15° Fahr. by the consumption of ½ cwt. of coke.

It is probable that this would prevent freezing during the severest weather. Such a boiler could be made at a very small cost by any of the makers of wrought-iron pipes; and many similar have been made for me by Messrs. Edwin Lewis and Sons, of Wolverhampton, for other purposes. The experiment would cost little to try; and, if desired, I should be pleased to give any assistance, although the matter is so simple that it is not likely any would be necessary.

The boiler specified is possibly rather small; and with so cheap a fuel as coke, it might perhaps be made larger with advantage. My own experience has been only with small boilers, the largest of which is eight coils on a 10-inch mandril; the pipe being 2-inch bore. It is possible that, if ten or twelve coils of 2-inch pipe were used, the boiler would still be easily portable, and would have a large margin of power. Gas for such a purpose I feel convinced would be a mistake. It is a fuel only for small, exact, and intermittent work; and its application should be strictly confined to purposes where it can be used easily and to advantage.

Warrington, Jan. 22, 1892.

THOS. FLETCHER.

Eschka's Method of Determining Sulphur in Coal.

SIR,—The description of this excellent method of determining sulphur in coal, which is equally applicable to coke, given on p. 111, of the last number of the JOURNAL, is somewhat incomplete, and the 15 grammes of magnesia and soda mixture mentioned should read 1.5 grammes. Many samples will require rather more frequent stirring than that indicated, to complete the combustion; and the heating must be cautious and gradual. Eschka also recommends that, after the combustion is complete, and the crucible and its contents are quite cool, from 0.5 to 1 gramme of ammonium nitrate should be stirred intimately into the mixture with a glass rod, the lid put on, and the whole heated to redness for some ten minutes. Another important precaution is to make a blank experiment with a similar quantity of the magnesia and sodium carbonate, under as nearly as possible precisely similar conditions. Even with the purest chemicals, an appreciable quantity of sulphuric acid will be found to be present; and this, of course, must be deducted from the result obtained from the coal or coke experimented upon, to give the net quantity present in the fuel. With these precautions, the method gives consistent and satisfactory results.

Salisbury, Jan. 20, 1892.

N. H. HUMPHRYS.

Boiling with Coal Gas.

SIR,—In the last issue of the JOURNAL (p. 108), appended to the report of some experiments by Herr Coglievina, of Vienna, he is reported to have stated that "the commonest fault of all types of boiling apparatus lies in the fact that the flame only plays on parts of the bottom of the boiler," and that "improvements can be best effected by securing an even spreading-out of the flame." This is an "opinion" evidently not based on experiment, as the actual facts are exactly the reverse. Other things being equal, the smaller the flame, and the more concentrated it is on the centre of the bottom of the vessel, the higher the duty. In a series of experiments made to determine this point, the diffusion of the flame in one case showed a waste of no less than 30 per cent. It is to be regretted that Herr Coglievina published this opinion without making the necessary experiments to prove it, or, rather, to prove its fallacy. The higher duty of small concentrated flames is only to be expected, as the smaller the area of the flame, the larger the surface available to absorb the remaining heat of the products of combustion; the results proving that theory and practice agree.

Warrington, Jan. 21, 1892.

THOS. FLETCHER.

Gas Exhibition and Cookery Lectures at Sheffield.—In conjunction with the Gas Company, an exhibition of gas appliances is now being held by Messrs. Richmond and Co., Limited, of Warrington and London, in the Music Hall, Sheffield. At the opening of the exhibition on Monday last week, Mr. Richmond explained that the object of an exhibition of this nature was to prove that the best thing for cooking and heating of dwellings was gas. A number of large towns had taken up the idea somewhat prominently; but Sheffield had not yet done so. In Leicester, between 4000 and 5000 houses used gas for cooking purposes; but in Sheffield only some 400 ranges were out on hire. The Sheffield Gas Company were willing to purchase whatever gas-stove a householder might desire, and let it out to him. With regard to the exhibits, the Gas Company have an elaborate stand, on which are displayed a great variety of chandeliers, brackets, globes, and ornamental fittings of all kinds. Messrs. Richmond and Co. show their cooking-ranges in five different sizes, and samples of the various heating-stoves; among the latter being the "Victor" and "Superb." Cooking demonstrations are given each afternoon and evening by Miss E. E. Golding. The exhibition, which has been fairly well patronized, will be continued during the present week.

MISCELLANEOUS NEWS.

THE PROPOSED GAS-WORKS EXTENSIONS AT ROCHDALE.

Opposition of Property Owners.

Last Wednesday week, Colonel W. M. Ducat, R. E., one of the Inspectors of the Local Government Board, held a public inquiry with respect to the application of the Rochdale Corporation for a Provisional Order to enable them to use certain lands adjoining the gas-works for the manufacture and storage of gas and of the residual products.

Mr. T. B. BALL, the Gas Engineer, was called, and stated generally why the Corporation needed to acquire the land referred to. During the past twenty years, he said, the consumption of gas had practically doubled, and the demand was constantly increasing; so that their powers of production were now taxed to the uttermost. The total number of retorts of all descriptions in the works was 417; and the estimated yield in the 24 hours was 2,230,000 cubic feet, but they had actually made 2,135,000 cubic feet. The amount sent out in one day had been as much as 2,444,000 feet; and for days together the demand had exceeded 2,250,000 cubic feet. The difference between what they could produce per day and the amount sent out from the works, was made good on Sundays. The total storage capacity of the holders was 1,865,000 cubic feet; whereas, as already stated, one day's consumption had been as much as 2,444,000 feet. In a manufacturing district like theirs, where they were constantly subject to heavy calls on the gas-works, it was very desirable that the storage should be at least equal to one day's requirements; otherwise, when there was a heavy demand, the consumers could not get a proper supply, and in consequence there were complaints. This statement, he thought, showed the pressing necessity which existed for additional producing power and storage accommodation.

Mr. RIPLEY said he was instructed by Mr. B. Stott, who owned eighteen adjoining cottages, to object very strongly to the land in question being used for any noxious work in connection with gas production or manufacture of residuals. The cottages were only 12 feet from one plot of land which the Corporation now sought to acquire; and if any offensive work was carried on there, the health of his client's tenants would suffer, and the property deteriorate in value.

The INSPECTOR remarked that Mr. Stott erected the cottages knowing that the gas-works existed there, and the only difference now was that the works would be brought nearer.

The TOWN CLERK said there had been no complaint for years in relation to the gas-works; and the object of the Corporation had been at all times to prevent any nuisance arising, so far as it could be prevented in such a place. The new works would be constructed on principles much better than those of the present works.

Mr. RIPLEY observed that he did not object to a gasholder or retort-house so much as to the manufacture of residuals.

Mr. RAMSBOTTOM said he appeared for himself and seven other owners of houses on the westerly side of Manchester Road. They urged that the high-level road which it was proposed to make would be a great annoyance to the tenants of these houses, which were more liable to be damaged than ordinary cottage property. They were built before the manufacture of residuals was commenced; and he was not aware that there were then any injurious smells. Since then, however, there had been a perpetual nuisance; and on many occasions complaints had been made to the Gas Committee (verbally and by letter) of the stench arising from the works. He understood that it was proposed to put a retort-house and coal-store on land now used for residual purposes; and he contended that the coal-store would be almost a greater nuisance than the residuals, as the dirt and dust arising from it would greatly depreciate the value of their property.

Mr. BALL denied that he or the Committee had received any complaint, either verbal or written, from Mr. Ramsbottom or any tenant during the past three or four years.

Mr. WOOLFENDEN and Mr. WALLWORK, owners of property near the works, also objected to the manufacture of residuals, to which they attributed the depreciation in the value of surrounding houses.

The Rev. J. GIBSON urged that the proposed extensions would increase the nuisance from the works, which was already intolerable. The stench was abominable both by day and night; and he had heard frequent complaints on the subject.

The inquiry shortly afterwards ended; and the Inspector then went to view the gas-works.

SUGGESTED PURCHASE OF THE PONTYPRIDD GAS-WORKS BY THE LOCAL BOARD.

At the last Meeting of the Pontypridd Local Board, a large deputation, representing the Pontypridd Chamber of Trade and the Pontypridd Ratepayers' Association, waited upon the Board to complain of the lighting of the town, and to urge upon them the advisability of either purchasing the present gas-works or of undertaking the lighting of the town by electricity or some other illuminant. The deputation was introduced by Mr. H. S. Davies, the President of the Chamber of Trade, who said that, having regard to the ineffective lighting of the town and the very inferior quality of the gas supplied, the bodies represented by the deputation considered it was incumbent on the Board to consider the question with a view to taking over the lighting themselves. They found that in England and Wales there were 178 authorities who had the gas supply in their own hands; and in most of these cases the revenue from the gas-works was not only sufficient to pay all expenses in connection with it, but also to considerably reduce the rates. In many large towns as much as £20,000 or £30,000 per annum had been saved to the rates from the profits made on the gas-works. The Board of Trade returns relating to gas undertakings showed that of 416 companies in 1890, 37 only paid less than 5 per cent.; 29 paid 5 per cent.; 133 paid between 5 and 10 per cent.; 48 paid between 10 and 15 per cent.; one paid 16½ per cent.; and one paid 32½ per cent. The last, he should explain, was the Pontypridd Gas Company, though it did not appear from the return that they had paid anything during the

previous two years. Other members of the deputation having spoken, the Chairman of the Board (Mr. D. Leyshon) observed that the question of lighting had frequently been before the Board; and personally he was glad the deputation had waited upon them. A deputation from the Board had had an interview with the Directors of the Gas Company, and had put the matter before them as strongly as they could. They were informed that, owing to the extraordinary increase in the consumption of gas in the district, the Company had had some difficulty in meeting the demand; but the Directors promised they would do everything they could to meet the requirements of the consumers, and intimated that they intended expending £20,000 on new plant. In the course of the subsequent discussion, Mr. Roberts said that he heartily agreed with the proposal to purchase the gas-works. Mr. Snape considered that the capital of the Company was not sufficient to properly meet the requirements of the district. Mr. J. Roberts thought the best plan would be to engage an expert to report to the Board on the matter. He felt confident that the purchase of the gas-works would be a profitable undertaking. After some further discussion, the deputation withdrew, when the Board decided that the Gas Company should be communicated with, in order to ascertain whether they were prepared to treat with them for the sale of the works, and also that an expert should be engaged to assist the Board in the matter, and to value the works.

JOHANNESBURG GAS COMPANY, LIMITED.

At the Annual General Meeting of this Company, held at the Offices in Johannesburg on the 7th ult., the Directors presented to the shareholders a report on the progress of the undertaking, of which the following is a full abstract.

The Directors commence by expressing regret that, since the previous statement of accounts was laid before the proprietors, the progress of the Company had not been so satisfactory as could be wished. It was expected, however, that in the immediate future the financial and other difficulties would be fully overcome. To clear off existing liabilities, and to provide further working capital, authority was obtained at an extraordinary general meeting, held on Oct. 8, 1890, to raise £50,000 by debentures of £100 each, to be issued at £85, bearing interest at the rate of 10 per cent. per annum. After some difficulty, this amount was eventually subscribed. The balance of the proceeds, after paying off the principal creditors, has been expended upon the prosecution of the gas-works and the purchase of the electric light concession. According to the accounts, there are existing liabilities of £7130, mainly for interest due on debentures and arrears of salary. As to the assets, there was on Nov. 30 last a cash balance in hand of £1768, which is being used in carrying on the works.

The Company's plans for the manufacture and distribution of gas were approved by the Government on Aug. 20, 1889. According to the terms of the concession, the works had to be completed within 18 months thereafter, or on the 20th of February, 1891. Owing, however, to the rapid increase in the town, and the fact that it had been found advisable to order about double the quantity of plant originally calculated upon; and in consequence of the exceptionally high rates of transport which then prevailed, the Company were placed in temporary financial difficulties. The Board, therefore, approached the Government, asking for an extension of time for the completion of the works. The Government acceded to the request, and granted six months—viz., to the 20th of August, 1891. Finding that the debentures could not be raised in time to complete the works by that date, the Directors again approached the Government, and asked a further extension—offering as a condition that some of the principal streets of Johannesburg should be lit by electricity (the Company having previously acquired the electric light concession). To this request the Government kindly acceded, and granted a further twelve months for the gas concession on the condition named.

The electric light concession was acquired on May 6, 1891, for £6000 cash, payable in instalments, and 8000 shares in the capital of a new Company that might be floated for £250,000, or a less number of shares in proportion to a smaller capital than the amount stated. The acquisition of this concession prevents any probable opposition in the lighting of Johannesburg. The Directors consider that for some purposes probably the electric light will be preferred to gas; but they are of opinion that gas will be much more in favour, as it can be used for both cooking and heating purposes, besides being very much cheaper to the consumer than the electric light. In order to meet the conditions of the Government, it has also been found useful as a means of temporary street lighting. This concession covers a period of 50 years, from Feb. 28, 1889, of which, for the first ten years, the right is exclusive.

On the 5th of May last the consent of the Government was obtained to the acquisition of the electric light concession by the Company, and the establishment of a new Company in Europe for the purpose of working these concessions. Steps were accordingly taken by the Directors to form a new Company; and Mr. Lance, the Managing Director, was requested by the Board to proceed to London, and arrange details of re-construction. Meetings were held, and the resolutions necessary for the dissolution of the old Company and the formation of a new one were duly carried.

With regard to the gas-works, a considerable amount of work has been done during the past few months, as shown by the report of Mr. W. Carr, the Clerk of Works (noticed below). There is every reason to hope that the Company will be able to supply a part of the town with gas about the latter end of the present, or the early part of next month.

Following advices from the London Committee, the Directors accepted, on the 31st of October last, the tender of Messrs. Woodhouse and Rawson United, Limited, for the supply and erection of nine arc lamps for public lighting, with engine, dynamo, and fittings. The work was pushed on with all speed by Mr. Cousins, the Consulting Engineer; and the light was installed on the 9th of December.

The following are the principal portions of Mr. Carr's report to the Directors on the progress of the gas-works: After my last report to you, the eastern gable of the retort-house, which was standing entirely

unprotected, was blown down one Saturday afternoon by a terrific gale blowing from the east. It has since been rebuilt; and as we are now able to get a much better quality of bricks and lime than we were two years ago, I consider it a piece of much stronger work than it was originally. The coal-shed on the north side of the retort-house has been adapted as the machinery-room for generating electricity for electric lighting. In the fall of last year we got together as much of the roof material as had arrived, and put it together and placed it in position. We were thus enabled to cover in the two coal-stores and half the retort-house, leaving only the east gable and a portion of the side walls of the retort-house uncovered. It was fortunate we did this, as the season turned out a very wet one; and other parts of the building must inevitably have gone had they been without covering. The remainder of the retort-house roof has recently arrived, and we have placed it in position. As the gable is rebuilt, this block of buildings is now complete. The whole of the material for the purifying-house roof is at the works; but it is not proposed to erect that building until after the purifiers are placed in position. We have recommenced the erection of the retort-stack and the chimney-stack; and when completed the work of putting in the retorts and retort fittings will be proceeded with. We have sufficient material to complete two sets, which will enable us to go on making gas, which will supply the wants of the town until a considerable amount of mains is laid. The whole of the boiler fittings have arrived, with the exception of two dampers, and these we have made. The boilers are all fitted up and ready for work. The exhausters have now arrived, and seem in very good condition, considering their long exposure at Aliwal North. The condensers arrived in a very bad state—very much broken and battered about. I have, however, had them repaired and placed in position. They are now ready for work. The scrubbers are almost complete. The purifiers are all fixed and bolted together ready for riveting, and three of them are partly riveted. One of the lids is in progress as well, and nearly complete. The material for the centre-valve and the travelling crane is all on the ground, so far as I can judge without putting it together. The station meter is fixed and in position, and only requires to be connected to the gasholder and purifiers when they are ready. We are proceeding with the excavation for a tank 40 feet in diameter by 10 feet deep, which, for the time being, will have to suffice for both tar and liquor. A second tank may be constructed later for tar, if advisable. It is intended to make this tank with bricks and puddle. The tank for the 60-feet gasholder is complete and ready for the holder. We are now proceeding with the construction of the latter, the whole of the material for which is on the ground, so far as can be ascertained at present. The 16-inch governor, with all the connections belonging to it, and the 14-inch governor are fixed in position. Beyond laying the two trunk mains to the outside of the fence, we have not done any main-laying as yet. But as soon as we are in a position to supply gas, we shall push along the principal streets as quickly as possible; then as we go along the streets, we shall erect the lamps and light them up at the same time. There is still a large quantity of plant lying at Aliwal North, Kimberley, Bloemfontein, and Durban, some of which will be absolutely necessary before the town can be lit up. The coal mine has been s'arding for some time; but previous to being shut down, it was sufficiently developed to enable us to get as much as 50 tons per day if required, and this could very soon be increased to 100 tons per day. It has been reported to me that a good quality of bituminous coal has been found near the Vaal River, and as it is thought that the railway passing this point will be through to Johannesburg during next year, it will favourably affect the position and prospects of the Company. I have had no opportunity as yet of examining or testing the coal.

THE CHESTER TOWN COUNCIL AND ELECTRIC LIGHTING.

As briefly mentioned in the JOURNAL last week, the Chester Town Council, at their meeting on the 13th inst., adopted a recommendation of the Watch Committee to vote a sum not exceeding £20,000 for carrying out an electric lighting scheme. This decision was come to upon a report presented to the Committee by a deputation (consisting of Mr. Alderman Gilbert, Mr. Stevenson, and the City Surveyor) who had inspected the working of the electric light at Brighton, St. Pancras, Eastbourne, and Brompton. In the course of their report, the deputation said:

Brighton represents two systems of distribution in operation in the same town—viz., the high-pressure alternating current, supplied by the Brighton and Hove Electric Light Company; and the low-pressure continuous current, supplied by the Corporation of Brighton. The high-tension electricity is distributed by means of overhead wires from the Brighton and Hove Electric Light Company's central station. The Company has existed for upwards of ten years, and the Town Council are somewhat indebted to them for working up the business, which, though steadily increasing, is stated to be at present an unprofitable one. The streets of Brighton are lighted by gas only. The gas-works belong to a Company—the charge for gas being 2s. 9d. per 1000 cubic feet; and it was observed that the majority of the tradesmen were not supplied with the electric light, and that the larger hotels provide the electrical machinery and appliances for their own lighting purposes. The Town Council of Brighton have borrowed £30,000 for a period of 30 years, and are now applying for a supplementary loan of £8500. The eventual total cost of the installation, including £7000 for the site of the station, is estimated at £42,000; and this sum, it is calculated, will supply 10,000 lamps—the usual average (5000) being lighted at one time. This station is now supplying 2500 lamps with current at 7d. per Board of Trade unit; the number lighted at one time being (say) 1200, and the largest single installation being 300 lights at the Alhambra. The Corporation cannot ascertain the profit or the loss; having had only two months' experience. An opinion was expressed that loss must arise on the present output; but that, if the maximum is supplied, profit may be made, as the only increased outlay will be in the direction of wages, fuel, &c. Coal costs at Brighton 22s. per ton; the best Welsh steam coal being preferred. The Mayor and members of the Council consider the low-pressure continuous current and storage battery system the best for compact areas (1½ miles the greatest distance); and therefore for Chester they advise keeping the Order in the hands of the Corporation, having great faith in the future of the electric light. The cost of the electric light, calculated

lamp against lamp, is double that of gas; but greater illumination is obtained. The consumers' expectation is met by giving a better light, besides improved conditions of health and cleanliness. Smaller fire risks, clearer atmosphere, and non-destructive effects are also advantages claimed for the electric light against gas. It will be observed that the coal cost at Chester is but one-half the price paid in the towns visited; and this fact, coupled with information derived from various returns, documents, pamphlets, and estimates, demonstrates that Chester is well circumstanced and favourably situated for an installation of the electric light.

Alderman Johnson moved the adoption of the recommendation; and the motion was seconded by Mr. Cunah. Alderman Gilbert remarked that the Town Clerk (Mr. S. Smith) seemed to think that the new light would be pretty largely taken up in Chester; and he (Alderman Gilbert) only hoped it would be. But he feared the initial expenditure to the consumer would be prohibitive. At Eastbourne they paid 6 per cent. on the debenture stock, and very likely would soon pay interest on the ordinary stock. At Eastbourne they had had an experience of ten years with the electric light; and a Director of the Gas Company there told him that the gas had suffered little or nothing. At Brighton the electric light was being worked at a very serious loss, because there was a competing Company. An authority at Brighton had prepared a written statement on the subject; and although he was concerned in private company promoting, he advised the Corporation to keep the matter in their own hands. Mr. J. Jones asked whether it was competent for the Council to renew the powers for another term, and how long the powers lasted. The Town Clerk replied that they came into operation in August next; but there was no such thing as the powers running out. If nothing was done before the 7th of August, it was competent for any company to approach the Board of Trade, and say, "The Corporation have not complied with their Order, so we apply for power to do it." Mr. Churton lamented the want of pluck displayed by the Corporation. He had frequently heard the lessons taught by not getting possession of the gas and water works. Over and over again it had been asked "Why don't you buy the gas-works? Why don't you buy the water-works?" and now they were afraid of taking the electric lighting into their own hands. From the first he had been in favour of the Council adopting the scheme. Of course, it was open to the Corporation to hand over the work to contractors; but this would be very unsatisfactory. They must face the question boldly. No doubt the expenditure was great; but the benefit would be equally great. They could not expect to make a profit to begin with; but when the light became better known, they would find it an enormous advantage to the city. Mr. T. Browne said he was as anxious as Mr. Churton to have the electric light, and to see it in the hands of the Corporation; but the matter ought to have due consideration. Mr. Cartwright remarked that, if the electric light was to be the light of the future, the effect would be to wipe out the gas-works. ("No, no.") Well, he asked, why not? If it did not wipe out the gas-works, they would be putting a double expense upon the consumers; for if they meant to say that some of the consumers were to have the electric light as well as gas, this would be putting an extra taxation upon them. The Gas Company had property which he thought might be used as a central station; and why should they not join with them in utilizing the two powers? He thought the Gas Company would readily meet the Corporation upon the matter; and he proposed that negotiations be entered into with them, with a view of utilizing their works for an electric light station. This proposition was not seconded. Mr. W. Brown urged that the Corporation had already delayed too long, and were now on the margin of the term of their Provisional Order. He was in favour of their undertaking the lighting themselves, and spending what he considered the comparatively small sum, for such a boon, of £20,000, even if it did involve a loss of £1000 for the first few years. Everyone would benefit by the electric light; and the time would come when they would secure all the profits, as in Manchester, where the rates were enormously diminished by the profits from the gas-works. Alderman H. T. Brown contended that the recommendation of the Committee was not at all borne out by the report which preceded it. He said he understood that, if there was one part of the community in Chester more anxious for the light than another, it was the tradespeople; and it was startling to find in a place like Brighton, with its attractive shops and the extent of its trade, and with two powers furnishing the electric light, that the tradespeople should not have adopted it in their establishments. He argued that the electric light was not wanted for street lighting in Chester, where the principal streets were at present as well lighted by gas as those of any town need be. As the light was not wanted by private residents, and as there was no need to tax the ratepayers for improved street lighting, the sole parties by whom the light was required were the tradesmen. It was important to consider whether, under the present circumstances, the Council would be justified in taxing the whole city for the private purposes and advantage of the tradespeople; because there was no doubt that for many years to come the electric lighting must entail loss, whether taken in hand by the Corporation themselves or by outsiders. It required most careful consideration before they launched out into an undertaking involving an expenditure of £20,000 for what was really a luxury. After a few remarks from Alderman Gilbert, the recommendation was adopted by 18 votes to 4.

The Kirkleatham Water Supply.—It is reported that Messrs. Walker, Maynard, and Company, of the Redcar Iron-Works near Middlesbrough, have served formal notice on the Kirkleatham Local Board that, in the event of the Board taking the water supply of the district into their own hands, the firm will hold them responsible for all damage sustained by reason of the Local Board putting in force any of the clauses of the Public Health Act of 1875 relating to water supply. The claim of the firm will, on the lowest estimate, amount to £22,000, and is based on the fact that they have a statutory right at present to a continuous supply of water from the Stockton and Middlesbrough Water Board at 3d. per 1000 gallons; and the damage is calculated on the loss which will be sustained by having to provide a new supply of water, or to pay the enhanced charges for water under the Local Board's proposed scale.

METROPOLIS WATER SUPPLY.

The Proposed Royal Commission.

At the Meeting of the London County Council last Tuesday, the Chairman (Sir J. Lubbock, Bart., M.P.) said he had received from Mr. Ritchie, the President of the Local Government Board, the following letter: "Sir,—Referring to the correspondence which has taken place between the London County Council and Her Majesty's Government, I have to intimate to you, for the information of the Council, that Her Majesty's Government have resolved to advise the appointment of a Royal Commission to inquire 'whether, taking into consideration the growth in the population of the Metropolis, and the districts within the limits of the Metropolitan Water Companies, and also the needs of the localities not supplied by any Metropolitan Company, but within the watersheds of the Thames and the Lea, the present sources of supply of these Companies are adequate in quantity and quality, and, if inadequate, whether such supply as may be required can be obtained within the watersheds referred to, having due regard to the claims of the districts outside the Metropolis, but within these watersheds, or will have to be obtained outside the watersheds of the Thames and Lea.'" Sir John remarked that the proposal contained in the letter was substantially in accordance with the suggestion made to the Government by the Council; and he was sure the decision of the Government must be satisfactory to them all. The letter was ordered to be recorded on the minutes, and was referred to the Special Committee on Water Supply.

The Quality of the Water Last Month.

The returns furnished to the Registrar-General by the London Water Companies as to the water supply of the Metropolis during the past month, show that the average daily supply was 177,450,133 gallons, as compared with 181,980,410 gallons in the corresponding month of 1890; being at the rate of 29.2 gallons per head of the population. Of the entire bulk of water sent out, 88,909,053 gallons were drawn from the Thames, and 88,541,080 gallons from the Lea and other sources. Reporting upon the quality of the supply, Dr. E. Frankland said: "Taking the average amount of organic impurity contained in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies and by the Tottenham Local Board of Health was: Kent, 0.8; East London (deep-well), 0.9; Tottenham, 1.5; Colne Valley, 1.7; Chelsea, 3.5; New River, 4.1; East London (river supply), 4.3; Lambeth, 6.1; Southwark, 6.3; West Middlesex, 6.4; and Grand Junction 6.5. The water abstracted from the Thames by the Chelsea Company was of greatly improved quality as compared with the November supply; but that delivered from the same source by the West Middlesex, Southwark, Grand Junction, and Lambeth Companies was, in every case, of much worse quality than the supplies sent out by the same Companies in November. The excessive floods in the Thames Valley rendered it very difficult for these Companies, who have but small storage at their command, to send out water fit for dietetic use. The Southwark Company's water was opalescent from finely-suspended clay, which was not removed by subsidence or filtration. The remaining Thames waters were efficiently filtered before delivery. The water taken chiefly from the Lea by the New River and East London Companies, though much better than the four inferior Thames waters, was not equal in quality to the Chelsea Company's supply. The water was, in both cases, efficiently filtered. The deep-well waters of the Kent, Colne Valley, and East London Companies, and of the Tottenham Local Board of Health, were, as usual, of excellent quality for dietetic purposes; and the Colne Valley Company's water, having been softened before delivery, was rendered suitable for washing. The Tottenham and East London waters were slightly turbid from minute particles of rust of iron. The others were bright and clear. Seen through a stratum 2 feet deep, the Kent, and Colne Valley waters were clear and colourless; the Tottenham and East London (deep-well), slightly turbid and colourless; the Chelsea, New River, and East London (river supply), pale yellow and clear; the West Middlesex, Grand Junction, and Lambeth, yellow and clear; and the Southwark, pale brown and opalescent."

OPPOSITION TO THE BIRMINGHAM CORPORATION WATER SCHEME.

A Meeting of gentlemen opposed to the scheme of the Corporation Water Department for bringing a supply from Wales, was held at Birmingham last Wednesday. Mr. S. Lloyd presided; and after he had made a few opening remarks, Mr. B. Shepherd (who demanded the poll at the recent meeting of ratepayers) addressed those present. He said that Sir Thomas Martineau had admitted that in the figures which the Water Committee laid before the Council, both on the question of demand and supply and also on the subject of finances, they had had to deal with estimates for the future, and had to indulge in a certain amount of prophecy; and such prophecy and undue speculation he (Mr. Shepherd) thought the ratepayers of Birmingham ought not to be made to support. The wasteful expenditure proposed would, in his opinion, amount to £10,000,000. He was thoroughly satisfied, moreover, whatever might be said against it, that the conduit would have to pass through a mining district in which, on account of the thicker seams of coal met with, there would be much greater danger of subsidence than in the country between Birmingham and Derbyshire, to which Sir Thomas Martineau took objection for the same reason. Besides this, the proposed collecting-ground consisted of sheep-runs and a lead mine; and it was well known that immediately water was stored in reservoirs, and became subject to the light and the air, deterioration and vegetation occurred. The Chairman of the Southwark and Vauxhall Water Company, at the recent meeting of the shareholders, referring to the proposal that water should be obtained from the same district for the supply of the Metropolis, said that the water

would be of "a dirty brown colour," and that the long conduit might be blown up by disaffected working men, or destroyed by enemies in case of war. That dirty brown water was what the Birmingham Water Committee proposed to give the inhabitants for £7,000,000. But what could they get for £500,000? Mr. Gray, the Corporation Water Engineer, had stated that the water-mains could be duplicated for that sum; and if duplicate pipes were supplied, he (Mr. Shepherd) believed nearly five times the present population might be supplied with drinking water from the present wells, which Sir Thomas Martineau himself had described as giving "a water which is the very best that we have supplied to the inhabitants." Mr. G. J. Whitfield remarked, on the question of the cost of the scheme, that it was impossible to estimate precisely a large job in which there would be 80 miles of cut-and-cover work, without knowing the nature of the ground which would have to be traversed. He should not be surprised if the estimate had not come out roughly at more than £7,000,000, and that £200,000 was knocked off to throw dust in the ratepayers' eyes. The present debt of Birmingham was nearly £10,000,000; and £2,500,000 of it was entirely unproductive of revenue. If the water scheme cost more than was expected, they would be in debt to the extent of £20,000,000. There was not the slightest doubt that the public officials of Birmingham had been fired into exultation by the example of the City of Liverpool in taking the water of the Vyrnwy. But Liverpool was more modest. Their scheme was only to cost £2,500,000, though he believed the expenditure had been rather more than £3,000,000. Liverpool, however, had more than the resources of Birmingham. They had nothing to tax but the houses and land; while Liverpool had shipping as well. There was already a first mortgage upon the water-rents; and the annuitants (as they were called) had determined to fight this new scheme because the Corporation wanted to throw them on to the rates. Mr. W. Blakemore next addressed the meeting. He said that, after a careful study of the existing state of affairs, the story of a probable shortness of water was a bogie. As a mining engineer, he could assure the ratepayers that the coal-fields through which it was proposed to carry the Welsh water were by no means worked out, and that beyond them there were other areas beneath which it was pretty certain there was coal, which would eventually be worked. He urged those present not to neglect the supplies which Nature had provided them with, which only required boring beneath the red sandstone to secure. The Chairman moved the appointment of a Committee, with power to add to their number, "to oppose the scheme, and to adopt such measures as may be found desirable to carry out the wishes of the meeting." The motion was unanimously carried, as was also the following: "That a petition, on behalf of the citizens of Birmingham, be presented to the Parliamentary Committee in opposition to the present scheme, and Mr. J. A. Bright, M.P., be requested to take charge of and present the same." An appeal for subscriptions was afterwards made; and it is stated that a considerable sum of money had been promised, with offers of more if required.

STOCKTON AND MIDDLESBROUGH WATER UNDERTAKING.

The Kirkleatham Water-Mains Arbitration.

In the JOURNAL last week (p. 120), we briefly noticed the arbitration proceedings to determine the amount to be paid by the Kirkleatham Local Board to the Stockton and Middlesbrough Water Board for their mains and the privileges of water supply in the Kirkleatham district. The award has now been made; and under it the Local Board are to pay the Water Board £25,424—both sides paying their own costs and half the costs of the award. It may be interesting to point out that the only previous purchase, as far as we are aware, under this dismemberment clause, of "pipes, fittings, and other apparatus," was that in which the Wakefield Rural Sanitary Authority took over the pipes in their district from the Wakefield Corporation. The award in that case was for an amount equal to the estimated first cost of the pipes, &c., as laid in the ground, without any addition for right of supply and goodwill; while in the present instance, it appears to have been based upon the contention of the Water Board that they were parting with a "portion of the undertaking," including goodwill, &c., which they had previously acquired from the Water Company. It is curious to note that, though the two awards (founded upon similar sections in two Acts of Parliament) are apparently contradictory, yet they are both essentially just. At Wakefield, the Rural Sanitary Authority agreed to take water from the Corporation at a fair price; and therefore the latter have not in any way suffered damage by the dismemberment. Here the Kirkleatham Local Board intend to obtain their water from the Cleveland Water Company; and so the Water Board will lose a customer, and consequently the profit they have hitherto derived from the consumption of water within the severed district. Probably this was the view taken by the Arbitrator, whose award may be regarded as substantially fair. It should be mentioned, in correction of our paragraph last week, that the Arbitrator was Mr. Henry Law; and that Mr. Bagallay appeared with Mr. Balfour Browne, Q.C., for the Water Board. Among the witnesses called for this body, the name of Mr. E. K. Burstal, of Messrs. Stevenson and Burstal, of Parliament Street, Westminster, should have been included.

Welsh Rivers and English Water Schemes.—In the course of the reply of the Rev. O. A. Nares to the letters of Members of Parliament on this subject (*ante*, p. 121), he said, referring to Lake Vyrnwy: "Beyond the expenditure incurred by the formation of the reservoir in Wales, the county of Montgomery has secured no advantage from the water-works." A correspondent of a Montgomeryshire paper, in answer to this, points out that the Liverpool Corporation have already been assessed on that property at a sum greater than the value of the whole of Kerry parish. The ratepayers of Llanfyllin Union will now be relieved to the extent of about 4d. in the pound, and in all probability the County Council will, before two years' time, revise the county rate basis; and thus every ratepayer in the country will be the better to the extent of about 1d. in the pound.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

The Edinburgh and Leith Gas Commissioners have this week done a service to the gas industry in Scotland, for which they must be inwardly thanked by all who are interested in gas undertakings. Objection was taken by the Surveyor of Income-Tax to their return for the year ending in May last, in respect that the Commissioners had not returned as part of their assessable income the amount of law and parliamentary expenses which they had paid during the year. These amounted to £2700; and the duty being about £70, the question was considered to be worth getting the opinion of the higher authorities upon. Accordingly, appeal was taken to the Income-Tax Commissioners for the district. The case was heard yesterday. The Commissioners were represented by the Treasurer (Mr. Gill) and the Clerk (Mr. Jack); and the finding of the Commissioners was against the opinion of their Surveyor, except upon a small sum of £200 paid as compensation to Messrs. Mackay and Co. for the pollution of the well of St. Margaret's brewery. Upon this subject the Tax Commissioners favoured the establishment of a fund to meet such claims; or at least they indicated an opinion that had the sum been taken from such a fund, it would not have been liable to tax. On the general question, they were clearly of opinion that outlays on legal and parliamentary charges which are incurred in the protection of the position of the undertaking are not taxable. It would be difficult to see how they could be. Money so expended is really and truly depreciation; in fact it is more, because it is spent to enable the undertaking to earn more in future. To look at it in another way, it would be hard to distinguish such expenditure from abnormal outlay upon the office staff, supposing it should require to be augmented for some necessary purpose in any one year. Certainly expenditure in that line is not profit; and expenditure upon lawyers, either at home or in London, cannot be classed as profit either. There is this further consideration, that all such outlay by public bodies is taxed in the pockets of those to whom it is paid; and to have charged the Gas Commissioners in this instance, would have meant that the same sum would have paid income-tax twice in one year. This latter remark applies also to the £200; for it should have been taxed in the hands of Mackay and Co. who received it, and not of the Gas Commissioners who paid it. The Surveyor of Taxes proposed to lay down a principle; and the Gas Commissioners by their action, have prevented him. Of course, it is open to the Surveyor to appeal to the Court of Session; but in face of the very clear opinion which was expressed by the Tax Commissioners, before such a step is taken very serious consideration will have to be bestowed upon the subject, and there is every likelihood that it will not be taken.

The Committee of Management of the Arbroath Gas Corporation have resolved to insure the gas-works in a sum of £10,230. Hitherto they have only been insured for about £1000. The Committee also had before them a more serious question, in the shape of the pressure which exists in the gas-mains in different parts of the town—the Manager's tests having shown that it varied from 6-10ths in the lower parts to 18-10ths in the higher parts. This is too great a difference of pressure to be passed over; but a decision as to what the Committee are to do, was left over until Mr. Carlow makes further tests both by day and night. It must be remembered that the Arbroath Gas-Works are situated in about the highest part of the town; and a difficulty has always been experienced in maintaining an equality of pressure at the different levels of the town. About three years ago, the Corporation rejected a proposal by Mr. Carlow, backed up by Mr. Mitchell and Mr. Foulis, for the introduction of a new independent main from which to supply the lower levels; and contented themselves with the addition of two new ovens to the retort-bench. Their mistake at that time is now coming home to them. They were then in a better position to afford expenditure upon their works than now; but as the proposed outlay upon the new main was only a few hundred pounds, they may even now be able to meet it. They must do something to put the pressure upon a proper footing; because the great inequality which has been revealed is very unfair to a portion of the community and prejudicial to the Corporation.

There is better news from Inverness this week. The Corporation Water and Gas Committee met on Monday, and considered a modified proposal by the Gas Manager (Mr. Thomson), with reference to the required extension of the gas-works. Mr. Thomson suggested that, by leaving over the construction of a second lift in the new gasholder till it was required, which would probably be six years, the cost of the extensions might be brought down from £9800 to £7500. The Committee, greatly to their credit, declined to consider the modified scheme; and resolved to recommend the Police Commissioners to go on with Mr. Thomson's original proposal. What helped them to this decision more than anything else was a letter which one of their number stated he had received from an English firm who had had large experience in the laying down of electric lighting installations, in which it was said that the cost of an electric lighting main from Foyers to Inverness—18½ miles—would be from £12,950 for 250-horse power, to £37,800 for 500-horse power. This was too much for the Water and Gas Committee; but that other peculiar body, the Electric Lighting Committee, who seem to be practically one man—Bailie Jonathan Ross—met on Wednesday to consult with the Resident Engineer for the Caledonian Canal as to the taking of water power from the canal. The Engineer suggested several points of difficulty, chiefly apparently on the details of construction, which might have been overcome; but someone started a difficulty which was not so easily disposed of—viz., as to how the flow of water could be maintained in winter if there were large masses of ice in the canal. This very difficulty was very clearly pointed out in these "Notes" on Aug. 18 last, the week after the electric lighting proposal was first made. I presume the promoters were too stiff-necked to accept advice except from the engineers they consulted; and that it was only when the practical mind of the Canal Engineer brought the matter up, that they listened to it. The Committee could do nothing; and so they asked their Consulting Engineer and the Canal Engineer to "investigate and consider the matter." These gentlemen may investigate and consider as

long as they please; but unless they are prepared to abolish snow and ice in the Highlands, they will never be able to satisfactorily light Inverness with electricity derived from water power.

The gas explosion on the Central Railway Works, Anderston Cross, Glasgow, on the morning of Dec. 3 last, through which personal injuries were sustained by three men, named Patrick M'Govern, George Henry Moulson, and James Devanny, has given rise to three legal actions for damages in the Glasgow Sheriff Court, which bid fair to be of very considerable interest. They had been raised at the instance of the three men named against the Caledonian Railway and Messrs. Charles Brand and Son, the contractors for the works. M'Govern states that at the moment of the explosion he was walking along the street towards his place of employment, when he was blown up into the air, and fell heavily to the ground; and that he has received a severe shock and other bodily injuries. He alleges that the explosion occurred through the interference of the defenders with the main gas-pipes belonging to the Gas Corporation; through having removed the soil from underneath them for about two lengths of piping, and thereby exposing two joints by which the several lengths of pipe were connected; through the pipe having been damaged by the said interference, allowing a large quantity of gas to escape into a covered cutting or tunnel running across Main Street; and through a workman of Charles Brand and Son having entered this cutting with a naked light. The pursuer also alleges that the provisions of the Glasgow Central Railway Act were not complied with, and that the defenders' operations were a nuisance and fraught with danger. In answer, the defenders deny that the explosion was occasioned through their interference with the gas-pipe or through any fault of theirs. They also aver that the works executed were in accordance with plans approved of by the Corporation of Glasgow, and were executed to their satisfaction in accordance with the said Act. In the actions at the instance of Moulson and Devanny, they aver that the work was being carried on carelessly and recklessly; and that the defenders Charles Brand and Son failed to take proper precautions for their safety, or to have the cutting properly ventilated or inspected. The record in the three actions was closed before Sheriff Spens yesterday (Friday); and they will come on for debate very shortly.

Another law case has cropped up this week in connection with a gas-supply undertaking—one, however, in which the judge has given his decision. The pursuer in this case, which was raised before Sheriff Muir, in the Airdrie Sheriff Court, was the father of a boy, Peter Reid, 4½ years of age, who met with an accident in Bank Street, Coatbridge, in November, 1890, which was alleged to have been caused through the fault of the defenders, the Coatbridge Gas Company, the damages sued for being £50. The Sheriff has found that the accident was not caused through any fault of the defenders; and therefore assoilizes them from the action, and finds them entitled to expenses.

The town of Kilbirnie, in Ayrshire, gets its supply of gas from Messrs. W. and J. Knox, who are the proprietors of an immense linen thread factory which provides a large proportion of the townspeople with labour. Some time ago Messrs. Knox found it to be absolutely necessary to provide an additional supply of light, and they gave the fullest consideration to the notion of introducing the electric light; but in the end they concluded that, on the score both of convenience and economy, it would be most prudent to extend the gas-works. In this connection, they have lately had finished a new gasholder which is 40 ft. in diameter by 15 ft. in depth, and contained in a cast-iron tank; and along with its completion new pipes, to the extent of about 600 yards, has been laid in the town and works. Messrs. W. Brodie and Co., of Paisley, were the contractors; and it is interesting to know that the first holder ever erected by Mr. Brodie on his own account was at these same works, about thirty years ago, within which period the gas supply of Kilbirnie has been at least quadrupled.

It is matter for regret that the experiment of hiring-out gas-stoves in Kilmarnock by the Corporation Gas Committee has not been attended with the amount of success that has been reported from scores of other towns up and down the kingdom, with the result that the Committee resolved, a few weeks ago, to close up the show-room which was started in one of the public thoroughfares of the town last spring, and to transfer the stock to the office at the gas-works. At the last meeting of the Town Council, when the Committee submitted their report, Bailie M'Graw expressed himself in very severe terms on the stove-hiring enterprise. He considered that the fact of closing the shop was an indication that all along they had simply been wasting their time and frittering away the ratepayers' money. Ex-Bailie Brown (Convener of the Gas Committee) stood up in defence of the action taken by the Committee. They had, he said, 97 stoves hired out, the revenue from which was £48 18s., something like 10 per cent. on the cost. As far as the stock was concerned, it belonged entirely to the firms that supplied the stoves, the Committee not being responsible for them. It transpired in the course of the discussion that there had been a profit of £15 for gas consumed in the stoves that had been hired out. It was also stated during the discussion by Bailie M'Graw that the Committee's report had been "doctored"—a statement which was strongly resented by Convener Brown, on behalf of Mr. Fairweather (the Gas Manager), who had drawn up the report. The matter was allowed to drop on the understanding that it would come up again at the next meeting of the Town Council.

The Glasgow pig iron market has been flat during the past week; but Scotch warrants have remained unaltered in price at 47s. per ton cash, at which there were buyers at the close yesterday. A large amount of business has been done in Cleveland and hematite iron at lower prices, which at the close yesterday were, respectively, 37s. 5d. and 47s. 1½d. per ton cash buyers.

[In the paragraph in last week's "Notes" dealing with the Glasgow gasholder contract, the point of one of the sentences in the letter of the "Embryo Town Councillor," there referred to, was destroyed by the omission of a negative. The sentence, which commences at the end of the 15th line from the bottom of the paragraph, should have read: "The successful offerer can give no more guarantee for the fulfilment of the contract than the other, who was £1200 lower," &c.—ED. J.G.L.]

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, Jan. 23.

Sulphate of Ammonia.—After a slight pause in the early part of the week, the market has increased in firmness, and an improved demand is noticeable. There are now buyers at £10 11s. 3d. to £10 12s. 6d. at the various ports; and there is but a moderate quantity offering, which, considering the time of the year and the state of the weather, is somewhat remarkable. While the above figures, of course, indicate a fair advance on the December quotations, the relative position of sulphate towards nitrate is in no way altered, since nitrate has advanced almost at the same rate as, and simultaneously with, sulphate. Hence the same anomaly still exists between the two commodities; and the arguments previously put forth in the JOURNAL continue in force. Sulphate, according to these reasonings, remain at too low a figure; and a further advance in nitrate, which is not at all improbable, must bring this fact home forcibly to the consumers of nitrogenous material. The quieter tone referred to above seems again to have created a hallucination as to the probability of an easier market; and many consumers are holding off in the hope of cheap purchases. But, considering the reduction of the stocks, owing to very heavy shipments, the small quantity on the market, and the impending requirements, it may be predicted that there will be disappointment in store for those who wait for a lower range of values in the near future.

LONDON, Jan. 23.

Tar Products.—Very little business is being done; and tar distillers are overflowing with stocks. In many instances, they have resorted to burning the creosote and common oils. A little business is reported in benzol; and, on the whole, their position is improved. In this improvement, solvent naphtha is also participating. Anthracene keeps extremely dull, with no inquiry; and, as makers are now stocking, the price is likely to be lower. Pitch is moving off freely, with an excellent demand both for prompt and forward delivery. Prices are: Tar, 19s. Pitch, 33s. 6d. Benzol, 90's, 2s. 2½d.; 50's, 1s. 9d. Toluol, 1s. 3½d. Solvent naphtha, 1s. 2d. Crude benzol naphtha, 30 per cent., 10½d. Creosote (nominal), 1d. Crude naphthalene, 35s. Crude carbolic, 60's, 1s. 1½d.; crystals, 5½d. Cresol, 8½d. Anthracene, 30 per cent. (nominal), "A" quality, 1s.; "B" quality, 8½d.

Sulphate of Ammonia.—A distinctly better feeling obtains in this market. A good deal of business is being done; and makers' stocks are remarkably low, having regard to the production. Buyers, however, "hang off" for forward business; and so far will not pay the advance asked for by makers. Prices paid during the week have averaged about £10 10s., less 3½ per cent. Gas liquor (10 oz.) is quoted at 6s. 9d. to 8s. 3d. per ton, according to position.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—There is practically no change to report in the coal trade of this district. For the better qualities, there is still rather a pressure of demand; and engine classes of fuel continue to move off without difficulty, with a slight advance maintained upon late rates so far as the medium and inferior sorts are concerned. But common round coals, except when they are drawn upon for house fuel requirements, remain in only moderate request for iron-making, steam, and general manufacturing purposes. The general tone of the market as regards prices continues very steady; and at the pit mouth, quotations average as under: Best Wigan Arley, 12s. 6d.; Pemberton 4-feet and second qualities of Arley, 10s. 6d. to 11s.; common house coals, 9s. to 9s. 6d.; steam and forge coals, 8s. to 8s. 6d.; burgy, 6s. to 6s. 6d., with some special sorts 7s.; best slack, 5s. to 5s. 6d.; medium, 4s. 3d. to 4s. 9d.; and common, 3s. 3d. to 3s. 9d. per ton. For shipment, there is a fairly active inquiry; and, in some instances, difficulty has been experienced in obtaining prompt delivery of quantities, with the result that prices temporarily have rather stiffened, and, delivered at the Lancashire ports, steam coal has readily fetched 10s. to 10s. 6d.

Northern Coal Trade.—There has been a slight easiness in the coal trade during the past few days—more especially in steam and household coal. Best Northumbrian steam coal is quoted from 10s. to 10s. 6d. per ton f.o.b., according to place of shipment. Most of the collieries have tolerably full work; but for second-class coal and for small steam coal, the demand is decidedly weaker. Gas coal is firm, and the demand for the past few days has been very heavy; the day consumption of gas having in several places shown a large increase. The price varies from 9s. to 10s., f.o.b. and less discount; but for contracts over the shipping season which are now under negotiation, a rather lower price may perhaps be taken. Shipments of this class of coal to London are beginning to fall off; but there is an increase in the tonnage sent to the Mediterranean. Bunker coal is rather easier, though heavy quantities are being shipped at West Hartlepool in steamers that are being put into the American grain trade. The price of bunker coal varies from 8s. 6d. for unscreened up to about 11s. 9d. for the best Durham screened. Manufacturing coals are quiet, with a somewhat limited consumption; strikes having interfered with the working of some large local establishments. In coke, there is a good demand for best blast-furnace qualities; and from 16s. to 16s. 6d. per ton is the price for f.o.b. supplies. Gas coke is dull; and it is said that as low as 8s. to 8s. 6d. per ton is being locally accepted—a price that would set against the lower cost of coal to gas companies in some degree.

West of Scotland.—The coal trade in the West of Scotland shows little alteration. A fair business is passing for prompt deliveries; and for these the rates current at the end of the year are obtainable. The men are not working well, however, and the output is being easily cleared off. There has been no forward business done as yet; foreigners holding off until prices take some definite shape. The following are the quotations per ton at Glasgow Harbour: Splint, 9s. 6d.; main coal, 8s. 6d.; steam, 10s. to 10s. 6d.; ell, 8s. 9d. to 9s.—all f.o.b. The increase in shipments for this year is 72,052 tons. It is anticipated that the Lanarkshire coal-masters will early next month intimate to the miners a reduction of 10 per cent. in the rate of wages.

Messrs. C. Wilson and Sons' London show-room is at No. 76, Queen Street, Cheapside, not in Queen Victoria Street, as announced in the last number of the JOURNAL.

A New Water Reservoir for Douglas.—Considerable progress is being made with a reservoir which the Douglas Town Council are constructing at Kerroodhoo, four miles from Douglas. This work, which is estimated to cost about £12,000, was undertaken by the Council soon after their purchase of the water-works; and its cost was included in the loan raised at that time. The reservoir is about 600 yards long, and has a capacity of 52 million gallons.

The Bilston Gas Company Fined.—At the Bilston Police Court recently, a summons was heard, in which the local Gas Company were charged with cutting up the roadway on two bridges belonging to the Great Western Railway Company, for the purpose of laying down gas-mains, without giving the Railway Company the statutory twenty-four hours' notice. It was contended for the defence that the Bilston Township Commissioners, and not the Gas Company, were responsible for the breaking up of the roads; and it was admitted that the notice had not been given, but it was held that it was not necessary. At the adjourned hearing last Tuesday, the Stipendiary decided that the bridges and roads on them were the property of the Railway Company, and that notice should have been given. He imposed a fine of 20s. and costs upon the Gas Company in respect of each bridge.

Great Wigston Gas Company.—The large augmentation in the consumption of gas which has been going on for the last eight or nine years at Great Wigston was fully kept up in the year just closed; the increase being 2,260,000 cubic feet, or about 15 per cent. The make of gas per ton of coal carbonized for the year was upwards of 11,000 cubic feet; the quantity sold per ton being more than 10,000 cubic feet. The two new beds of retorts, with regenerators designed by the Manager (Mr. J. A. Harris), which have been at work the whole of this season, have exceeded the expectation of the Directors; the make of gas per day from the 12 retorts, 22 in. by 15 in., and 10 feet long, being repeatedly over 100,000 cubic feet. We understand that this quantity could have been exceeded if required. It is intended to extend this system to the other retorts during the coming season.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 151.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon invest. ment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	15 Oct.	10½	Alliance & Dublin 10 p. c.	10	16-17	..	6 3 6
100,000	10	"	7½	Do. 7 p. c.	10	11½-12½	..	6 0 0
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105-107	..	1 13 5
100,000	20	27 Nov.	8	Bahia, Limited	20	12-14	..	11 8 6
200,000	5	12 Nov.	7½	Bombay, Limited	5	6½-7	..	5 7 1
40,000	5	"	7½	Do. New	4	4½-5½	..	5 14 1
380,000	Stock	13 Aug.	12½	Brentford Consolidated . . .	100	210-220	..	5 11 4
125,000	"	"	9½	Do. New	100	157-162	..	5 14 2
220,000	20	16 Sept	11½	Brighton & Hove Original . .	20	40-42	..	5 9 6
888,500	Stock	16 Sept.	5	Bristol	100	98-103	..	4 17 1
320,000	20	15 Oct.	11½	British	20	42-44	..	5 2 3
50,000	10	28 Aug.	11½	Bromley, Ordinary 10 p. c.	10	18-20	..	5 15 0
50,380	10	"	8½	Do. 7 p. c.	10	13-15	..	5 13 4
328,750	10	"	—	Buenos Ayres (New) Limited	10	6-7	+½	—
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	92-97	+2	6 3 9
150,000	20	13 Aug.	8	Cagliari, Limited	20	25-27	+1	5 18 6
550,000	Stock	15 Oct.	13	Commercial, Old Stock . . .	100	240-250	..	5 10 0
165,000	"	"	10	Do. New do.	100	190-195	..	5 10 3
130,000	"	30 Dec.	4½	Do. 4½ p. c. Deb. do.	100	117-122	..	3 13 9
800,000	Stock	30 Dec.	13	Continental Union, Limited .	100	220-230	-5	5 13 0
200,000	"	"	10	Do. 7 p. c. Pref.	100	185-195	..	5 2 7
75,000	Stock	16 Sept.	10	Crystal Palace District . . .	100	190-200	..	5 0 0
486,090	10	15 July	10	European, Limited	10	19-20	..	5 0 0
354,060	10	"	10	Do. Partly paid	7½	14-15	..	5 0 0
5,470,640	Stock	13 Aug.	12*	Gaslight & Coke, A, Ordinary	100	216-221	-2	5 8 7
100,000	"	"	4	Do. B, 4 p. c. max.	100	95-98	..	4 1 7
665,000	"	"	10	Do. C, D, & E, 10 p. c. Pf.	100	248-253	..	3 19 1
30,000	"	"	5	Do. F, 5 p. c. Prf.	100	118-123	..	4 1 4
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	172-177	..	4 4 9
1,300,000	"	"	7	Do. H, 7 p. c. max.	100	152-157	..	4 9 2
463,000	"	"	10	Do. J, 10 p. c. Prf.	100	245-250	..	4 0 0
476,000	"	"	—	Do. K, 6 p. c. Prf.	100	147-152	+2	3 18 11
1,061,150	"	11 Dec.	4	Do. 4 p. c. Deb. Stk.	100	110-114	..	3 10 2
294,850	"	"	4½	Do. 4½ p. c. do.	100	118-123	..	3 13 2
908,000	"	"	6	Do. 6 p. c. do	100	160-165	..	3 12 9
3,800,000	Stock	12 Nov.	12	Imperial Continental	100	224-229	..	5 4 9
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4-4½	..	6 13 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p. c. Deb.	100	109-111	..	4 10 1
541,920	20	27 Nov.	6½	Monte Video, Limited	20	15-16	..	8 2 6
150,000	5	27 Nov.	10	Oriental, Limited	5	8½-9	..	5 11 1
60,000	5	30 Sept.	7	Ottoman, Limited	5	4-5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited	10	2½-3½	..	—
				People's Gas of Chicago—				
420,000	100	3 Nov.	6	1st Mtg. Bds.	100	98-102	+3½	5 17 8
500,000	100	1 Dec.	6	2nd Do.	100	98-102	+4½	5 17 8
150,000	10	15 Oct.	10	San Paulo, Limited	10	10-11	-½	9 1 0
500,000	Stock	28 Aug.	15½	South Metropolitan, A Stock	100	265-275	..	5 12 9
1,350,000	"	"	12	Do. B do.	100	222-227	..	5 5 8
200,000	"	"	13	Do. C do.	100	230-240	+5	5 8 4
700,000	"	30 Dec.	5	Do. 5 p. c. Deb. Stk.	100	138-143	..	3 10 0
600,000	Stock	16 Sept.	11½	Tottenham & Edm'ton, Orig.	100	—	..	—
				WATER COMPANIES.				
729,331	Stock	30 Dec.	10	Chelsea, Ordinary	100	260-265	..	3 15 6
1,720,560	Stock	15 Oct.	8	East London, Ordinary . . .	100	206-211	..	3 15 11
544,440	"	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	136-140	..	3 4 3
700,000	50	11 Dec.	8	Grand Junction	50	101-106	+2	3 15 6
708,000	Stock	13 Aug.	10½	Kent	100	268-273	-2	3 16 11
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max.	100	225-235	..	4 0 10
406,200	100	"	7½	Do. 7½ p. c. max.	100	189-194	..	3 17 4
260,000	Stock	30 Sept.	4	Do. 4 p. c. Deb. Stk.	100	120-123	..	3 5 0
500,000	100	13 Aug.	12½	New River, New Shares . . .	100	335-345	..	3 10 4
1,000,000	Stock	30 July	4	Do. 4 p. c. Deb. Stk.	100	125-127	..	3 3 0
902,300	Stock	30 Dec.	6½	S'thwk & V'xhall, 10 p. c. max.	100	149-154	..	4 4 5
126,500	100	"	6½	Do. D 7½ p. c. do.	100	140-145	..	4 9 8
1,155,066	Stock	11 Dec.	10	West Middlesex	100	245-255	..	3 18 5

* Next dividend will be at this rate.

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THE
**JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.**

TUESDAY, FEBRUARY 2, 1892.

The Report and Accounts of The Gaslight and Coke Company.
THE report of the Directors and the accounts relating to the last half-year's working of The Gaslight and Coke Company have been issued, and will be found in another column. The general meeting of the Company will be held, as announced, on Friday next. According to the report, the operations of the Company for the past half year have resulted in the provision of a balance of profit amounting to £206,876 after satisfying all fixed charges; and this sum is applicable to paying a dividend on the

ordinary stock. The selling price of gas during the half year having been 2s. 9d. per 1000 cubic feet, or 1s. per 1000 cubic feet below the statutory initial price under the sliding scale, the legally-permissible rate of dividend would be 13 per cent. But to pay this full rate of dividend, it would be necessary to take £148,727 out of the reserve fund. The Directors are unable to see their way to such a heavy dip into the reserve; and they therefore recommend that the dividend should be after the rate of 12 per cent. instead of 13 per cent. This will require £121,372 to be withdrawn from the reserve fund; leaving a balance of £115,244 to its credit.

"In view of the continued deficiency in profit required "to meet the authorized dividend involving the absorption of so large a portion of the reserve fund," the price of gas has been raised. The Directors explain that "this "step is taken in the belief that it is necessary to maintain the margin of profit required to pay the statutory "dividend without, if possible, further trenching upon the "reserve fund." What "sweet simplicity" there is in this way of dealing with a non-paying business! The report then goes on to state that the abnormal increase of gas consumption during the winter of 1890-91 was followed in the last half year by an actual decrease of 1·74 per cent.; while the mild weather of the early winter, and other causes, led to a bad sale for coke and other residuals. It is, however, carefully pointed out that, by taking the two halves of the year together, the absolute increase of gas sales averages 3·76 per cent.; the mean over the past twelve years having been 3·43 per cent. The report admits a reduction in the cost of coal, but accuses its quality and condition of being inferior, which, of course, is very deplorable. The inveterate fancy of the Chartered Board for big figures finds expression in the statement of the report respecting the demand for gas during Christmas week. The undecided assessment appeals are curtly mentioned; and the report concludes with a reference to the Standards of Light Committee, and a paragraph designed to take the place of the officers' reports regarding the state of the Company's manufacturing and distributing plants, which have been a feature of these half-yearly reports for a long time past.

The revenue account credits the Company for gas sold during the half year with the sum of £1,299,026, as against £1,309,802 for the corresponding half of 1890, when the price was the same. Residuals show a more serious drop, from £466,227 to £404,476. Altogether, there was a falling off of revenue from £1,813,995 to £1,744,462, or a decrease of £69,533. On the other side, the working expenses have likewise been diminished, from £1,442,445 to £1,351,160. It is noteworthy, therefore, that the management has not merely held its own in face of narrower means, but has actually improved the gross balance from £371,550 to £393,301, for which unstinted praise must be given. The decreased cost of working was as much as £91,285, which is derived as follows: Coal cost £722,757, as against £788,990; salaries of Engineers and works' officers were slightly cut (those in the Secretary's Department being meanwhile increased); wages fell from £180,825 to £172,076; purification was cheapened from £41,802 to £38,482; and repairs came to £160,591 instead of £178,727. Thus gas manufacturing charges stand for £1,103,787, as compared with a sum of £1,200,453, or a drop of £96,666. This is where the saving has been effected; other entries pointing in a different direction. Let us now see how the figures look in respect to work done. There were 973,949 tons of coal carbonized, and, in addition thereto, oil equivalent to 14,631 tons of cannel was employed. The use of this oil (some of which was probably heavy oil put into the retorts, some gasified in a water-gas cupola, and some merely vaporized as spirit) rather complicates the calculation; but, taking coal and oil together, the carbonizing returns work out to a make of 10,321 cubic feet per ton—leaving 4·45 per cent. of the output unaccounted for. Still regarding the oil as cannel, the coal carbonized cost 15s. 11·52d. per ton; and the labour for carbonizing the coal only (not reckoning the oil this time, for obvious reasons) works out to 3s. 6·24d. Six months ago we found that the coal carbonized cost 16s. 4·72d. per ton; and carbonizing wages were practically the same as now.

Much might be advanced in regard to the foregoing details of the Company's operations; but we prefer to revert for the present occasion to the broad facts of the

Company's position. Exactly twelve months ago, the Governor (Colonel Makins, M.P.) told the proprietors that, while it was probable that the reserve fund, which, after the declaration of the dividend then recommended, would stand at £385,700, might be still further reduced, "he did not expect to see it fall below £250,000." Well, it is to be reduced to £115,234; and, in order to save this comparatively small balance from disappearing altogether during the current half year, the Directors have had to take the heroic step of increasing the price of gas to 3s. 1d. per 1000 cubic feet. If they were alone in London, or in the country, there would not exist any means of comparison, through observation of which it might be possible for outsiders to judge of the amount of justification for such a course. It so happens, however, that these means of comparison do exist; and the Horseferry Road authorities are likely to hear a good deal about them before their part of London will be resigned to pay for the dearest gas in the capital, merely in order that a gas-works administration, whether capable or not, may be sure of as wide a margin of profit as they think proper.

Appointment of a Secretary by the Standards of Light Committee.

THE Standards of Light Committee did a good stroke of business on Thursday in appointing Professor Vivian B. Lewes to be their Secretary. It is obvious that a very great deal of responsibility for making the result of the deliberations of such a heterogeneous body really useful must of necessity rest with the Secretary; and, without saying anything depreciatory of other qualified gentlemen who might be named as fit for the post in question, we do not fear contradiction when we say that Professor Lewes is one of the best of the contemporary specialists upon whom the choice of the Committee might have fallen. It was hinted of the last Board of Trade Committee on the Standards of Light that rather more than the due share of responsibility for the result was attachable to the Secretary; but in all Professor Lewes's published work, we do not recall any expression of opinion bearing upon the matters now before the Committee which stamp the author as a partizan of candles, pentane, amyl-acetate, or anything else. He is, moreover, a most industrious worker; and the fact that he has the business in hand is a sufficient guarantee that every point brought before the Committee will be thoroughly dealt with. While mentioning the work of the Committee, it may be noticed that the electricians are taking a serious interest in this inquiry, which they perceive may have important results for the electric lighting industry. They appear to desire the retention of the candle unit as the standard measure of artificial light; but are indifferent as to whether the statutory representation of this measure is the equivalent of one candle or of a multiple of the candle. They do not give up the hope of producing an electrical standard of light; but they admit that, so far as can be seen, too many elements would have to be standardized to render the production of a reliable incandescent standard lamp an easy or even a practicable matter. It is quite possible that some steps may be taken, by representatives of electric lighting interests, to convey a statement of their views on the subject to the Committee. There is nothing very definite about these views at present; but if the electricians have only to say that, in the settlement of the bases of photometrical practice, they desire the special requirements of the photometry of electric lamps to be considered, it will be as well for this request to be formally put upon the record.

A Point of Law Reform.

THE position which we have long occupied respecting the scandalous waste of money and time in connection with the trial of patent cases has recently been strengthened by comments from the Bench and admissions from the Bar. Mr. Justice Romer had to try a couple of consolidated actions bearing upon patented machinery used in the manufacture of wood screws; and, of course, the usual strings of Counsel appeared for the parties, who also paraded the inevitable array of "experts." Fourteen days were taken up in hearing these learned gentlemen solemnly contradict each other; and, in the end, the Judge told the Counsel, in almost as many words, that they ought to be ashamed of themselves for their conduct of the matter. The Attorney-General very handsomely admitted the reasonableness of the Judge's censure, and as good as

promised that he and his colleagues would try and behave better in future. But Sir Richard Webster, who is nothing if not bluff, candid, and hearty, suggested that in reality it is not the lawyers who are to blame for the scandalous costliness and over-elaboration of these essentially trumpery patent cases. It is all the fault, says this authority, of the scientific witnesses, the experts, particularly when these happen to be "professors." These gentlemen insist upon lecturing before the Court, and spin out their evidence upon immaterial points of detail beyond anything that the law requires. This is naturally particularly distressing to the legal gentlemen, who are not under any similar temptation to give the case every possible "squeeze" that the pockets of their clients can be supposed to be capable of bearing! Before, however, one can absolve the latter of all complicity in creating and fostering the abuse so strongly condemned by Mr. Justice Romer, it is necessary to inquire who is responsible for getting up these cases. How is it that, before a manufacturer of screws, or gas-lamps, or any other patented specialty, can bring the most obvious of infringers to book, he must not only retain the Attorney-General and three or four other "leaders" in this class of business, but must also engage half-a-dozen recognized "experts," whose names will occur at once to the minds of our readers, and who may know no more about the business in hand than the Man in the Moon? It matters not whether the subject of the dispute be telephones, ships' anchors, wood screws, or gas-lanterns, the same "experts" are laid on, at enormous expense. The practice has attained such a pitch that the mystic initials F.R.S. might in some instances bear the interpretation of Follower of Remunerative Science instead of that which is ordinarily attached to them. The existing usage in regard to the presentment of patent cases before the Court is, in short, a grave scandal; and it is to be hoped that the observations of Mr. Justice Romer upon this head will bear good fruit.

The Labour Commission.

THE Mining and the Shipping and Transport Sections of the Labour Commission sat for several days last week; and some important evidence was given with regard to the condition of miners, seamen, and dock labourers, and the character and operations of the various associations of employers and Trades Unions connected with these industries. We notice that some of the daily newspapers have begun to complain of the proceedings of the Commission as being "uninteresting." This is only what might naturally have been expected. The average newspaper reporter and editor soon find the transactions of a public body dull, if they are not freely sprinkled with "startling disclosures," personal "scenes," and similar good things for the posters. It does not seem to have occurred to these critics that the Commission was not really appointed with the object of providing exciting reading for purchasers of halfpenny evening newspapers, or that evidence which the caterers for the public that likes "spicy news" despise as dull, may be in reality the best possible justification for the existence of the Commission. It is becoming increasingly evident, as time goes on, that the proceedings of the Commission are not likely to advance the cause of the New Unionism, or to favour the views of those sentimental dabblers in so-called Labour Politics of whom the late Cardinal Manning was the type, and whose general idea was that employers are all bad together, and invariably in the wrong in all disputes with their work-people. Naturally, there is a good deal of assertion and counter-assertion before the Commission by witnesses for different interests; but the burning abuses which bulk so largely in the orations of mass-meeting speakers appear very dead in the quiet air of the Commission-room. The obligation to support statements by figures and other verifiable data is fatal to the agitator, who is now learning that the atmosphere of his favourite "house of call," whence he has been in the habit of issuing his "strike manifestoes," is better for him than that of Westminster Hall. Last Thursday's proceedings were particularly instructive; two different accounts of the Southampton Dock strike of September, 1890, being given by a local employer, Honorary Secretary of the Free Labour Association, and Tom M'Carthy, who figured so prominently as an "organizer" in connection with this affair, which resulted disastrously for the men, and was accordingly repudiated by the Dockers' Union. There

was also something said on Friday by a Barking clergyman, who has officiated as head of a local branch of the Dockers' Union, about the astonishing amount of money which the down-trodden victims of the Dock Directors, for whom Messrs. Mann and Tillett plead so piteously, squander for drink. Unfortunately, in the necessary condensation which the transactions of the Commission receive for newspaper purposes, so much matter is cut out, that it is desirable to read several such abstracts every day in order to glean a reliable idea of what the Commissioners are doing. The worst of it is, moreover, that this process of condensation is hardly distinguishable sometimes from garbling the matter; so that those newspapers which follow the cue of truckling to the Trade Union leaders are able to suppress evidence uncomplimentary to the latter, without appearing to act from other motives than those which operate, in a general way, to prevent full reports of the proceedings of the Commission from filling the Daily Press.

A Curious Suspicion.

ALMOST anything bearing upon the subject of the influenza is regarded by newspaper editors as good matter at the present time; but recently a London daily paper which specially prides itself upon the immensity of its circulation, gave publicity to a suggestion which deserves to be called amazing. This was, that the prevalence of the epidemic in question might possibly be explained by reference to the modern introduction of high-pressure electrical distribution systems, which are to be suspected of so disturbing, by induction, the usual balance of atmospheric influences, as to create an opening for the development and spread of this specific infection. The fact that such a suggestion has been made is, at any rate, an indication that no sooner does the electric lighting industry lose the protective charm of novelty, than it inherits all sorts of popular suspicions of the same character as, if differing in kind from, those which have long attached to gas. When the electricians first essayed to enter the domain of public and private lighting, in which gas had previously been supreme, they doubtless thought it a favourable circumstance that they were welcomed with enthusiasm by a noisy host of malcontents, some of whom had to allege that gas lighting is unhealthy, while others cherished an invincible scepticism regarding the trustworthiness of gas-meters. All these cranky sanitarians and domestic economists in their various degrees hailed electricity as their means of deliverance from the injuries which they suspected to flow from the use of gas for lighting purposes, simply because they were so accustomed to it, and its employment was so general. And all the malcontents were sympathetically received by the prophets of the new order, who promised undimmed satisfaction to all and sundry who would abandon the poisonous, inefficient, and fraudulent gas for their pure and flawless illuminant. Alas! the community has had some experience of electric lighting; and still the "quidnuncs" are not happy. They accuse electricity of even more fantastic crimes against the public health and the public pocket than gas was ever reproached with; and the electricians learn, by painful experience, that the favours of grumblers against an established industry constitute but an insecure foundation for the creation of a new one. These observations are not very complimentary to the sense of the community; but they are true. Electricians will probably live to perceive with gas managers, if they do not yet understand the matter, that one of the disadvantages of a free Press is the absurdly disproportionate importance which newspaper correspondence and commentary confer upon malcontents of all kinds, comparison with the mute majority which does not take the trouble to express its satisfaction with existing arrangements.

The Board of the Croydon Gas Company.—Mr. Pelton has been elected a Director of the Croydon Gas Company, in place of the late Mr. Charles Newton. It has been already mentioned that the deceased gentleman is succeeded in the chairmanship by Mr. W. Hyslop, formerly the Deputy-Chairman.

Mr. James Madge.—It is with much regret that we have to record the death of Mr. James Madge, who was the respected Secretary of the West Ham Gas Company from June, 1866, to June, 1889, when he retired through failing health. For many years previous to 1866, the deceased gentleman was Manager of Messrs. Tucker's silk-works at West Ham Abbey. Mr. Madge died last Tuesday at Brixton; and the interment took place at the West Ham Cemetery on Saturday.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 215.)

ANOTHER dull week, and business seemed not to have much life in it. Prices were not dashed down, but were in a drooping mood generally. After the settlement, the tone was somewhat improved; but the markets remained very quiet. The Money Market is much firmer than it was; the demand having greatly improved. Business in Gas has been moderate; and the tendency was, on the whole, very favourable. Gaslight "A" was in good favour, and advanced 3. The opening price on Monday was 218; and the closing bargain marked on Saturday was 223. The report and accounts of the Company were in general circulation on Friday; and, if the course of prices is any guide, the market seemed to like them. They are fully discussed in another column. The report appears to have been drawn with less than the usual care and skill; and some portion of it strikes us as decidedly injudicious. By a curious slip of the pen, too, the lowering of the dividend from 13 to 12 per cent. is termed a reduction in the "standard" rate of dividend. The standard rate is, of course, 10 per cent.; the 13 per cent. is the "statutory" or "authorized" rate. As for the accounts, they are, barring the reduced quantity of gas sold, about as good as could be expected. South Metropolitans have been active and firm. The buying prices of the "A" and "C" advanced 5 each; and business was done in the former at 275, and in the latter at 239. The Company invites applications for "C" stock at 240 net, free of charge. This is quite as good as buying in the market at 239; and the indefeasible title thus acquired from the Company may be worth something more to those who are haunted by the bogey of forged transfers. Commercially were more frequently dealt in than of late; but prices were not remarkable. The Suburban and Provincial undertakings were almost entirely neglected; and the only change in quotation was a rise of 1 in British. The Continental Companies were irregular. Imperial receded 1; but afterwards remained very steady at 225. Continental Union recovered half its loss of the week before; and European was quoted at an advance *ex div.* Among all the rest of the Foreign division, nothing moved but Buenos Ayres, the shares of which relapsed $\frac{1}{2}$, while the quotation of the bonds was drawn in closer. Water shows a renewed disposition towards weakness; and Chelsea, East London, and Southwark have also receded in price.

The daily operations were: At the opening on Monday, business was steady, remaining rather quiet all day. Continental Union rose $2\frac{1}{2}$. Business continued about the same on Tuesday, with a good tendency generally. Gaslight "A" rose 2; and Buenos Ayres debentures $1\frac{1}{2}$. But Imperial Continental fell 1. In Water, Chelsea and East London fell 2 each. On Wednesday there was rather more activity, coupled with firmness. Gaslight "A" rose 1 more; but Buenos Ayres lost the rise of the preceding day. Chelsea and Southwark Water dropped 2 each. Prices throughout held up well on Thursday; the only move being a fall of $\frac{1}{2}$ in Buenos Ayres shares. Friday's business was quiet and without special feature. Saturday was rather more animated than usual; and the tendency was favourable. South Metropolitan "A" and "C" rose $2\frac{1}{2}$; and British, 1.

ELECTRIC LIGHTING MEMORANDA.

The Affairs of the St. James's and Pall Mall Electric Light Company—Professor Ayrton on Electrotechnics—The State of the Electrical Exhibition at the Crystal Palace.

THE annual general meeting of the St. James's and Pall Mall Electric Light Company has been held; and one or two interesting points are to be noted in the condition of the undertaking, as revealed by the statutory accounts and disclosed by the proceedings at the meeting. It must never be forgotten that this is the *ne plus ultra* of central station electric light companies; enjoying full possession of perhaps the best district in the world for incandescent lighting—a district, moreover, not exceeding 0.26 of a square mile in area. The circumstances of the Company must therefore be understood as being extremely favourable for the low-pressure, three-wire system of distribution employed. So well is this fact appreciated by the public, that the last issue of 7 per cent. preference shares of the Company was taken up at a premium of 30s. per £5 share. The nominal capital of the concern at present stands at £200,000, or after the rate of nearly £800,000 per square mile of the statutory district. The net earnings of the Company for the past year amounted to £10,395, of which £7100 has been distributed as dividends. The actual sum on which dividends were paid was £155,000. A second station has been found necessary, which means, in a sense, a further absorption of capital unproductively. It may be doubted, therefore, whether the Company are ever likely to stand in a better position than they occupied last year. This being the case, it is hardly surprising that some of the shareholders severely criticized the statement put forward by the Directors. Dissatisfaction exists upon two grounds—financial and commercial. The subject of founders' shares is a very sore one

among the St. James's proprietary; as well it may be, seeing that while these shares stand at £100 in the capital account, the holders took last year a dividend amounting to £1075. Then the cost of the stations and the rate of allowance for depreciation are also causes of uneasiness in the minds of many shareholders, who seem to more than suspect the existence in the undertaking of a "secret" that may eventually transpire with disastrous results to the ordinary proprietary, after the founders and others, who hold the wires in their hands, have utilized the present appearance of prosperity for quietly realizing their interest at the top market prices.

The annual meeting of the Institution of Electrical Engineers was held on Thursday last, when Professor W. E. Ayrton, the President for the ensuing year, delivered an Inaugural Address, the theme of which was the training of the young electrical engineer. Nobody is better qualified to expatiate upon this subject than the deservedly eminent head of the City training establishment. In an otherwise appreciative notice of the address, the *Standard* of Friday last, however, seems to think that the eminent Professor, while justified in much that he said, could not altogether resist the temptation to raise the old chorus: "There's nothing like leather!" We are always hearing, from one quarter or another, glorifications of the cause of technical education; and those who are professionally occupied in this work can hardly be expected to realize the position of the outsiders, not otherwise devoid of intelligence, who already entertain doubts as to the real good of it all. Professor Ayrton is naturally one of those who hold that the means of technical instruction provided in this country fall very far short of the reasonable requirements of the teachers and their pupils; but there are two sides to every question, even when, as in this instance, it happens to be a "fad" of the day. It is perfectly reasonable to urge that young people engaged in various industries should be enabled to learn all that is necessary and helpful to the easy and successful prosecution of their occupation; but how shall we guard against the abuse of such means of instruction by aspirants who are not wanted in these industries? It is one thing to make the technical school the appendage of the workshop, and quite another to convert it into a substitute for the latter, as a "genteel" way of picking up the rudiments of a trade. Herein lies the weakness of technical colleges and schools—that they attract neophytes for whom there is no proper after-employment. The condition of the electrical trades is proof of the truth of this objection.

A very great deal yet remains to be done by many exhibitors before the Crystal Palace Electrical Exhibition can be described as fit for inspection. This is a deplorable state of things; and we cannot but think that the success of the undertaking, as a whole, will be prejudicially affected by the culpable unreadiness of so many of those who have been admitted to take part in it. The more practice the frequent holding of exhibitions affords to exhibitors, the more dilatory they appear to grow in getting their stands in order. In the present case, if the exhibition had been an independent venture, with special buildings devoted to it, and held on a site to which the public would need to be specially attracted, it would stand already a confessed failure. Even as it is, unless the public can be induced to take very much more interest in the show than they have done up to the present, there is reason to fear that the Crystal Palace authorities will have cause to regret having given up so much of the building to illustrate the unbusinesslike ways of the electricians and their allies. All last week the Palace was comparatively a desert—ordinary visitors being driven away by the incessant hammering and other noises incidental to a belated industrial exhibition; while of special visitors interested in the application of electricity supposed to be illustrated in the Palace, there were few or none. This means a considerable loss and a great annoyance to those exhibitors whose stalls are ready; for every technical journal joins with us in the cry of warning to all and sundry to keep away from Sydenham for awhile. A good deal of extra lighting has been started during the past few days; but much of it is very unsatisfactory, the occasional extinctions and continual pulsations noticeable in different parts of the show being anything but a recommendation of the systems employed. The exhibition is a real godsend to the newly-started Crystal Palace District Electric Light Company, whose plant is reported to be so fully occupied in the supply of exhibitors, that private customers will be unable to obtain current before the close of the exhibition. Well, the supposititious "private customers" will probably display exemplary patience in waiting; and the Company had better make the best of their present opportunity, for they will find nothing like it afterwards. The Crystal Palace District Gas Company are very busy too; so that both interests have ample cause to be satisfied with things as they are.

Professor Vivian B. Lewes, F.I.C., F.C.S., of the Royal Naval College, Greenwich, has been appointed Secretary of the recently-formed Committee for investigating the standards of light. Professor Lewes's qualifications for this position will, we think, fully justify his selection for it. He has not only had practical experience as a gas examiner, but is at present, and has for some time been, engaged in investigating the light-giving properties of flame, and the nature of combustible gases.

GAS ANALYSIS.*

THIS work is an important contribution to the subject of gas analysis. It is something more than a mere compilation of methods, or description of apparatus of various kinds. Not only are the details of actual working described with scrupulous care, but in several places comparisons between different methods of effecting the same purpose will be found, enabling the reader to judge for himself as to the degree of accuracy that may be expected to be attained by any one of the plans described. While in no sense an elementary manual of the text-book class, the descriptions are so clear and concise as to render the work a great help to those who have no special chemical knowledge; though it will probably be better appreciated by readers who have had some practical experience in the difficult and tedious work of obtaining accurate determinations as to the composition of gaseous mixtures—such as coal gas, generator gas, chimney gases, &c. In the preface, the author disclaims any intention of preparing a manual of gas analysis. His object is to describe the construction of apparatus and details of operations included in ten years' experience and work upon various gases, actually carried out in his own laboratory, chiefly with the forms of burettes and pipettes designed by himself. Without any attempt at a complete description of all the known methods, particulars of other forms of apparatus have been introduced. By this course, he has produced a wholesome corrective to the somewhat widespread notion that, by means of Hempel's or other similar apparatus, analyses of gaseous mixtures may be effected with little expenditure of time, by persons possessing no skill or experience in analytical operations, giving results sufficiently accurate for all practical purposes, if not scientifically correct. When referring to rapid and simple processes, the author is careful to give a clear idea of the approach towards accuracy that may be expected; thus dealing with a most important item, for the doctrine of "sufficiently accurate" is capable of being expanded to cover operations that are worse than useless. When the "sufficiently accurate" researches give results that are erroneous and misleading, then the last state is worse than the first; so that, when a departure from strict accuracy is permitted—on the ground of economy in time or cost of apparatus—the operator should take special care to know exactly where he stands, and the extent to which his results may be relied upon.

The translator (who may be congratulated upon the clear and precise manner in which he has reproduced the meaning of the author) also gives a short preface, in the course of which he points out that the chapter on the heating power of fuel has been largely re-written, and new illustrations showing the latest forms of apparatus have been substituted for those in the original. The chapter upon the analysis of illuminating gas has been somewhat re-arranged, and a new method for the determination of hydrocarbons inserted. In other respects, the work has been brought up to date; and these alterations have either been suggested or approved by the author.

The work is divided into three parts. The first deals with general methods; the second, with special methods; and the third, with the practical application of gas analysis. The first chapter treats of the precautions necessary in collecting and preserving samples; and the next describes the various forms of Hempel's burettes and pipettes, with complete instructions for their use. In the third chapter, an advancement is made to the apparatus necessary for exact work. After this, there is a description of the arrangement and fittings of a laboratory, an account of methods for purifying mercury, and some details of several forms of absorbing tubes. The second part includes practical considerations—the difference between operations conducted over water or over mercury; the running down of liquids in a burette; the solubility of gases in the absorbents used; calculation of results from combustions; oxygen and hydrogen generators; batteries and coils for producing the electric sparks, &c.; the proportions of gases and other details necessary to secure complete combustion; and the absorbing power of various solutions. The concluding chapter of this part gives details of methods for determining all the gases usually met with in industrial operations—oxygen, ozone, nitrogen, hydrogen, nitrogen and carbon oxides, ammonia, hydrocarbons, cyanogen, hydrogen sulphide, &c. Amongst the "practical applications" are furnace gases, illuminating gas, sulphuric acid works gases, air, and the determination of carbon and oxygen with the simultaneous volumetrical determination of nitrogen in the elementary analysis of organic substances. The last chapter treats of a calorimeter for determining the heating power of coal, coke, and other fuels.

Several points may be specially recommended to those engaged in gas-works laboratories—for instance, the precautions necessary for securing a proper sample of furnace gases; the excellent description of experiments on the best methods of

* "Methods of Gas Analysis." By Dr. Walther Hempel, Professor of Chemistry in the Dresden Polytechnicum. Translated from the second German edition by L. M. Dennis, Assistant Professor of Analytical Chemistry in Cornell University. London: Macmillan and Co.; 1892.

dealing with the residue remaining after absorbing as many constituents as possible from coal gas; and the effect of various absorbents on constituents other than those they are expected to remove. It has been generally supposed, according to the researches of Mr. Lewis T. Wright and others, that the "residue" from coal gas contains other members of the paraffin series in addition to methane. The author, however, has made experiments upon this question, and concludes that "there is no appreciable amount of ethane present with the methane." It should be noted that he absorbs "hydrocarbon vapours" by means of alcohol; and perhaps this explains the discrepancy. Several analyses of samples of coal gas are included in this part of the work.

The details of methods of obtaining specific gravities of gases appear somewhat meagre; and the absence of any reference to several simple methods that are generally known and practised in England is noticeable. For example, the author does not appear to be aware of the existence of Wanklyn's bottles, or the Referees' ammonia and sulphur apparatus. This is the more striking because the numerous precautions shown to be necessary in proceeding by means of absorption or of combustion furnish striking evidence in favour of determining a constituent by precipitation and weighing, in all cases where such is practicable.

Death of Dr. A. Carpenter.—The ranks of sanitary reformers have just lost a prominent figure by the death, last Wednesday, at Ventnor, in his 67th year, of Dr. Alfred Carpenter. After completing his medical studies, he commenced practice at Croydon in 1852; and with that town his name will always be closely identified—having been a member of the Board of Health since 1859, and for many years a Justice of the Peace for Surrey. Among his many works on sanitary subjects are "Hints on House Drainage," "The First Principles of Sanitary Works," and the "Physiological and Mechanical Aspect of Sewage Irrigation." He was a member of the Council of the Sanitary Institute, and was one of the founders of the Smoke Abatement Institution. His keen interest in the object aimed at by the latter body was displayed, only a few weeks before his death, in a letter in *The Times* on the subject of London fogs, the correspondence on which was dealt with in an article in the *JOURNAL* for the 12th ult. (p. 63).

A Suggestion for The Gas Institute.—In the course of a long letter on the subject of the advisability of gas companies supplying a cheap gas of low illuminating power, suitable for heating purposes, in place of the present 16-candle quality, a correspondent says he considers this might be done to much advantage if the gas could be utilized for lighting by the aid of a thoroughly satisfactory burner of the incandescent type. In this connection he throws out the following suggestion: "Here an opportunity is afforded for the Incorporated Gas Institute to show that it has been incorporated to some purpose. Why does it not offer a certain sum of money for the best burner, capable of being used for lighting purposes with water gas, forwarded to them by a given date; at the same time promising to the successful inventor a definite proportion of the profits made by the sale of his invention, should they place it upon the market? Why not appoint a Committee from among its own members, to make a thorough investigation into the whole question; calling in, if necessary, the aid of a practical chemist, acquainted with gas matters, to aid them in their researches? Surely, from an Institute of this kind, a Committee could be selected who would work at it without payment, and for the good of the gas industry."

Society of Engineers.—At the first ordinary meeting of this Society for the present session, held last night at the Town Hall, Westminster, the retiring President (Mr. W. N. Colam) presented the following premiums of books awarded for papers read during his year of office: The President's Premium to Mr. G. M. Lawford, for his paper on "The Drainage of Town Houses;" the Bessemer Premium to Mr. J. H. Paul, for his paper on "Corrosion in Steam-Boilers;" and a Society's Premium to Mr. J. Kerr, for his paper on "Portable and Pioneer Railways." He then introduced his successor in the presidency (Mr. J. W. Wilson, jun.), who delivered his Inaugural Address. In the course of it he dealt with the chief points of interest in the papers read and discussed during the past session, and referred to the professional visits undertaken during the summer; the Crystal Palace District Gas-Works being among the places selected. The President next referred to the growth of the population of the world, and the corresponding development of engineering enterprise; also to the present unsatisfactory condition of the London sewage question, in reference to which he had received from Sir R. Rawlinson an epitome of his solution of the sewage difficulty as being "Out of the River Thames and into the Sea over the Maplin Sands." The work of the recent International Congress of Hygiene and Demography, especially in reference to the section of "Engineering in relation to Hygiene," was touched upon; and it was felt that, although a great deal had been done, much still remained to be accomplished in relation not only to the disposal of sewage, but also to the adequate supply of water to, and the prevention of smoke in, London. At the close of the address, a vote of thanks was heartily accorded to the President.

WATER BILLS FOR 1892.

THE following abstracts of the deposited Bills relating to water supply indicate the character of the projected legislation with regard to this subject.

The Llanbradach District and Aber Valley (Eglwysilan) Water Bill is the only measure proposing the incorporation of a new Water Company. The Company are to supply a district of Glamorganshire and Monmouthshire comprising the watershed of the River Rumney. The capital is to be £40,000, with the usual borrowing powers. The proposed works consist of an impounding reservoir on the Nant Ilan, with various wells and service reservoirs. For the protection of the Cardiff Steam Coal Collieries Company, Limited, it is provided that no water is to be taken from the Llanbradach Brook until the flow of the stream exceeds 150,000 gallons in 24 hours. The works are to be completed within seven years. Rates for domestic supply are to range from 10 to 6 per cent.

The Airdrie and Coatbridge Water-Works Bill is to authorize the Airdrie and Coatbridge Water Company to raise £120,000 of new 5 per cent. capital, to carry the usual borrowing powers. The works are to be enlarged by the addition of two impounding reservoirs, and certain burns are to be appropriated for filling them, with a specified allowance of compensation water; all to be completed within ten years. The district of supply is also defined. The East Grinstead Gas and Water Bill contains clauses for increasing the undivided capital of the Company by £40,000 in new 7 per cent. shares. The water-works are to be enlarged by the construction of a new adit and a reservoir and pumping station, to be completed within five years. Provision is made for the laying of mains in undedicated roads, and for the erection of workmen's cottages. The Exmouth and District Water Bill is to enable the Company to enlarge their works by the construction of an impounding reservoir upon the Budleigh Brook on Bickton Common; the work to be completed within five years. The Rhymney Valley Gas and Water Bill contains provisions for the transfer to new ownership of the water-works at Bargoed and Hengoed, and their extension by the construction of certain tanks and pipe-lines. This scheme appears to be to a certain extent in competition with the Llanbradach District scheme mentioned in the preceding paragraph. The rates for domestic supplies are to range from 10 to 7 per cent. The Brynmawr and Abertillery Gas and Water Bill contains provisions for defining the existing capital of the undertaking as consisting of £18,000 in shares, and £6500 by way of loan; and also for increasing the undivided share capital by £40,000. The water supply limits are to be enlarged to comprise the parish of Llanhilleth, Monmouthshire. New works are projected, including an impounding reservoir on the Tillery Brook, to be completed within six years. Certain leases to the Company are to be confirmed. The Mold Water Bill is to empower the Mold Gas and Water Company to raise £25,000 of additional 7 per cent. capital, with the usual borrowing powers; and to enlarge their works by the construction of an impounding reservoir upon the Cwm Llydan stream, which here forms a portion of the boundary between the counties of Denbigh and Flint, with the usual subsidiary works. The limits of supply are also to be extended. The Company are to be bound to furnish a continuous supply of water at high pressure to the Local Board of Mold for public purposes, at the rate of 1s. per 1000 gallons. The Pontypool Gas and Water Bill is to enable the Company to construct a reservoir upon certain common lands known as Mynydd Garn Clochdy; impounding a spring there existing, and completing the work within four years. Certain other authorized works are to be abandoned, and the time allotted in the Act of 1890 for the construction of others is to be extended by two years. The Pontypridd Water-Works Bill is to authorize the Pontypridd Water Company to construct certain additional works—comprising a reservoir across the Rhondda Fach River, impounding the waters of this and of several other streams flowing directly or indirectly into the River Taff—to be completed within ten years. Additional capital, amounting to £120,000, is required, bearing 7 per cent. dividend, with the usual borrowing powers. The North Shields Water Bill is to enable the Company of Proprietors of the North Shields Water-Works to purchase water in bulk from the Newcastle and Gateshead Water Company, and the latter are to be bound to supply such water under certain conditions, and on terms to be agreed upon. The Company's district of supply is defined; and various minor provisions of their existing Acts of Parliament are to be amended. A clause is inserted giving power for the sale of the undertaking to the Newcastle Company. The Rhyl District Water Bill is to confer further powers upon the Company. It is proposed that the Company, with the authority of three-fourths of the votes of the shareholders present in person or by proxy at a general meeting specially convened for the purpose, shall be enabled to increase their capital by £25,000, by borrowing on mortgage of the undertaking, by issuing fresh preference capital, or by a combination of both methods. A new reservoir is to be sanctioned for impounding the Dolwen stream in the parish of Llanyfydd, Denbighshire; the works to be completed within ten years. In addition to the other capital, old or new, the Company desire power to capitalize, at a 5 per cent. fixed perpetual preference dividend, a sum of £3536 expended out of revenue in the construction of works. The Sunderland and South Shields

Water Bill is to authorize the construction by the Company of further works, consisting mainly of a pumping-station to be situated in the parishes of Houghton-le-Spring and Bishopwearmouth, Durham, to be completed within fifteen years. The Western Valleys (Monmouthshire) Water Bill is for authorizing the transfer to, and the vesting in the Company of this name, of the undertaking of the Risca and Pontymister Gas Company. The consideration for the transfer is to be the sum of £9000 in fully paid-up shares of the Company, and a sum not exceeding £2000, which may be ascertained to have been expended out of capital on the undertaking between Dec. 31, 1890, and July 30, 1892. New capital to the amount of £20,000 is to be raised; and the gas and water concerns of the Company are to be kept separate.

The Abergele, Rhyl, and St. Asaph Joint Water Bill is to authorize the provision of a supply of water to the Urban Sanitary Districts of the Abergele and Pensarn Local Board and the Rhyl Improvement Commissioners and the Rural Sanitary District of St. Asaph, including the acquisition by a Joint Board of the undertaking of the Rhyl District Water Company. The capital of the Company consists of £12,000 in preference 5 per cent. shares, £1660 in preference 7 per cent. shares, and £20,753 ordinary capital. There is also a debenture debt of £12,500. The Bill recites the method by which the proposed Joint Board is to be constituted; and it proposes that the Board may require the Company to sell their undertaking, on requisition addressed to them within two years, for a price to be agreed upon or determined by arbitration in the ordinary way. Borrowing powers to the amount of £150,000 are desired for the Joint Board for carrying out the scheme. The Frimley and Farnborough District Water Bill proposes that the Aldershot Gas and Water Company, the Wokingham District Water Company, Limited, or any other water supply undertaking whose district may abut upon or lie in the vicinity of the district named, and the Surrey County Council, the Farnham Rural Sanitary Authority, the Hartley Wintney Rural Sanitary Authority, or any other authority in the district, may enter into mutual agreements for the supply of water. When any such arrangement has been concluded, the statutory limits of the supplying Company are to be extended to include the Frimley and Farnborough District. The Ipswich Corporation Bill is to enable the Corporation to acquire the undertaking of the Ipswich Water-Works Company; the consideration for the purchase being the sum of £200,000, and the stock-in-trade to be taken at a valuation. The Corporation desire to borrow £230,000 for the purposes of the Bill. Provision is made for the creation of Corporation stock. The Kilmarnock (Corporation) Water Bill is to enable the Corporation to acquire the Kilmarnock Water Company's undertaking, according to the terms of an agreement scheduled with the Bill. The consideration for the purchase is stated to be the granting by the Corporation of 10 per cent. perpetual annuities in exchange for the ordinary and preferential 10 per cent. obligations of the Company; also the grant of 6 per cent. perpetual annuities to the holders of the Company's $4\frac{1}{2}$ per cent. preference shares, the taking over by the Corporation of the Company's bonded and floating debts, and the payment of £5000 in regard to unpaid dividends. The Company are to retain their reserve fund and cash balance on the last revenue account. Certain additional works are to be constructed, including an impounding reservoir on the Loch Burn and Dunton Burn, in the parish of Fenwick. Public and private water-rates may be levied; any surplus reserve being applied to the reduction of the domestic rate. The Lanarkshire (Middle Ward District) Water Bill is to empower the District Committee of the Middle Ward of the County of Lanark, who are the local authority, to construct water-works, comprising two reservoirs for impounding the Glengavel Water and the ordinary subsidiary works, from which compensation water is to be discharged at the rate of a million gallons daily. Certain special water supply districts are to be abolished. Water is not to be demanded compulsorily for premises distant more than 100 feet from the pipes of the District Committee. The Lanarkshire County Council are to be authorized to borrow so much money as the District Committee may require for the purposes of the Bill. The Rhyl Improvement Commissioners' Bill contains provisions to enable the Commissioners to acquire the undertaking of the Rhyl Water Company upon terms to be settled by agreement or ascertained by arbitration. The rate for domestic supplies is to be 7 per cent.

The Ashton-under-Lyne, Stalybridge, and Dukinfield (District) Water-Works Bill is to extend the time allotted to the Joint Committee for the completion of certain reservoirs and works to ten and fifteen years after the passing of the Act. Power is also sought for exchanging lands; and various minor amendments of the existing statutes are contemplated. The Barrow-in-Furness Corporation Water Bill is to empower the Corporation to construct an additional reservoir, to be called the Harlock Reservoir, as well as to draw water from certain streams; also to borrow for these and other purposes the sum of £45,000. The Birmingham Corporation Water Bill is to empower the Corporation to obtain a supply of water from the Rivers Elan and Caerwen, and their tributaries, in the counties of Cardigan, Radnor, Brecknock, and Montgomery, at a cost of £6,600,000 for the necessary works and land. The latter is to be acquired within seven years; and the works, 50 in number, are to be executed under various restrictions—among these being the discharge of

compensation water down the Elan watercourse after the rate of not less than $22\frac{1}{2}$ million gallons daily. The Bradford Corporation Water-Works Bill is to vary the provisions of the last Corporation Water Bill so as to alter the principle of collecting the water required from pumping to gravitation, which involves the abandonment of some authorized works and the substitution of others in different places. The Blackburn Corporation Bill contains a clause for extending the limits of water supply. The Glasgow Corporation Water Bill is to authorize the Corporation to construct certain aqueducts and to abandon others previously sanctioned. It also contains clauses to enable the Corporation to supply water for hydraulic power purposes, and to enter into arrangements with landowners for preventing the pollution of the waters of Loch Katrine and Loch Arklet. The Ilkley Local Board Bill has a section relating to water supply, which comprises clauses for extending the limits and enlarging the water-works under the control of the Board by the construction of an impounding reservoir on Ilkley Moor. The sum of £15,000 is to be borrowed for this purpose. The Leeds Corporation (Consolidation and Improvement) Bill contains a section devoted to the water undertaking. Most of the clauses are re-enactments, but there are some new provisions, among others being a clause fixing the water-rates for business premises not occupied as dwellings otherwise than by a caretaker. Power is asked for granting discounts for prompt payment of water-rates, and forbidding the use of hose pipes without permission. The sum of £250,000 is to be borrowed for water-works purposes.

The London County Council (General Powers) Bill contains clauses for enabling the Council to continue to conduct inquiries and negotiations relating to water supply, and to promote Bills dealing with the subject. The London Water Bill (No. 1), which has been already noticed, is for the constitution of a Water Committee of the London County Council; and the Corporation are to have power to acquire the existing water undertakings and to make new ones. The London Water Bill (No. 2) is a duplicate of this measure. The Swansea Corporation Water Bill is to empower the Corporation to enlarge their works by the construction of an impounding reservoir upon the River Cray, and carry out other works. The sum of £270,000 is to be borrowed for water purposes. The Tredegar Local Board Water Bill is to authorize the Board to enlarge their works by drawing from a certain spring named, and to extend their district. It is provided that, when they shall be able to supply the whole of their district, the statutory powers of the Ebbw Vale Local Board over the same area shall cease; the former Board purchasing the disused plant of the latter. A sum of £35,200 is to be borrowed for water purposes. The Uttoxeter Water Bill is to enable the Rural Sanitary Authority to improve their supply; it has hitherto been provided by an application of the proceeds of certain charities. The source is to be Bramshall Spring, in the parish of the same name, and also some other springs in the parish of Somershall Herbert. Rates for domestic supplies are to range from 12 to 6 per cent. The sum of £10,000 is to be borrowed for the purposes of the Bill.

Death of Mr. C. King.—We regret to record the death of Mr. Charles King, of High Wycombe. Mr. King was formerly Assistant-Manager of the Malton (Yorks.) Gas-Works; but he relinquished the position not quite two years ago to take the appointment of Secretary and Manager of the High Wycombe Gas Company, in succession to the late Mr. E. E. Phillips.

Sir Douglas Galton on Ventilation, Warming, and Lighting.—The thirteenth course of lectures and demonstrations for sanitary officers, held in connection with the Sanitary Institute, was commenced last Friday evening, at the Parkes Museum, Margaret Street, W. Sir Douglas Galton delivered the lecture; and he dealt with the subjects of ventilation, warming, and lighting. The larger part of the lecture was devoted to the first-named subject. Having referred to the composition of air, he enlarged upon its density, dilatation, and movement; and then described various simple methods of changing air in rooms. In connection with the second part of his lecture, Sir Douglas discussed the methods of generating heat in houses—by open fireplaces; by warmed air conducted into rooms by flues from a central source; by closed stoves; and by hot-water pipes. This led up to a brief reference to the warming and ventilation of large buildings by mechanical means. So much time was occupied in the consideration of the first two sections of the lecture, that Sir Douglas was only able to touch very lightly upon the third. He explained the chemical action which occurred in the development of artificial light; and then remarked that, from a hygienic aspect, perfect combustion was most essential to the maintenance of the purity of the air of a room, as if it was imperfect various impurities would be thrown off. It was also essential that the agents used to produce the light should be as pure as possible. Oil gave a light which had the least injurious effect upon the air of a room; and, taking an equal light, coal gas threw out more impurity into the air, and also produced a larger amount of heat. The only real hygienic light was the electric incandescent light. The arc light, which was in contact with the air, gave off a certain quantity of nitric acid, and was therefore not so hygienic as the incandescent light. The lecture was a very interesting one, and was illustrated by a large number of diagrams and tables.

NOTES.

The Recovery of Cyanides from Coal Gas.

A patent has been obtained for the United States by Mr. W. L. Rowland, of Philadelphia, for a process of recovering cyanides from coal gas. It consists in the addition of an iron salt to the water used in the ordinary way for taking ammonia out of the gas in the usual forms of washing or scrubbing apparatus. The proportion of the salt to be added to the washing water is to be sufficient to remove cyanides, but insufficient to remove sulphides; thus enabling the cyanogen compounds to be removed as soluble ferro-cyanide of ammonia along with the ammonia compounds usually recovered. The invention also comprises the method of recovering the ferro-cyanides from the ammoniacal liquor, which consists in first adding a portion of iron salt to the liquor, boiling off the ammonia in the usual manner, and treating the settlings with lime in order to obtain a solution of ferro-cyanide of calcium. Then for the second stage an alkaline chloride or sulphate is added to this solution, to form the double salt ferro-cyanide of calcium and the alkali, and finally decomposing this with an alkaline carbonate, to produce an alkaline ferro-cyanide, which may be crystallized out in the usual manner.

Austrian Tests for Portland Cement.

Austrian engineers test Portland cement under rules practically identical with those employed in Germany. The method for ascertaining whether a cement is free from any tendency to blow or expand in air consists in the employment of the firing tests in conjunction with the wet-pat tests. The first is carried out as follows: The cement is gauged with water to the normal consistency, and spread out upon two glass or metal plates in the form of pats 10 centimetres in diameter, and 1 centimetre thick. In order to avoid shrinkage cracks, the pats are protected from draughts and from direct sunlight, preferably by being kept in a moist chamber. After 24 hours they are gradually heated in an air-oven to a temperature of 120° C. for two or three hours, until all perceptible water vapour has been driven off. If radial cracks should then appear at the edge of the pat, the cement is unfit for use in air; but it is necessary to discriminate carefully between these cracks and those due to mere shrinkage, which do not appear at the edge of the pat. The influence of calcium sulphate in causing cement to crack is not detected by this test; but it becomes evident from the result of the wet-pat test. In the latter test, which shows the suitability of the sample for use under water, the same gauging and precautions to avoid the formation of shrinkage cracks, as with the dry-pat test, are necessary to begin with. After having been allowed to set for 24 hours, the pat is kept in water for 27 days. The other tests for breaking strength and fineness of grinding do not call for special comment. Sometimes the pat that has been kept for 27 days under water crumbles on exposure to the air. This is due to the cement having been too new when gauged, and is prevented by aëration.

Electricity a Bye-Product of Heating Apparatus.

A remarkable thermo-electric stove has been invented by Dr. Giraud, of Chantilly, who has been turning his attention to the problem of heating and lighting from a single source. This apparatus has the external appearance of an ordinary heating-stove. It differs widely, however, from common stoves in its internal arrangements. The products of combustion rise vertically through a cylindrical chamber, and then descend by an annular space formed by the walls of this cylinder and those of another which surrounds it. In their course, the products of combustion are brought into contact with a number of rectangular boxes stamped out of sheet iron, which contain the thermo-electric elements. These are about seven in number, and consist of couples of nickelled or tinned iron and an alloy mainly composed of zinc and antimony. Other metals are added in small quantity, but merely to prevent the composition from being too fusible. The elements are insulated by asbestos; and cooling is effected partly by the shape into which the elements are cast, and partly by circulation of air. The useful output is stated to be 40 watts, equal to about one kilowatt-hour per day of continuous working, to produce which some 62 lbs. of coke would have to be consumed in the stove. Even at the price ruling for coke in Paris (2.75 frs. per cwt.), this would make the electricity cost about 15d. per kilowatt-hour, or Board of Trade unit, which is the rate charged by the Paris central lighting stations. So far the facts appear to be favourable to Dr. Giraud's system; but the current from his thermal couples is so small that it would take an altogether disproportionate amount of stove capacity to supply any considerable proportion of light; and, in consequence, storage batteries would have to be used, which means more loss. On the other hand, it is argued that heating is required for many more hours than lighting; so that the electrical energy which would be otherwise lost during the hours of daylight would be conserved by the accumulators. Moreover, it is to be remembered that the heat utilized in this way by Dr. Giraud is waste heat, so that any portion of it that can be recovered in the form of electricity is so much gain. There is something fascinating about the idea of placing thermo-electric piles in the smoke-flues of boilers, &c., and so obtaining power that can be utilized for lighting.

COMMUNICATED ARTICLE.

LIGHTING.

By W. H. Y. Webber.

PART III.—A CRITICAL EXAMINATION OF MODERN PRACTICE.

(Continued from p. 154.)

The question that suggests itself, after due consideration of the mathematics of lighting and of the practical examples of street illumination to which reference has been made in these articles, is whether there is any convenient numerical expression to be found for the difference between good and bad street lighting—whether it is possible to arrive at any *number* which shall give the measure of spottiness in a way that is useful for calculations of lighting effect. For instance, how can we expose in positive figures the fallacy which underlies such attempts as that of Professor Robinson, already referred to, to make out that because an ordinary street gas-lamp gives a certain light-effect at an arbitrarily chosen distance from the post, therefore this system of lighting may be regarded as exchangeable with electric arc lighting producing the same effect at very much greater range?

The author ventures to propose a method of answering this question, which depends upon the proposition that whatever may be the gross quantity of light employed in any case of street lighting—whether the lighting is done by 5-foot gas-burners or by 1000-candle power electric lamps—the *practical measure of the efficiency of the lighting is given by the difference between the brightest and the dimmest parts of the illuminated area.*

This proposition recalls the observation that has already been made, as to the necessity of raising the minimum effect commensurately with the maximum brilliance. The construction of the human eye requires this concession, which has never been clearly set out in these terms by previous writers upon the general subject. A degree of obscurity between lamps which is endurable with ordinary 5-foot gas-burners, is unendurable when the brilliance of the light-sources is increased fifty or a hundred-fold. Simple and obvious as this statement appears to be when made in this way, its truth is constantly being ignored by the self-styled scientific persons who advocate electric arc lamps for streets, when considerations of economy prevent their being spaced thickly enough to escape the reproach of spottiness. Electric arc lamps can, of course, be used with brilliant effect in street lighting; but they must be placed much closer together than can usually be afforded, if the unevenness of the effect is not to amount to an absolute nuisance. The same may be said of high-power gas-lamps, although in their case the brilliancy of the direct rays entering the eye is not so great as to paralyze this organ, as in the case of the electric arc; and it is therefore not necessary to elevate them so high above the roadway, and thus sacrifice illuminating power.

The test for the true efficiency of street lighting which the author now proposes is intended to apply to all lighting when the light-sources are spaced at greater distances than those deducible from the Heath formula of the radius commanded being 1.42 times the height of the lamp above the plane of the area lighted. The rule proposed is: That the true efficiency of any system of scattered lighting is represented by the numerical difference between the light-intensity calculated from the darkest spot, and the light-intensity of the same flame at distance unity from the vertical passing through the source.

Take an example from what would be called good ordinary street lighting, without any pretension of display, such as that of 5-foot gas-burners at a height of 10 feet above the pavement—the lamp-columns being 30 yards apart on both sides of a 45-foot roadway. Supposing the columns to alternate on the opposite sides of the road, the darkest spot might be taken as occurring along the line of the curb at mid-distance between the lamps. At this point, light would be received from three lamps at equal distances of 45 feet. Consequently, it is necessary to determine the intensity of the light from one source, and then to triple it. Let the illuminating power of the lamps be taken at 12 candles. The slant distance from the gas-flame 10-feet high to a point on the ground 45 feet away is $d^2 = 45^2 + 10^2 =$ rather more than 46 feet. Hence, by the formula applicable in this case, the intensity $i = \frac{12 \times 10}{46^3} = \frac{120}{97336} = 0.0012$, which multiplied by 3 = 0.0036. Let us call this number the index of minimum intensity. In the same way the index of the maximum intensity will be $i = \frac{12 \times 10}{10^3} = \frac{120}{1000} = 0.12$. The index of true efficiency is therefore, according to the proposition, $\frac{0.12}{0.0036}$, or 33.3.

Take for a further example some data supplied by the Belfast lighting. In the Royal Avenue, from North Street to Castle Place, there are 100-candle lamps at intervals of about 24 yards on each side of the street; the columns being of such a height that the flames are 15 ft. 6 in. above the pavement level. The street is about 60 feet wide. Here the darkest spot in the line of the kerb will be midway, at a distance of 36 feet, between two lamps on the same side of the way, and it may also receive light from a third lamp immediately opposite, at a distance of 60 feet. In this case, the distance $d = 47$ feet nearly from the

lamps on one side of the road, and close upon 62 feet from that which crosses the road. Hence $i = \frac{100 \times 15.5}{47^3} = \frac{1550}{103823} = 0.014$ for the first effect; and $i = \frac{100 \times 15.5}{62^3} = \frac{1550}{238328} = 0.006$ for the second. Multiplying the former by two, and adding the latter, we have 0.034 as the index of minimum intensity. For the index of maximum intensity we have—

$$i = \frac{100 \times 15.5}{15.5^3} = \frac{1550}{3723.87} = 0.42. \text{ The index of efficiency is consequently } \frac{0.42}{0.034} = 12.$$

Again, the electric lamps in Queen Victoria Street, in the City of London, are of about 1000-candle power nominal, and 700-candle power effective; being nine or ten ampère lamps in wavy glass lanterns. This is an outside valuation; but it is better to state the case at its best. The light is exhibited at the height of about 18 feet above the pavement; the columns being spaced about 50 yards apart. The darkest spot is midway between two lamps on the same side of the street, and opposite a third. Hence the minimum of lighting effect is that afforded by two lamps each 50 yards away, with the addition of that of a third 22 yards distant. (It must be understood that these distances are only approximate, because the lamps are, as a matter of fact, placed wherever street corners, refuges, &c., offer a suitable place, equality of spacing being only a secondary consideration in the arrangement.) The main object in this calculation is to give the utmost value to the system of lighting. Here the slant distance d is in the first case 155 feet nearly, and in the latter case rather more than 68 feet. Hence—

$$\frac{700 \times 18}{155^3} \times 2 + \frac{700 \times 18}{68^3} = 0.046 \text{ for the index of minimum intensity. For the maximum intensity we have } \frac{700 \times 18}{18^3} = 2.14;$$

so that the measure of efficiency is $\frac{2.14}{0.046} = 46.5$.

Recently there was a question of the best way of lighting the Marine Parade at Hastings and St. Leonards; the choice lying between electric arc lamps 100 yards apart, and 100-candle gas-lamps at distances of 30 yards. The lamps being in a single line, there is no question here of cross-lighting; and the darkest place is midway between the lamp-posts, where the minimum light intensity must be twice the calculated intensity at this spot from one light-source. In the case of the electric lighting, we will assume the effective illuminating power to be 700 candles (a high estimate when opal globes are concerned), and the light to be 18 feet high, as in Queen Victoria Street, City. Here we have an index of minimum intensity of 0.007, and a maximum of 2.14; so that the difference is $\frac{2.14}{0.007} = 305.7$.

With the gas-lamps as proposed, assuming the light to be exhibited at the same height of 15 ft. 6 in. as in the Belfast example, we have a darkest spot 45 feet from the lamp. The distance d is $45^2 + 15.5^2 = 47.5$ nearly. Whence we have $\frac{100 \times 15.5}{47.5^3} \times 2 =$

0.028 for the minimum effect, and 0.42 for the maximum effect. The difference is therefore 15. Expressed in popular terms, this result might be put as showing that, whereas the brightness immediately under the electric lights is upwards of *three hundred times* that of the darkest places, in this system of lighting—a degree of “spottiness” which a blind man could appreciate—the difference in the case of the gas is only *fifteen times*. Again, whereas immediately underneath the lamps the comparative brilliancy between the electric and the gas lamps is as 2.14 candles to 0.42 candle, or a superiority of slightly more than 5 to 1 for the former, in the darkest spots midway between the lamps the difference is 4 to 1 in favour of the gas. If a chain is no stronger than its weakest link, certain it is that a scheme of outdoor lighting for promenade purposes is to be estimated by its darkest places.

The formula herein given may be applied in a variety of ways; but we can see, by the examples selected, that any specimen of outdoor lighting may be judged with reference to the two principal considerations of the minimum intensity and the difference between this and the maximum effect. The value of the former may be anything, according to the scale upon which the lighting is done. It will rarely be necessary, however, to exceed the Belfast figure of 0.034 candle for cross effects (that is, when a street is lighted by alternately spaced lamps), or the Hastings Marina minimum of 0.028 candle for a single row of lights. With regard to the index of practical efficiency, which is the name here given to the difference between the best and the worst effects, it should clearly be kept as low as possible. It is hardly practicable to get it below 12 or 15, with cross or linear outdoor lighting respectively; and the best electric arc lighting in London runs it up to nearly 50, which should never be exceeded.

(To be continued.)

TECHNICAL RECORD.

FUEL GAS: ITS PRODUCTION AND DISTRIBUTION.

A Paper read by Mr. Arthur Kitson before the Franklin Institute.

(Concluded from p. 158.)

I will now briefly describe the apparatus which I have designed for the manufacture of semi-water gas, and which I am now using, in connection with the Körting gas-engine, for the production of power. This furnace has been in operation for some time driving the gas-engine, which supplies power to a dynamo; and this in turn charges a storage battery. The battery furnishes current for a number of incandescent lamps, and occasionally for a small electric motor.

The producer occupies about 10 square feet of floor space, and stands 8 feet from the floor to the top of the feed hopper. This will furnish 1500 cubic feet of gas per hour. The machine consists of a cylindrical shell of boiler-iron, lined with fire-brick. The internal diameter of the brickwork is 21 inches, and the height from the grate to the top of the furnace is 3 ft. 6 in. The grate is connected on one side with a steam and air injector; on the other, with the gas-supply pipe (which runs to the place of consumption), and is surrounded by a cast-iron box, which is securely attached to the cylindrical shell, forming the ash-pit. The whole machine is supported on four cast-iron legs. The ash-box terminates in a mouthpiece, which is opened and closed with a valve operated by a lever from the outside; and it serves to dump the ashes, whenever desirable, without interfering with the process of making the gas. The top of the furnace is closed by an iron plate; and upon this the hopper for feeding is securely fastened. An opening is provided in the plate for a pipe leading to the chimney. Another connection leads also to a gas-supply pipe; each of these pipes being opened and closed by valves. A small reservoir forming the boiler is placed on one side; and communicating therewith are two coils contained in the brickwork. The lower coil heats the water and furnishes steam; while the upper coil superheats it. Water is pumped into the boiler from time to time. An injector is also provided at the top of the furnace. Air channels are arranged spirally in the brickwork, through which air is drawn by the injectors. The air thus becomes heated before mixing with the steam, which must be thoroughly dry. The walls of the furnace are inclined inwardly towards the top, and outwards towards the bottom; thus throwing the entire weight and body of the fuel on the grate. This is provided with mechanism for giving it a rotary and up-and-down motion, the effect of which is to break up any clinker that may have adhered to the sides of the furnace, keep the coal in a compact mass (avoiding holes in the fuel), and throw the dust and ash into the ash-pit. The caking with soft coal is effectively broken up; and the steam finds an easy passage through it.

The entire gas plant I have described is simple, cheap in construction, and economical in its working. It can be made small enough to produce 500 cubic feet per hour, which means a consumption of only 6 or 7 lbs. of coal. It is easily set up, taken down, and removed. There is no danger from fire or explosion; and it requires but ordinary care, as in the case of a coal furnace.

Let us now consider in what manner we may utilize our gas, and ascertain the results obtainable; commencing with the subject of power. It may astonish the general public, who are accustomed to regard the highly-developed steam-engine as the perfection of human ingenuity in the transformation of heat into work, to learn that the gas-engine, with all its imperfections, is a far more efficient instrument. Although the gas-engine is limited in various ways, in capacity and power, and is, mechanically speaking, vastly inferior to the steam-engine, its absolute efficiency is at least double that of its rival. The absolute efficiency of the gas-engine is 20 per cent., and has in some cases exceeded 22 per cent.; while that of the best steam-engine never exceeds half this amount. With illuminating gas, a consumption of from 25 to 30 cubic feet per hour in any of the standard gas-engines will develop one actual horse power, which is equivalent to a consumption of from 15,000 to 18,000 thermal units.

I have made a considerable number of experimental tests of semi-water gas with Körting gas-engines, varying in size from 18-horse power down to 2-horse power, and found no difficulty, with a consumption of 85 cubic feet, in developing an actual horse power by brake test. This is equivalent to $1\frac{1}{4}$ lbs. of coal per horse power per hour. For several years a well-known firm in Manchester have supplied their works with power by means of gas-producers and gas-engines; and they claim that the cost has not exceeded $1\frac{3}{4}$ lbs. of coal per horse power per hour. A recent test with an Atkinson engine gave 1-horse power with 1.11 lbs. per hour. In comparison with the steam-engine, these results are startling. Compare, for instance, the efficiency of the best steam plant—comprising furnace, boiler, and engine—with a gas-producer and gas-engine. It is hardly fair to make comparisons with very large steam plants, for the simple reason that the largest gas-engine does not exceed 100-horse power.

A 50-horse power steam plant of the most approved pattern will consume 45,000 thermal units in the production of each horse power per hour—an efficiency of less than 7 per cent. In the largest plants, the efficiency will not exceed 10 per cent. Now take the gas plant. We get an efficiency of 80 to 85 per

Mr. Frank Vivian, who has been managing the Llanelly Gas-Works since the resignation of Mr. A. G. Browning in November last, has now been permanently appointed Manager and Secretary of the Company.

cent. in the producer, and an absolute efficiency of from 14½ up to nearly 19 per cent. for the entire plant. Here is a method for the supply of power for which there is an unlimited field; and, notwithstanding the years that have elapsed since attention was first called to the subject, it is entirely unknown to the public generally. Instead of large reservoirs for the supply of steam, we may generate gas as required; converting its potential energy into useful work more economically and more efficiently than has ever been dreamed of by steam engineers. The gas-producer and the gas-engine must eventually supplant steam—at least, for all small uses.

My experiments showed me: (1) That it is decidedly advantageous to clear the cylinder entirely of the exploded products before taking in a fresh charge; (2) that a higher compression than that ordinarily used with illuminating gas is beneficial; and (3) that sufficient time should be allowed to enable the gas and air to intermingle in the exact proportions for combustion, before ignition. The presence of a small proportion of the exploded products in the new charge affects this quality of gas much more disastrously than where a richer gas is used. There being already 50 per cent. of non-explosive gas in the charge itself, the addition of a small percentage of so injurious a diluent as carbonic acid gas injures the explosive force of the charge materially. The best effects from the use of this gas may therefore be expected from engines having a variable piston stroke, such as the Atkinson. The disadvantages attending the slow combustion of carbonic oxide gas (especially when this gas is accompanied by much nitrogen) is, to a great extent, remedied by high compression. High compression also increases the capacity of a given-sized engine—a decided advantage where semi-water gas is used.

The outlook for the gas producer and engine is very encouraging, and bids fair to out-rival the steam boiler and engine. Not only is it more economical in the conversion of potential heat units into work, but there is less labour involved, and less danger. The results I have mentioned may at first sight seem startling, especially to those accustomed to the use of small steam plants, where the consumption of coal varies from 4 up to 10 lbs. of coal per horse power. So accustomed have we become, in our crude utilization of natural forces, to throw away more than we use, that we are apt to lose sight of the proportion and magnitude of such waste.

Every factory and household chimney, every locomotive stack, every ash-pit and dust-bin, testifies to the frightful extravagance in our modern and much-vaunted methods of utilizing fuel. When we reflect that in every pound of coal lies hidden a force which, if wholly utilized, would furnish 4 or 5 horse power, while at present we employ at least 10 lbs., and often 40 lbs., to accomplish the same results, and that in our highly-efficient gas motor we consume 5 volumes to obtain the energy contained in one, some idea of the present wasteful methods of producing power may be realized. The prediction, therefore, that the gas-engine and gas-producer will shortly furnish power with 1 lb. of coal per actual horse power per hour, is only incredible to those who regard present achievements as the summit of human attainment.

This question of cheap power brings us directly to another—the production of light. The great obstacle the electric light encounters when competing with gas is the cost of power. Here, it seems to me, is a solution of the problem. Taking an incandescent electric plant capable of furnishing ten lamps of 16-candle power per actual horse power, the cost of coal would be less than 0.25c. per hour. This would permit the use of storage batteries, and allow a margin for loss in discharging. The gas is also available in connection with incandescent gas-lamps, such as the Welsbach and Lungren. I have used the former with success. The Kitson water-gas lamp, in which the gas is carburetted by the vapour of naphthalene, produces a very beautiful light with semi-water gas.

For heating purposes, the uses of this gas are almost endless. With properly constructed burners, gas cooking and heating stoves are available for domestic purposes; while for industrial work its different spheres are legion—brick and lime burning, soldering pots, singeing yarns, roasting and smelting furnaces, cupolas, &c. In fact, wherever artificial heat is required, this gas may be made available in one special way or another.

Chief among the items that make the price of gas high to consumers is the cost of distribution; and in large cities it is certainly attended with the greatest conceivable annoyance and expense. The breaking up of roadways, the laying, re-laying, and repairing of pipes, the loss from leakage, the actions for damages, the conflicts with city councils, surveyors, street car companies, and property owners—all these things serve to make the lot of a gas company at times anything but a happy one. These expenditures have to be met, and serve to make the price of gas to the consumer wholly out of proportion to its cost of manufacture.

The plan I wish to suggest for supplying fuel gas in its three departments, as light, heat, and power, is to bring the place of manufacture and point of consumption as near together as possible, and avoid long distance of delivery. I would let every block of houses contain its own gas-works and electric light station. A basement in the centre of a block would be provided and equipped with several gas generators, engines, dynamos, and storage batteries. This plant I would erect in a substantial manner, and, where necessary, dig below the basement

for several feet. I would put in good foundations, and sink the generators considerably below the floor level, for convenience in supplying the hoppers with coal. One set of generators I would keep constantly in operation, running gas-engines which would operate the dynamos, continually charging the storage batteries to supply the necessary lights. This part of the plant I would operate for 24 hours a day, so as to reduce the size and cost of the plant requisite to do a given amount of work. Another set of generators would furnish gas for heating and cooking purposes. Boilers would be used for supplying steam heat or hot water in the ordinary manner. Pipes would be run from the main tank to each house in the block, and wires connected from the storage batteries in the customary way. It would be necessary to have a small holder under each house; and this I would also sink below the floor level in the basement. This holder would regulate any great variation in the supply of gas. Each block would thus be provided with its own plant, and be entirely independent of central stations and city gas companies. Duplicate sets of machines would have to be kept ready in the event of one or more of the others giving out.

The advantages to be reaped by this system would be: (1) That, owing to the short distance which the gas and electric current would have to travel, the cost of supply, as well as the amount of capital invested, would be reduced to a minimum. (2) The system avoids at once the overhead wire nuisance, and the annoyance of tearing up the streets to alter and change the gas-mains. (3) Consumers would be entirely independent of City Councils and City franchises; they would have simply to consult themselves and their own interests, and deal with their own property. (4) An accident to one gas plant would not interfere with the lighting of a whole district, as is the case under the present system.

By this method of distribution, you will see that the objection urged against the carrying of a quantity of inert gas, necessitating very large mains, disappears.

COMPARATIVE WORKING EXPENSES OF SMALL MOTORS.

At the last Meeting of the Association of German Engineers, some interesting statistics were presented by Herr C. Korte on the subject of the comparative cost of working small motors. An abstract translation of the paper appears in the Proceedings of the Institution of Civil Engineers, from which we take the following particulars:—

The statistics embodied in the communication are the result of investigations undertaken by the author for the purpose of fixing a tariff for the use of the municipal hydraulic mains and electric current at Barmen. It is practically impossible to give any figures capable of universal application, as the chief factor—the cost of generating the motive power—must necessarily vary according to the local prices of coal, gas, water, &c., and wages. As far as possible, however, the result has been given in general terms, with the proportion which, upon such basis, the cost of motive power alone bears to the total working expenses, so that the corresponding figure for other prices is readily obtainable. Small motors may be divided into two categories—viz., (1) those which are worked from a central point, under either municipal or private control, and which include gas, hydraulic, electric, and compressed-air motors; and (2) those which are worked independently—viz., steam, hot-air, and petroleum engines, &c.

In estimating annual working expenses, two examples are given—viz., for 300 days of five and ten hours respectively, or 1500 and 3000 hours per annum; and it is assumed that the work is performed under average fair conditions—viz., as continuous as possible, and at nearly full power. In practice, this is, of course, a very variable condition; and as interrupted working, or running for short periods only, naturally increases the cost, the figures represent the minimum working expenses. With regard to the various classes of motors, it may be noted that in gas motors $\frac{1}{4}$ and $\frac{1}{2}$ horse power sizes have vertical cylinders; the larger sizes being horizontal, and more economical in their consumption of gas. Comparative figures are given for four different prices for gas—viz. 2s. 10d. per 1000 cubic feet, as at Düsseldorf, Dortmund, Elberfeld, &c.; 3s. 4d. per 1000 cubic feet, as at Cologne, Hanover, Frankfurt-on-the-Main, Barmen, &c. (Berlin slightly higher), 4s. 3d. per 1000 cubic feet; as at Leipzig; 7s. per 1000 cubic feet, as at Paris. In most cases the bulk of the consumption for motors is during the daytime; and a considerable reduction—from 30 to 60 per cent.—off the price charged for lighting purposes is allowed. At Barmen, in 1884, with gas at 5s. per 1000 cubic feet and no discount for motors, the annual consumption under this head was a little more than 4 million cubic feet; but with an allowance beginning, in 1885, at 10 per cent., and since increased to 33½ per cent., the present rate of consumption is upwards of 18 million cubic feet. Hydraulic motors are based on Munich estimates, and for working at six atmospheres. No reduction is allowed at Barmen—for which the estimate is framed—for electric current for motors, as against lighting. The statistics for compressed-air motors are based on estimates for Paris, which are above what may be accomplished in other places; and the author notes that these figures may be considerably reduced in consequence of recent improvements in this class of motor. In connection with steam

power, it may be mentioned that it is placed at a considerable disadvantage by intermittent or irregular running. In the larger sizes and with regular working, and when the price of coal is not excessively high, the steam motor competes very closely with the gas motor; but in the smallest sizes, the gas-engine is practically the only motor to be considered. The hot-air engine is the only other system in which the working expenses compare at all with gas and steam. The author has not investigated the cost of working petroleum motors; but he considers that they have a great future before them. The cost of working hydraulic motors and electro-motors will doubtless in time be much reduced, when competition results in effecting improvements in the central distributing stations and the transmission of power. In the case of hydraulic power, the working expenses may be considerably diminished when the waste water can be further utilized.

Size of Motor, H.P. . . .		$\frac{1}{4}$	$\frac{1}{2}$	1	2	3	4	6
Class of Motor.	Locality.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.
Gas . . .	London .	33 0	60 0	80 0	120 0	155 170	0 0	195 0
	Paris .	38 0	60 0	88 0	112 0	130 152	0 0	200 0
	Cologne .	32 10	60 0	75 0	92 10	110 132	10 10	180 0
Compressed air . .	Paris .	157 10	232 10	385 0	461 10	538 604	10 10	716 10
	Augsburg .	75 0	157 10	190 0	250 0	300 390	0 0	575 0
Steam . .	Paris .	..	..	87 0	112 0	133 167	10 10	200 0
	Germany	..	..	68 15	83 0	105 132	10 10	158 0

Gas Motors.

Size of Motor, H.P. . . .		$\frac{1}{4}$	$\frac{1}{2}$	1	2	3	4	6
		£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.
Cost, inclusive of bed . .		38 15	68 15	84 14	104 9	124 4	149 5	202 0
Cost of working 1500 hours —i.e., 300 days at 5 hours, with gas at 2s. 10d. per 1000 cubic feet		11 13	16 18	21 15	32 19	43 2	54 9	75 6
Cost of working 3000 hours —i.e., 300 days at 10 hours, gas as above		16 8	23 5	30 13	49 18	66 16	85 18	119 16
Cost of gas as above in per- centage of total working cost for 3000 hours . . .		45	45	50	59	67	64	69

Cost per H.P. per Hour.									
Price of Gas per 1000 Cubic Feet.	Daily Working Hours.								
s. d.		d.	d.	d.	d.	d.	d.	d.	d.
2 10	{ 5	7'44	5'40	3'48	2'64	2'28	2'16	2'04	
	{ 10	5'28	3'72	2'40	2'04	1'80	1'68	1'56	
3 4	{ 5	7'92	5'76	3'72	2'88	2'52	2'40	2'28	
	{ 10	5'76	4'08	2'64	2'28	2'04	1'92	1'80	
4 3	{ 5	8'64	6'24	4'08	3'24	2'88	2'76	2'52	
	{ 10	6'48	4'56	3'00	2'64	2'40	2'28	2'16	
7 0	{ 5	11'04	7'92	5'28	4'44	3'96	3'84	3'60	
	{ 10	8'88	6'24	4'20	3'84	3'48	3'48	3'24	

Comparative Summary of Cost per Horse Power per Hour.

Size of Motor, H.P.		$\frac{1}{4}$	$\frac{1}{2}$	1	2	3	4	6
Class of Motor.	Hours Daily.	d.	d.	d.	d.	d.	d.	d.
Gas motor (gas at 3s. 4d. per 1000 cubic feet) . .	5	7'92	5'76	3'72	2'88	2'52	2'40	2'28
	10	5'76	4'08	2'64	2'28	2'04	1'92	1'80
Hydraulic motor (water at 6½d. per 1000 gallons) . .	5	12'12	10'80	9'72	9'00	..	..	..
	10	10'56	9'84	9'12	8'64	..	..	..
Electro-motor (at Berlin tariff)	5	8'88	7'22	5'88	5'04	4'68	..	..
	10	7'56	6'48	5'40	4'80	4'44	..	..
Compressed-air motor (at Paris tariff)	5	15'00	11'64	8'40	6'96	6'00	5'40	4'32
	10	13'08	10'44	7'68	6'48	5'64	5'16	4'08
Steam motor, with coal at 12s. 6d. per ton . . .	5	..	..	4'20	2'88	2'40	2'04	1'80
	10	..	..	2'88	2'04	1'68	1'44	1'32
Steam motor, with coal at 20s. per ton	5	..	..	4'92	3'48	3'00	2'82	2'28
	10	..	..	3'48	2'52	2'16	1'92	1'68
Hot-air motor, with coal at 12s. 6d. per ton . . .	5	11'28	6'72	4'44	3'36	..	..	..
	10	6'48	4'08	2'76	2'16	..	..	..

The Meteorology of Nottingham.—We have received a copy of the tables relating to the meteorology of Nottingham for the past year, compiled by Mr. A. Brown, M. Inst. C.E., the Borough Engineer, and Mr. P. Boobyer, M.B., the Medical Officer of Health. They are accompanied by an elaborate chart showing the relations of the number of deaths from various causes to the principal meteorological conditions on each day of the year.

Additional Gasholders for the Manchester Gas-Works.—The Gas Committee of the Manchester Corporation have decided to erect three new gasholders. One of these, to be put up at the Bradford Road station, will be 250 feet in diameter, and be capable of containing 7 million cubic feet of gas; another, to hold 1½ millions, will be erected at the Gaythorn station; and the third, for 500,000 cubic feet, at the Droylsden station. The Committee have placed the preparation of the drawings and specifications for these holders (which will raise the storage capacity of the works to 24 million cubic feet) with Mr. G. Ernest Stevenson, M. Inst. C.E., who a few months ago was appointed Manager of the Rochdale Road station.

THE GALICIAN PETROLEUM INDUSTRY.

At a recent Meeting of the London Section of the Society of Chemical Industry, Mr. BOVERTON REDWOOD read a paper on the above subject.

The general applications of petroleum, and its special use for carburetting water gas, and for making oil gas for admixture with coal gas, was first touched upon by the author, who next gave a historical account of the industry in Galicia. Petroleum, he went on to say, is mentioned in records of the seventeenth century, and in a government decree in 1810, from which date oil fit for burning in lamps was produced, until 1818, when it appears to have been neglected until 1852. In that year, a liquid was observed to condense from the paraffin which was in common use as a cart-grease; and, on purification, it was found to burn satisfactorily in lamps. In 1853, petroleum began to replace candles in Galicia; but it was not till 1891 that the first important well was dug. In treating at some length the geographical and geological distribution of the oil, the association of the oil-fields of Europe with important mountain ranges, and the occurrence of the oil in belts having a general north-westerly or south-easterly direction, were the points most insisted upon. The petroleum district of Galicia is situated on the northern slopes of the Carpathians, and is some 260 miles in length, with an average breadth of about 40 miles. Mr. W. Topley, F.R.S., was quoted as the authority for the geological data, from which it appeared that the Carpathians consist chiefly of sandstones of the Eocene, Cretaceous, and Neocomian strata; and in the latter stratum, which in places has been forced up to the surface, the bulk of the petroleum occurs. Galician petroleum has a very variable density, that from wells which have been dug being heavier than that from drilled wells; the greater depth of the latter preventing the loss of volatile constituents, which doubtless takes place from oil found near the surface of the ground. The density may range from '750 to '950; but that of petroleum from East Galicia is ordinarily between '830 and '866, while that from West Galicia is usually between '835 and '859. These densities refer to oil from drilled wells; that of oil from excavated shafts is from '859 to '864.

The author provided tables showing the specific gravities and distillation products of a number of samples of the petroleum. Summarizing these, it is found that the specific gravities range from '845 to '901; that the percentage yield of petroleum spirit is from 7'5 to 12'0, of kerosene from 32'5 to 38'4, and of paraffin and heavy oil from 40'0 to 50'8; while 1 to 5 per cent. of solid hydrocarbons are also obtained. The oil from the older strata is the most limpid, and contains least paraffin. The main constituents of the petroleum are volatile paraffins. Some of the less volatile are, on distillation, probably dissociated into olefines, which occur in the distillates, though probably not in the original oil. Hydrocarbons of the aromatic series are also found in the distillates to the extent of 2 per cent. of the crude oil; but possibly their presence is likewise due to certain changes during distillation.

In the early days of the Galician petroleum industry, the wells were dug; and the substitution of drilling for digging marks a most important stage in the development of the industry. Having described the first system of drilling adopted, and then the Canadian system which was introduced in 1882, the author stated that the oil does not as a rule flow from the Galician wells, but is raised therefrom by a small diameter pump attached to lengths of gas-piping. The quantity of petroleum obtained increases each year. In 1890, it amounted to 816,000 barrels; while in 1883, it was only 166,500 barrels. Notwithstanding this increased output, 867,830 barrels of oil were imported in 1890, against 735,000 barrels in 1883. The distillation is carried on in cylindrical horizontal stills; and the burning oil is purified by treatment with 3 to 4 per cent. of sulphuric acid. The native industry is protected and encouraged by an import duty on petroleum; nevertheless, as will be seen by the above figures, the home production does not suffice for the wants of the country.

The rest of the paper was devoted to ozokerite, and its applications. This mineral, it was pointed out, occurs in Galicia in the tertiary (Miocene) formation, and is usually found associated with rock salt and gypsum. Its density varies from '850 to '950, and its melting-point from 58° to 100° C. It is worked by a very primitive system of mining, in which fatalities are of frequent occurrence. The amount of ozokerite remaining in the deposits is estimated at 2 million tons.

In the course of the discussion which followed the paper, some questions were put concerning the fitness of Galician petroleum for gas making. In reply, Mr. Boverton Redwood explained that, as might be suspected from its low specific gravity, it did not contain water in suspension, but only a small quantity in solution; that both it and the ozokerite were practically free from sulphur; and that he had not observed any evolution of ammonia during its distillation.

Mr. Alderman Durden, who was Chairman of the Blandford Gas Company till last year, died on the 20th ult., at the advanced age of 84 years.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

Standards of Light.

SIR,—It is greatly to be hoped that the Committee on Standards of Light will see their way to the introduction of a system of gas testing by which practical uniformity may be ensured, not only in the Metropolis, but throughout the kingdom. In this view, Mr. Leicester Greville's recommendations leave something to be desired. I refer particularly to the proposal to consume such quantity of the gas to be tested in the standard Argand as will give an illuminating power of 16 candles. In my opinion, the plan more likely to conduce to uniformity would be to burn the gas at a fixed height in the chimney, and correct the indicated illuminating power to the 5-foot rate. My reasons for preferring this are as follows:—

- (1) The proper development of luminosity is dependent upon a suitable air supply. The air supply is influenced by the height of the flame. Consequently, any alteration in the latter affects the development of luminosity.
- (2) The height of flame is not merely dependent upon the rate of consumption; it is also influenced by barometrical pressure and temperature, and varies according to the composition of the gas.
- (3) The influence of barometrical pressure upon an Argand flame does not appear to be confined solely to its effect upon the volume of gas consumed. By altering its height, it also alters the air supply; and thus affects the development of luminosity. These influences may be overcome by the adoption of a fixed height of flame, to which the present corrections would be suitable.

A height of not less than (say) 4 inches in the chimney would, in all probability, not only ensure greater uniformity in testing 16-candle gas, but would also enable a lower or higher quality of common gas such as is supplied in the provinces to be tested under practically the same conditions.

The proposal to use a 16-candle standard seems to imply that this is looked upon as a Metropolitan rather than a National question. On the other hand, a 10-candle standard does not involve committal to any particular quality of gas; and the slight difference that this would make in the distances from the disc should not be of much importance.

Birmingham, Jan. 30, 1892.

CHAS. HUNT.

SIR,—It would seem that Mr. H. Leicester Greville, in his remarks on this subject in last week's JOURNAL, ignores or overlooks, in treating of his fifth recommendation, one important consideration to which he pays heed when dealing with his first. I refer to the (in his own words) "possible effects on ratio between height of flame and illuminating power, in the event of gas companies introducing water gas." Recommendation No. 5 proposes that, instead of a rigid 5-foot consumption, the gas should be burnt to a constant 16-candle flame. Now, assuming (what has indeed been established by many observers, from Bowditch onwards) that the ratio of height of flame to illuminating power does vary with the composition of the gas consumed, and that, in consequence, a 16-candle flame from one gas, burnt in the standard burner, differs considerably in size from that produced by another gas of unlike composition, it follows that equal justice cannot, by this mode of testing, be done to the two gases. The only right procedure to follow is—having defined your burner—to burn each gas through it under the very best conditions, which are obtained when the flame fairly fills the chimney without smoking.

Glasgow, Jan. 29, 1892.

JOHN T. SHEARD.

Municipal v. Private Control of Gas Undertakings.

SIR,—You conclude an article on "Gaseous Fuel and Fog Prevention," which appeared in the JOURNAL for Jan. 26, by referring to the municipal control of the gas-works in Manchester and in Birmingham; and you ask: "Have these Municipalities done anything to disestablish their local fogs by reducing the price of gas to its lowest manufacturing cost?" And you answer: "Not at all. They have subsidized their ratepayers." Your answer may be correct, and your testimony may be true. Allow me, however, to apply the same question *re* the Gas Companies of London, Liverpool, and other towns. Have they done anything to "disestablish their local fogs by reducing the price of gas to its lowest manufacturing cost?" "Not at all. They have subsidized their" shareholders. I submit that it is incorrect to say that nobody is, or has been, the better. The shareholders have been the better in each case. In that of Companies, these may be strangers, whose only interest in the town is to draw as large dividends as possible from the gas-works; and in that of Municipalities, the ratepayers are the shareholders, whose interest in the town is not confined to gas, but extends to all departments of the Local Authority.

Profit is made from the manufacture of gas, whether the works are owned by a private company or by the local authority. That made by a company goes into the pockets of the shareholders, who spend it as they like, and the town is not one whit the better for it; whereas profit made by a local authority is devoted to the reduction of rates, or to the improvement of the town.

Manchester, Jan. 28, 1892.

C. N.

[Our correspondent misses the point of the original communication to *The Times*, which was that Municipalities, if they had the opportunity, would sell gas cheaper than Companies. We stated upon this that, as a matter of fact, Municipalities which have the opportunity, do nothing of the kind. This letter, indeed, yields our point; for it admits that there is no difference between Companies and Municipalities in the fundamental matter of gas-works administration, but that the latter merely put ratepayers in the place of shareholders, leaving the interest of the consumers precisely the same in each case.]

—ED. J. G. L.]

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Monday, Jan. 25.

(Before Mr. Justice DENMAN and a Special Jury.)

Fox v. Wildy—Action as to Shares in the British Water-Gas Syndicate.

In this case, the plaintiff, Mr. Samson Fox, sought to recover from Mr. William Lawrence Wildy the sum of £500, money alleged to have been lent. The defence pleaded was that the amount in question was given as the purchase-money for 200 shares in the British Water-Gas Syndicate, and was not a loan.

Mr. C. F. STUDD, in opening the case, said the question to be decided was as to whether the £500 was given by way of loan or as the purchase-money for certain shares. The plaintiff had been for three years the Mayor of Harrogate, Chairman of the British Water-Gas Syndicate, and Managing-Director of the Leeds Forge Company. About ten years ago the plaintiff made the acquaintance of the defendant, and engaged him in various capacities at the Leeds Forge—ultimately as engineer and draughtsman. Mr. Fox, being pleased with the way in which Mr. Wildy performed his duties, from time to time made him small presents of money, in addition to his salary, to encourage him in his work. In the autumn of 1888 and spring of 1889, the defendant was engaged in erecting and working at the Leeds Forge the first plant for water gas that had been erected in this country; and he also wrote two pamphlets on the subject of the gas. A certain amount of use was made of these pamphlets; and they were of assistance to the plaintiff. In June, 1889, Mr. Fox, being still pleased with the defendant's general conduct, with the pamphlets, and with the way in which he had done his duty, made him a present of 200 vendors' shares in the British Water-Gas Syndicate. In October, 1889, the defendant left the Leeds Forge under the following circumstances: The post of Engineer of the British Water-Gas Syndicate became vacant; and Mr. Fox obtained the offer of the situation for the defendant, at a salary of £500 a year, being an increase of £200 on the salary he was then receiving. The defendant took the appointment. On the 2nd of November the defendant called upon Mr. Fox, and told him that he owed £360 in respect of share speculations and other matters. Mr. Fox asked defendant how much he required to clear himself; and Mr. Wildy said he should want £500. Mr. Fox agreed to lend this sum, at 5 per cent. interest, taking by way of security the certificate of the 200 shares and a transfer. A transfer of the shares was thereupon executed by the defendant. In March, 1890, it came to the knowledge of Mr. Fox that Mr. Wildy was ill; and looking to see that all the documents were in order, it was discovered that the transfer was not properly stamped. Thereupon a correspondence ensued; and, in one of the letters, reference was made to the "loan." The learned Counsel was proceeding to read the correspondence at length, when

Mr. LOCKWOOD, Q.C., who represented the defendant, said he was happy to inform the Court that the case was settled. There would be, by consent, a verdict for the plaintiff for £250, to be paid in four quarterly instalments, both sides paying their own costs. The plaintiff was also to retain the shares.

Keane and Greene v. Parker-Rhodes and the United Printing and Publishing Company, Limited—Action for Libelling the Directors of the Lothammer Gas Company.

This was an action brought to recover damages in respect of an alleged libel published in the *Oracle*. The defendants admitted the publication; but they denied that it had been published falsely or maliciously, and, further, that the words were not capable of the interpretation sought to be put upon them.

The SOLICITOR-GENERAL (Sir Edward Clarke, Q.C., M.P.), Mr. F. LOCKWOOD, Q.C., and Mr. MONTEFIORE appeared for the plaintiffs; Mr. PARKER-RHODES attended in person to support his own case; and Sir CHARLES RUSSELL, Q.C., M.P., Mr. BUCKNILL, Q.C., and Mr. BANKES represented the other defendants.

Mr. LOCKWOOD, in opening the case, said the plaintiffs complained of certain statements printed in the *Oracle*, which reflected very strongly upon their conduct in connection with a Company known as the Lothammer Gas Manufacturing Company, Limited. The patents, which were the property of Mr. F. J. Lothammer, involved a process for the manufacture of gas from gasolene, which was a product of naphtha; and the process enabled the gasolene to be so dealt with that, upon atmospheric air being passed through the vapour emitted by the gasolene, a gas was produced which could be utilized by the ordinary appliances with which gas is usually consumed, though a separate apparatus was necessary to allow of its consumption. One could not turn on Lothammer gas and ordinary gas in the same pipe. Mr. Lothammer's specification described his patents as for "an improved portable apparatus for the manufacture of gas." The Company, which was formed in March, 1889, was brought to the attention of the plaintiffs, who took advice on the matter from various persons of experience—among others, from a patent agent named Prince. The Company was registered on April 29, 1889, with a nominal capital of £60,000, in £1 shares; the first Directors being Colonel H. Y. Murray (late Superintending Engineer, Bengal Presidency); Mr. Thomas A. Greene (of Messrs. H. Greene and Sons, gas engineers); Mr. C. F. Joselyne (Director of the New Durham Salt Company); Mr. J. R. R. Keane (a civil engineer); and Mr. Lothammer, the vendor of the patents. On May 2, 1889, a meeting of Directors was held; and, after reports of different experts had been read, shares to the number of 5448 were allotted. The prospectus stated that two agreements had been entered into. The first was made between Mr. Lothammer, of the one part, and Mr. L. H. Blumfield, on behalf of the Company, on the other part; and it was an agreement for the sale of the invention for £40,000—£2000 being payable in cash, and £38,000 in shares, with power to the Directors to pay part of the £38,000 in cash. The second agreement was made between Mr. Lothammer and one Buttifant, by which

the latter undertook to pay all the expenses of promotion up to the date of allotment; and in consideration of so doing, Lothammer agreed to pay him £500 in cash and £14,500 in shares out of the purchase-money.

Justice DENMAN asked what was the nature of the libel.

Mr. LOCKWOOD said it was directed against gentlemen connected with the Company; and, inasmuch as the libels were generally made on the Company, he thought it would be better to give the initial history of the concern, in order to make the matter clear to the jury. It appeared that the Company carried on business for a time, and did substantial work. Mr. Parker-Rhodes, who was the holder of ten £1 shares, succeeded in obtaining the liquidation of the Company, and the appointment of his nominee as liquidator. Contending that he was Chairman of the Provisional Directors who had ousted the original Board, he addressed to the shareholders the circular which contained the libel.

Justice DENMAN (impatiently): What sort of conduct?

Mr. LOCKWOOD said the imputation was that the Directors had not honestly carried on the operations of the Company; that they had not borne in mind the interests of the shareholders, but had worked to their own advantage and that of the promoters. The circular was published in the *Oracle*; and the following statement therein was the one complained of:

The Provisional Board now understand why the former Board obstructed rather than encouraged the practical development of the Company's undertakings. Their policy was not, as is clearly evidenced by extant documents, to earn fair profits by a regular course of legitimate working, but rather to organize a series of derivative companies, after the fashion of the Date Company and the Water-Gas Syndicate, and other cognate schemes, in the interests of promoters and directors rather than in those of investing shareholders. The interests of the Company have, beyond question, been grievously betrayed. The total cash share capital of the Company has never exceeded £5025, while the amount of the vendor's shares, in reality only about £12,000, was augmented by a group of promoters to no less than £38,000, thus leaving the cash-subscribing shareholders only a modicum of interest in the concern. The circumstances of the case, as disclosed in the report of the Committee of Investigation, and now further elucidated, are so exceedingly flagrant that the Board deemed it incumbent upon them to lose no time in instituting proceedings against the confederacy of Directors and promoters, with the object of getting a judicial rescission of the contracts and transactions by which the body of shareholders have been victimized.

From June, 1889, constant meetings of the Directors were held; one of the main objects being to establish in various districts subsidiary companies for carrying on the manufacture of gas under the patented process. This had many advantages, for the reason that those companies would pay to the parent concern one-third of their capital; and it was thought that the gas would have a much better chance of succeeding in a district provided with a central motive power. If the Company were selling to private individuals—say, in the Bristol district—it would be necessary, in the case of each individual purchaser, to set up for him an apparatus for the manufacture of the gas; but if, on the other hand, several districts were willing to combine, the advantage would be that a central motive power feeding the district could be provided. Whatever might be charged against the Directors, it could not be said that they did not give the best of their time and ability to the prosecution of the business. He was instructed to say that neither of the plaintiffs had received any fees in respect of the services they had rendered to the concern. Mr. Parker-Rhodes expressed unqualified approval of the formation of subsidiary undertakings. When, however, in October, 1889, it was resolved that the plant should be constructed by Mr. G. Bower, he for the first time objected; and having defeated the Directors, he carried a resolution to the effect that a Committee of Investigation should be appointed. In December, 1889, a Chancery action was commenced by Mr. Parker-Rhodes and Mr. Cantwell, on behalf of the shareholders, against the Directors and promoters, seeking to invalidate the contract for purchase of the patents, and asking for an account of the moneys paid. This action proceeded for some time; but in March, 1891, the plaintiffs were dismissed from the suit—it being admitted that they were not guilty of any fraudulent conduct, as Mr. Parker-Rhodes had written a letter exonerating them from participation in fraud. This, urged the learned Counsel, was all very well; but Mr. Parker-Rhodes should have thought of that before venturing, in December 1889, to send forth the libel of which complaint was now made. The plaintiffs courted the fullest investigation into their connection with the Company; they having made nothing out of it. They had, in fact, endeavoured to make the undertaking a success; and it was not their fault that it had been a failure.

Justice DENMAN asked if it was worth while to follow up the case against Mr. Parker-Rhodes; he having made a complete admission.

Mr. LOCKWOOD said the admission amounted to this—that if, in 1889, he called the plaintiffs scoundrels, he withdrew it in 1891. The plaintiffs were bound to bring the action.

Justice DENMAN asked whether, after the letter of March, 1891, it could be worth while to go on with the story as regarded the conduct of all the Directors.

Mr. LOCKWOOD said he was only appearing for Messrs. Keane and Greene, who were included in the sweeping allegation against the Directors.

Sir C. RUSSELL: Whose names were not mentioned at all.

Justice DENMAN: Where people are commenting on the conduct of a Board of Directors, they do not necessarily attack each individual, who may have been in the minority all the time.

Mr. LOCKWOOD said he should contend that each Director was attacked.

Justice DENMAN: Suppose an individual comes forward and says: "You attack a body of which I am one;" and the answer is: "I do not attack you—I except you. I do not believe there has been the slightest dishonesty on your part." Is it worth while to go on, and say "The cap fits me?" Is it of any use to go on with the action against Mr. Parker-Rhodes?

Mr. LOCKWOOD said he thought it was. As to the other defendants, the defence consisted mainly of privilege.

Justice DENMAN: They publish something which is an attack on the Board; but there is nothing to particularly fix it against the two

plaintiffs, who are members of that body. Unless it is an attack against every individual member of the Board, you are in the same difficulty.

Mr. LOCKWOOD did not see how it could be for the public benefit that the Press should take up the cudgels and endeavour to procure a judgment at the bar of public opinion. The Press had no privilege in the matter at all, and had no right to comment on questions involved in an action where fraud was alleged.

Mr. John Richard R. Keane was then called, and examined by Mr. MONTEFIORE. He said he was a civil engineer, carrying on business at 2, Storey's Gate, Westminster; and he was one of the first Directors of the Lothammer Company, having been asked to join the Board by Mr. Moll. After investigating the matter, he came to the conclusion that the patent was a valuable one; and consequently he agreed to become a Director. Being much interested in the Australian colonies, he thought the invention would be of very great use there. The Directors set to work and opened up negotiations, with the object of forming subsidiary companies and earning profits by a regular course of legitimate working. The Company sold various sets of patents, the details of which would appear in the books. He denied that he was in league with the promoters; in fact, he did not know who they were. He had never made any profit out of the concern. The Directors always acted under the advice of the Company's solicitors. Mr. Parker-Rhodes first opposed the policy of the Board four months after the Company was formed. The Directors retired in a body after the presentation of the Investigation Committee's report. The Company was wound up on a petition presented by Mr. Parker-Rhodes. An action was brought against the former Directors and promoter for the rescission of the contract, and for an account of moneys paid; and it had been dismissed as against Mr. Greene and himself. The action was, however, being continued as against the other Directors.

Cross-examined by Sir C. RUSSELL: The libel of which complaint was made was contained in a letter or circular addressed by Mr. Parker-Rhodes, in his capacity as Chairman of the Provisional Board, to the shareholders of the Company. This letter appeared in the *Oracle* on Dec. 14, 1889, with the addition of the words: "The following circular has been addressed to the shareholders of the above Company." As a matter of fact, the name of neither of the plaintiffs was mentioned in the circular, which was a direct attack upon the policy of the Board. It was not by witness's direction that his solicitor served the writ on the United Printing and Publishing Company without sending any letter of complaint. The writ was issued on April 1, 1891, in respect of the publication of a letter on Dec. 14, 1889. The invention was described as being one for "the instantaneous production of light, heat, and motive power, the importance and commercial value of which it would be difficult to over-estimate;" and the capital of the Company was said to be £60,000. The prospectus stated that, by means of this invention, an immense economy was effected in the production of light, heat, and motive power. Its advantages were simplicity, purity, economy of installation, illuminating power, motive power, and adaptability. The prospectus further set forth that the system of lighting had been successfully tested by the Paris, Lyons, and Mediterranean Railway Company, as well as by other companies; but he could not say whether any of them were now using the patent. Mr. Prince, an expert, had given an opinion upon the validity of the patent; but witness had not seen it, nor could he produce it. He was told by Mr. Greene that an opinion had been obtained. The prospectus stated that it was estimated that the sale of the foreign patents would yield a sufficient profit to pay a bonus of 200 per cent. on the capital of the Company. This might be effected by sale outright or by forming separate companies to work the patents. Witness bought 100 shares in the month of October; but the provisional directorate would not allow the transfer to be registered. He bought the shares because of their cheapness. The transfer now produced, dated the 5th of November, was the one in question. He had acted as a Director, although he had not invested a farthing of his money in the concern. He had many times offered to take up his shares. He was aware that clause 96 of the Articles of Association provided that a Director must hold at least 100 shares in the Company; but the solicitor had told him that there was no necessity to qualify until within twelve months of the statutory meeting. Witness had never read the contracts referred to in the prospectus. Mr. Greene examined them; at least, witness arranged with him that, if he was convinced they were in order, this would satisfy witness. He had no recollection of the agreements being read in his presence. By the first agreement, Mr. Lothammer was to get, in meal or in malt, £40,000; the Directors having the option of paying part of the £38,000 in cash. This option, however, they did not exercise.

Sir C. RUSSELL: Would it have affected your judgment if you had known that, instead of Lothammer getting £40,000 "in meal or in malt," a great part of the sum was going to the promoters?

Witness: I know that, as a rule, there are promoters who have to get payment in some sort; and it is generally from the vendors.

Would it have affected your judgment in the matter as to the *bona fides* of the business, if you had known that, instead of Lothammer getting £40,000, a large proportion was going to the promoters?—It would not.

Would it have affected your judgment about the Company if you had known that some of it was going to the Directors?—Certainly.

Cross-examination continued: In the second agreement, Buttifant figured as the promoter; but witness did not know who was behind him. He had no idea who Buttifant or Blumfield was. He did not know that they were clerks in the Hamilton Syndicate, or that they were the promoters of the Company in connection with Mr. Moll and Mr. Dando. There was no reason why he should, before commencing the action, have taken steps to inquire the antecedents of these people. He did not know that Mr. Moll had been concerned in promoting the Moldacott Sewing-Machine Company, the Etienne Gas-Engine Company, the Whole-Meal Bread Company, or the Hamilton Syndicate, but he believed he was connected with the Metropolitan Coal Consumers' Association. He could not say whether or not any of these Companies were in existence now.

Sir C. RUSSELL: Would it be too much to say that a good many of them were shown to be swindles?

Witness: The only one that I know anything of which has "come to grief" is the Coal Consumers Association.

In further cross-examination, witness said he did not know that Colonel Murray was a friend of Mr. Dando; and he had not taken any steps to bring him to the Court. Colonel Murray, as a signatory to the Memorandum of Association, had one share, though afterwards he acquired 3000 shares, the consideration for which was 5s. It was explained by Colonel Murray that the shares were given to him as security by a Mr. Robbins, who owed him money; Mr. Robbins being one of the nominees of Mr. Lothammer. Mr. Greene was, like witness, waiting to take his qualification, as they had an idea of going more extensively into the Company. The other Director—Mr. Joselyne—did not hold any shares. Witness was a constant attendant at the Board meetings; but he could not say that he recollected the following letter, which was written to Mr. Smith, of Plymouth: "In reply to yours of the 7th of May, 1889, I have to state, for your information, first, that all the shares were not applied for; secondly, that the Directors, having obtained sufficient subscriptions to go to allotment, have made the allotment, and closed the list; thirdly, that applications for 25,000 shares had in consequence been refused, with letters of regret; that offers are under consideration for the sale of patent rights for upwards of £200,000, but as a shareholder, and one interested, you will understand that, pending completion of such arrangements, the Directors do not invite discussion on the subject publicly." At this time, only 5024 shares had been applied for by the public; and of the amount so received, £2000 in cash had to go to the vendor. The statement that the Directors had obtained sufficient subscriptions to go to allotment, had made the allotments, and closed the list, and that applications for 25,000 shares had in consequence been refused, was not for the purpose of whetting the appetite of the persons to whom it was addressed. He did not see any application for 25,000 shares; but the Secretary told him that it had been made. At subsequent Board meetings, shares were allotted to various persons. The Directors resolved that the first certificate should be numbered 20,001; that then the 38,000 vendor's shares should be numbered; and after that the shares allotted to the public. He did not see anything to object to in doing this.

Sir C. RUSSELL: As you are so innocent, let me suggest this to you: Would it not occur to an early applicant, if he found his shares marked with a very high number, that there had been a large application for shares by the public?

Witness: I do not see that it would have anything to do with it, as he would not get his certificate until a long time afterwards.

Can you suggest any honest reason for it?—I cannot suggest any reason at all. I do not see any dishonesty in it.

Justice DENMAN asked whether the object of the cross-examination was to show that the plaintiffs had been guilty of bad management.

Sir C. RUSSELL said that was his object.

Justice DENMAN suggested that the parties should consent to withdraw a juror.

Sir C. RUSSELL said, on the part of the defendants, he should contend that the conduct of the Directors had been of the most flagrant character; and as the affairs of the Company had been commented upon by almost every paper in London, it was very hard that his clients should be made to suffer.

Justice DENMAN said that, if the case went on, each party would incur very considerable costs.

Mr. LOCKWOOD asked for and obtained permission to confer with his clients.

While the conference was proceeding,

Justice DENMAN asked Mr. Parker-Rhodes if he was willing that a juror should be withdrawn.

Mr. PARKER-RHODES said he had been put to great inconvenience in the matter, and should rely upon the conduct of each member of the Board.

Justice DENMAN expressed his opinion that it would be a wise thing for all parties not to proceed further with the case.

Mr. PARKER-RHODES said he would leave the matter in the hands of Sir Charles Russell.

Mr. LOCKWOOD stated that, having conferred with his clients, he was willing to consent to the course proposed, upon the distinct understanding that all charges of fraud were withdrawn.

By consent, a juror was then withdrawn, and the case closed.

BANBRIDGE QUARTER SESSIONS.—Friday, Jan. 22.

(Before Mr. D. COLQUHOUN.)

Banbridge Gas Company v. Seapatrick Parish Select Vestry.
The Supply of Gas to a Church and Schools.

This was a case in which the Banbridge Gas Company sued the Rev. C. T. P. Grierson and others, constituting the Select Vestry of Seapatrick, for £7 14s. 6d. for gas supplied to them for consumption in the parish church and schools up to July 1 last. The matter was argued at the previous Sessions; and his Honour now delivered judgment, in which the facts are set out.

Mr. D. WILSON appeared for the plaintiffs; Mr. W. H. BROWN represented the defendants.

His Honour said the action had been brought for the purpose of recovering from the defendants a sum of £7 14s. 6d. for gas supplied to the church and schools in the parish of Seapatrick. It appeared that for years past the plaintiffs had been in the habit of supplying gas to the church and schools, and of receiving payment therefor from the Treasurer of the Select Vestry, who, up to the 1st of April last, seems to have been Mr. Joy, one of the defendants. The gas account was supplied to the debt of "the church." No individuals were mentioned, either in their personal or their official capacity. Owing to some dispute among the congregation, at the annual election of Vestrymen, which took place on the above-named date, almost all, if not all, the old members were turned out, and their places filled by new ones. Mr. Joy ceased to be Treasurer; and he was replaced by Mr. Cunningham, one of the defendants. Mr. Joy had paid the gas account up to

Jan. 1, 1891. The account for the quarter ending April 1, 1891, which amounted to £5 15s. 9d., was not paid by Mr. Joy before going out of office, because, after reimbursing himself for certain sums which he was out of pocket in his capacity as Treasurer, he had no funds available for the purpose. The plaintiffs, after the 1st of July, furnished to the defendants, as then constituting the Select Vestry of the parish, the account for the two quarters from Jan. 1 to July 1, 1891, amounting to £7 14s. 6d., the sum sued for. The defendants admitted their liability to pay for the gas supplied to the church during the quarter from the 1st of April to the 1st of July; and they tendered £1 15s. on that account. The actual consumption in both the church and the schools during this period was £1 18s. 9d.; but the defendants denied that any liability attached to them in this respect. The whole case resolved itself into a struggle as to whether the defendants were liable in law to pay for the gas supplied to the church up to the 1st of April, and while the old Select Vestry were in office. Mr. Brown contended that the plaintiffs were restricted to the remedies given to them by the Gas-Works Clauses Act. He (his Honour) passed this contention with the observation that, in his opinion, it was not well founded, and came to the real point at issue. By the 20th section of the Church Act, 1869, the members of a church are bound by the constitution and laws for the time being in force, in the same way as if they had mutually entered into a contract to this effect. Section 20 of cap. 3 of the statutes of the General Synod of 1879 provided that, subject to any regulations of the Diocesan Synod, the Select Vestry were to have control of the church funds, and provide all requisites for Divine service. This would clearly include gas or other artificial light. The incoming Vestry in the present case allege that they did not receive any funds from their predecessors on taking office; and therefore were not bound to pay a debt previously contracted. On the other hand, it was alleged that the new Vestry, since entering into office, had received all the church funds, which were much more than sufficient to pay this gas account. The incoming Vestry must be taken to have assumed office with all the obligations to it; and it was for them to ascertain what these obligations were. Moreover, it appeared from the parish account ending March 1, 1891, that there was then only a sum of 5s. in the Treasurer's hands; and although, during his fourth additional month of office, Mr. Joy received more monies, yet he seemed to have expended them for church purposes before going out of office. It might therefore well be that, having regard to the organization of the church and the practice which appeared to have prevailed in the parish, an implied contract at least would exist on the part of the incoming Vestry to indemnify the outgoing one in respect of any debt properly incurred by the latter for the purpose of Divine service. The plaintiffs were no parties to the contract incident to the membership of the church, created by the 20th section of the Act. They were complete strangers to it; and, in his opinion, the case must be decided outside the section, and any of the rules or regulations of the church springing from it. The plaintiffs must certainly succeed on some contract, either expressed or implied, whereby the defendants—not in any official or representative capacity, but as individuals—were jointly liable to pay for the gas consumed in the church between Jan. 1 and April 1, 1891. Where was such a contract between the plaintiffs and the defendants to be found? Where was the contract between them and the plaintiffs to pay the debt for gas supplied while the old Vestry was in office? Mr. Wilson's argument, on behalf of the plaintiffs, was to the effect that the old Vestry were liable on a contract between them and the plaintiffs to pay for this gas; that the new Vestry, on coming into office, assumed this liability; and that, by some legal *legerdemain*, the contract was transferred from the old to the new Vestry, so as to enable the plaintiffs to sue on it. It was well-settled law that a new partner coming into a firm could not be sued by a creditor of the firm on a contract entered into before the new partner joined, even though he became entitled to his share of the property and profits, including the benefit of the contract in question. [His Honour cited a number of cases in support of his views. Supposing that, instead of the gas having, as in this case, been furnished to a church, it had been supplied to a trading concern in which the defendants became partners after such supply, it was clear that they could not be sued by the plaintiffs. The present case seemed to him to be much stronger in the defendants' favour than any he had cited; and he felt reluctantly coerced, both on principle and authority, to dismiss the case.]

The Swinton Gas Bill and the Supply of Eccles.—A letter appeared in the Manchester papers recently, from a correspondent residing at Eccles, in which the attention of the Local Board was called to two or three provisions in the Bill of the Swinton Local Board, in order that they may consider whether or not it is desirable to oppose the scheme. The writer says that the gas consumers of Eccles now complain of gas which has an illuminating power of nearly 19 candles; while Swinton proposes to supply gas of only 14-candle power. This will mean a loss of 25 per cent. in light; or if extra burners are used to procure the same amount of light as at present, it will represent an increase of 33 per cent. in the quarterly gas accounts. In the second place, the consumers now object to the enormous profit alleged to be made by the Salford Corporation; and the Eccles Local Board have endeavoured to induce them to be content with 10 per cent. The Swinton Bill, however, specifically provides that the provisions of the Gas-Works Clauses Act, 1847, with respect to the amount of profit to be received, shall not apply to their scheme. The consumer; also think that the Salford Corporation are charging too much when the price of the gas is 2s. 8d. per 1000 cubic feet. The Swinton Bill, the writer points out, fixes the maximum price at 4s. per 1000 feet; but if the promoters are as disinterested as they profess to be, the maximum price, he contends, should be 2s. 6d. With regard to the differential rate, the gas consumers, continues the letter, entertain a strong opinion about it, and it was made the main point in the opposition of the Eccles Local Board to Salford twelve months ago. Nothing is mentioned in the Swinton scheme about a differential rate to Eccles, Barton, and Worsley, &c.; but it is said as a fact that they intend to charge a very large differential rate, in order that their own ratepayers may receive gas at a reasonable or even very low price.

MISCELLANEOUS NEWS.

THE GASLIGHT AND COKE COMPANY.

The Directors' Half-Yearly Report.

The following report, with the accounts showing the working of this Company during the six months ending Dec. 31 last (given on the opposite page), will be submitted to the proprietors at the half-yearly general meeting on Friday next :—

The half-year's accounts to the 31st of December last, herewith submitted, show that, after providing for all fixed charges, a balance of profit amounting to £206,876 5s. 6d. remains applicable to dividend on the ordinary stock of the Company. The statutory rate of dividend for the half year, the price being 2s. 9d. per 1000 cubic feet, would be 13 per cent., which would require £148,727 os. 6d. to be taken from the reserve fund. Having regard to the desirability of not unduly reducing the reserve, the Directors recommend that 12 per cent., instead of 13 per cent., should be divided, which will require £121,372 18s. 6d. to be taken from the reserve; leaving a balance of £115,244 1s. 5d.

In view of the continued deficiency in profit required to meet the authorized dividend involving the absorption of so large a portion of the reserve fund, the Directors have increased the price of gas for the current year from 2s. 9d. to 3s. 1d. per 1000 cubic feet for common gas, with a corresponding increase in the price for cannel gas. This rise in price will, under the sliding scale, involve a reduction of 1 per cent. in the standard rate of dividend—that is, from 13 to 12 per cent. This step is taken in the belief that it is necessary to maintain the margin of profit required to pay the statutory dividend without, if possible, further trenching upon the reserve fund.

In the half year ending Dec. 31, 1890, the increase shown in the sale of gas was 5·16 per cent.; and in the first half year of 1891, 9·55 per cent.—an average of 7·35 per cent. for the two half years. The dark, cold, and foggy winter of 1890-91 produced this abnormal increase. During the past half year, the weather, with the exception of the last two weeks in December, has been much milder; and a decrease of 1·74 per cent. in the sale of gas is the natural consequence. The same cause, coupled with a stagnant condition of the cement and chemical industries, has considerably reduced the receipts from coke and other residuals. The increase in gas sold in the June half year of 1891 was, as stated above, 9·55 per cent.; so that, in spite of the reduction of 1·74 per cent. last half year, the absolute increase for the whole year is 3·76 per cent.; the average increase for the past twelve years being 3·43 per cent. The increase in the number of consumers also maintains the same average rate, and for last half year amounted to 2565; bringing the total number up to 200,577.

Coal cost less in the past half year than in the corresponding half year of 1890; and the Directors look for a further reduction in price. But its quality and condition as delivered have been much inferior; owing, it is asserted, to difficulties with the miners.

The fog which a few days before Christmas suddenly enveloped London was, in density and duration, more serious than any yet experienced. The quantity of gas sent out by the Company during the 24 hours ending at six o'clock in the morning of the 23rd of December was 128 million cubic feet—the highest figure ever reached, and involving the carbonizing of about 13,000 tons of coal; and this figure would have been materially increased if the Company had had further manufacturing power. The resources of the Company were very severely taxed to meet this great and sudden demand, which points to the necessity of making considerable additions to the carbonizing plant.

The appeal for the reduction of the rateable value of the Company's property, at the quinquennial re-assessment, was heard at great length, and concluded in December; and judgment is now awaited.

The question of standard tests for illuminating power has been submitted to the consideration of a Scientific Committee appointed by the Board of Trade; and it is hoped that the use of some uniform testing apparatus may be arrived at, and a simplification of the present standard of light may be devised which will be equitable as between the Companies and the consumers.

The Engineers of the several manufacturing and distributing departments have certified to the Court of Directors that all the plant of the Company under their charge respectively has been maintained in full efficiency during the past half year.

Following the report is the statement of accounts. As usual, we merely indicate the alterations that have taken place in those portions which are not subject to much variation; reproducing the remainder in full.

Nos. 1 and 2 are the statements of stock, share, and loan capital, the totals of which on Dec. 31 last were as follows: Stock and share capital, £8,579,000; loan capital, £2,444,000. These amounts stand as on June 30 last.

No. 3 is the capital account, the receipts on which are also as on June 30—viz., £11,795,400. The expenditure is shown in the following items :—

Expenditure to June 30, 1891.	£10,808,619	0	3		
Expenditure during the half year to Dec. 31, 1891, viz. :—					
Lands acquired, including law charges	£7,076	17	9		
Buildings and machinery in extension of works	159,376	13	10		
New and additional mains and service-pipes	7,455	13	11		
Do. do. meters	7,174	13	5		
Do. do. stoves.	8,520	17	11		
	<hr/>				
	£189,604	16	10		
Cr. By depreciation of meters	£4,150	0	0		
Do. do. stoves	6,205	0	0		
	<hr/>	10,175	0	0	
		<hr/>	179,429	16	10
			£10,988,048	17	
			807,351	2	11
Balance of capital account			<hr/>	£11,795,400	0

Nos. 4 and 5 are the revenue and net revenue accounts. These are given in full on the opposite page.

No. 6 is a statement showing how the Directors propose to appropriate the balance applicable for dividend. It is as follows :—

Dec., 1890.					
£7,393	..	Net balance brought from last			
		account	—		
202,502	..	Net revenue for the half year . . .	£206,876	5	6
145,696	..	Amount to be withdrawn from the			
		reserve fund	121,372	18	6
				£328,249	4 0
£355,591					
(13 per cent.)		A dividend on the ordinary stock—			
£355,591	..	12 per cent. on £5,470,820 . . .	—	328,249	4 0

Nos. 7 and 8 are the reserve and insurance fund accounts. The former shows that the balance of the reserve fund on June 30 last was £391,914 6s. 6d., which was increased to £396,462 5s. 1d. by the addition of £4547 18s. 7d., interest on the sum invested. The amount carried to the net revenue account was £159,845 5s. 2d.; so that the balance at the end of the year was £236,616 19s. 11d. The insurance fund stood at £87,130 9s. 10d. on June 30 last; it amounted to £88,322 3s. 8d. at the end of the year.

No. 9 is the depreciation fund account. It stood at £39,162 18s. 9d. at the close of the June half year; and on Dec. 31 it had been raised to £39,750 7s. 7d. by the addition of £587 8s. 10d. received as interest.

Nos. 10 and 11 are as follows; and Nos. 12 and 13 are given on the opposite page.

No. 10.—STATEMENT OF COALS USED, ETC.

Description of Coal.	In Store, June 30, 1891.	Received during Half Year.	Carbonized during Half Year.	Used during Half Year.	In Store, Dec. 31, 1891.
	Tons.	Tons.	Tons.	Tons.	Tons.
Common	187,840	1,062,623	950,661	1,856	297,946
Cannel	12,812	31,198	23,288*	—	20,722
Total	200,652	1,093,821	973,949	1,856	318,668

* In addition to this quantity, oil, equivalent of 14,631 tons of cannel, has been used during the half year.

No. 11.—STATEMENT OF RESIDUAL PRODUCTS.

Description.	In Store, June 30, 1891.	Made during Half Year.	Used during Half Year.	Sold during Half Year.	In Store, Dec. 31, 1891.
Coke—tons	40,419	599,832	158,351	430,361	51,539
Breeze—tons.	9,708	59,563	21,620	41,987	5,664
Tar—gallons.	554,107	10,224,998	9,908,398	27,915	842,792
Ammoniacal liquor—butts	14,719	265,402	249,573	9,044	21,504

The Position of the Company—Suggested Committee of Investigation.

The following article, dealing with the position of the Company, and suggesting the appointment of a Committee of Investigation, appeared in *Money* last Saturday :—

The Gaslight and Coke Company has announced a dividend on its ordinary stock of 12 per cent. for the past half year, against the 13 per cent., and even higher dividends, it has paid for so long a time. Our readers doubtless know that for the past three or four half years the Company has been able to keep up its dividend only by drawing upon its reserve fund. Now that fund has been so much reduced that the Board shrink from drawing further upon it; and so the practice of paying dividends which have not been earned is given up, and the rate of dividend is reduced. Naturally there is much grumbling amongst the shareholders; but the general public too—the customers, that is to say, as distinct from the shareholders of the Company—have also a very material interest in the matter. It will be in the recollection of our readers that within the past nine months or so the price of gas has been raised 7d. per 1000 cubic feet, or 25 per cent. Now, 25 per cent. in so short a time is an enormous increase in the cost of gas. It means the extraction from the pockets of the people of London of about £600,000 per annum; and the people of London have a right to ask why so great an addition is made to the cost of what is now a necessary of their existence. If the dividends had been increased, the action of the Board would at all events be intelligible. In that case the general public would be taxed to enrich the shareholders; and there would be ample justification for the strictures that are so freely made about the Gas Company. Fortunately, however, the provisions of the sliding scale render it imperative that any increase in dividend must be accompanied by a reduction in the price of gas. But that the people of London should be required to pay 25 per cent. more for their gas than they were paying a year ago, and that at the same time the shareholders' income should be cut down from 13 per cent. to 12 per cent., or nearly 8 per cent., is a state of things which calls loudly for explanation. It is said, on behalf of the Board, that the price of coal has been high for several years. No doubt that is so. The coal trade was the first that felt the influence of the wild speculation in South America, which was one of the main causes of the recent prosperity of trade. The miners took advantage of the great demand for coal to insist upon rises of wages again and again; so that in a comparatively short time miners' wages were raised from 25 to 30 per cent. Further, it is alleged that since the dock strike wages of all kinds in London have been raised very greatly; that the Company has, in consequence, had to pay very much more money for labour; and that increased cost of coal, together with the rise in wages, accounts for the difficulties in which the Board finds itself.

Unfortunately for this explanation, The Gaslight and Coke Company is not the only one that serves London. The Commercial, the South Metropolitan, and the Brentford have at least equal difficulties to contend against; and yet they have not had to raise the price of gas and to lower their rates of dividend to anything like a proportionate extent. They buy their coal, presumably, in the same market; at all events, the same market is open to The Gaslight and Coke Company which is open to them. They sell their residual products, presumably, also in the same markets; and they draw their employees from the same classes and the same districts. How is it that they have not suffered

ACCOUNTS OF THE GASLIGHT AND COKE COMPANY FOR THE HALF YEAR ENDING DEC. 31, 1891.

Dr.				No. 4.—REVENUE ACCOUNT.				Cr.			
December Half Year, 1890.		£	s. d.	£	s. d.	December Half Year, 1890.		£	s. d.	£	s. d.
£788,990	To Manufacture of gas—					£1,193,150	By Sale of gas—				
10,109	Coals, including oil, dues, carriage, unloading and trimming (see Account No. 10)	722,757	9 8			44,682	Common gas, per meter, at 2s. 9d. and 2s. 3d. per 1000 cubic feet.	1,186,214	5 11		
180,825	Salaries of Engineers and other Officers at works	9,879	7 2			69,290	Cannel gas, per meter, at 3s. 5d. per 1000 cubic feet	39,438	18 9		
41,802	Wages (carbonizing)	172,076	13 8			2,680	Public lighting and under contracts—				
	Purification, including £12,332/14/6 for labour.	38,482	2 10			£1,309,802	Common gas	70,693	6 6		
	Repair and maintenance of works and plant, materials and labour, less received for old materials, £1924 18s. 1d.	160,591	19 0			6,229	Cannel gas	2,676	16 7		
178,727				1,108,787	12 4		(See Statement No. 12.)			1,299,023	7 9
	Distribution of gas—						Rental of meters	..		28,372	0 0
23,013	Salaries and wages of Officers (including Rental Clerks)	23,671	3 8			277,054	Rental of stoves	..		7,829	13 10
27,994	Repair and maintenance of mains and service-pipes	28,684	16 11			7,490	Residual products—				
16,773	Repair and renewals of meters	20,334	19 4			116,460	Coke, less £39,079 17s. 1d. for labour, &c.	231,697	8 11		
22,882	Stove fixing, repairs, and renewals	20,824	9 0			65,223	Breeze, less £2968 8s., for ditto	5,271	2 8		
							Tar and tar products	103,712	8 1		
	Public lamps—			93,515	8 11	3,660	Ammoniacal liquor and sulphate of ammonia	63,795	7 1		
16,093	Lighting and repairing	16,435	11 6			192				401,476	6 9
189	Experimental street lighting	141	6 0			300	Rents receivable			4,248	3 8
				16,576	17 6		Transfer fees			209	12 6
8,388	Rents, rates, and taxes—						Canteen account			300	0 0
77,092	Rents payable	3,177	1 9								
	Rates and taxes	79,371	18 1								
				82,548	19 10						
	Management—										
2,750	Directors' allowance	2,750	0 0								
200	Company's Auditors	200	0 0								
7,972	Salaries of Secretary, Accountant, and Clerks	8,543	15 6								
14,676	Collectors' commission	14,678	1 0								
4,605	Stationery and printing	3,512	11 7								
1,619	General charges	1,835	5 0								
				31,519	13 1						
536	Parliamentary charges	..		311	8 4						
3,538	Law charges (including Surveyors' charges re Quinquennial Valuation).	..		2,952	6 4						
6,349	Bad debts	..		7,817	12 6						
	Depreciation fund, for works on leasehold land	..									
750	Annuities	..		10,217	8 3						
9,624											
	Public Officers—										
849	Gas Referees and Official Auditor.	851	1 2								
1,100	Public testing-stations	1,032	5 3								
				1,883	6 5						
£1,442,445				1,351,160	13 6						
371,550	Balance carried to net revenue account, No. 5			393,301	11 0						
£1,813,995				1,744,462	4 6	£1,813,995				1,744,462	4 6

Dr.				No. 5.—NET REVENUE ACCOUNT.				Cr.			
December Half Year, 1890.		£	s. d.	£	s. d.	December Half Year, 1890.		£	s. d.	£	s. d.
£59,643	To Interest on debenture stocks and bonds, accrued to Dec. 31, 1891.	..		62,659	12 6	£362,983	By Balance from last account	195,746	6 10		
63,279	Dividend on the preference stocks	74,034	10 0			..	" Amount withdrawn from Reserve Fund	159,845	5 2		
							Less dividend on the ordinary capital for the half year to June 30, 1891.	..		355,591	12 0
47,500	Dividend on the maximum stocks	47,500	0 0			355,590				355,591	12 0
				121,534	10 0						
4,819	Interest on temporary loans and sundry funds	..		2,231	3 0	£7,393	" The South Metropolitan Gas Company	..		..
	Balance applicable to the payment of dividend on the ordinary stock	..		206,876	5 6	6,193	" Revenue account (No. 4)	..		393,301	11 0
209,895						371,550					
£385,156				393,301	11 0	£385,136				393,301	11 0

No. 12.—STATEMENT OF GAS MADE, SOLD, ETC.

Description of Gas.	Quantity Made.	QUANTITY SOLD.			Quantity used on Works, &c.	Total Quantity accounted for.	Quantity not accounted for.	Number of Public Lamps.
		Public Lights and under Contracts (estimated).	Private Lights (per Meter).	Total Quantity Sold.				
	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	
Common	9,655,618	503,867	8,593,482	9,097,349	129,934	9,227,283	428,335	49,494
Cannel.	262,007	16,682	228,555	245,237	2,079	247,316	14,691	2,185
Total.	9,917,625	520,549	8,822,037	9,342,586	132,013	9,474,599	443,026	51,679
December half year, 1890	10,102,092	510,373	8,997,480	9,507,853	125,667	9,633,520	468,572	50,946

Dr.		No. 13.—GENERAL BALANCE-SHEET.						Cr.								
December Half Year 1890.		£	s.	d.	£	s.	d.	December Half Year 1890.		£	s.	d.	£	s.	d.	
£	To Capital—							£								
729,438	Balance at credit thereof . . . .	..			807,351	2	11	114,346	By Cash at Bankers. . . . .	..			95,797	2	8
	Net Revenue—							..								
299,895	Balance at credit thereof . . . .	..			206,876	5	6								
	Reserve Fund—								Amount invested—							
531,395	Balance at credit thereof	236,316	19	11					2½ per Ct. Consoli- dated Stock	£328,421	15	9	..	324,939	3	7
85,962	Insurance Fund—							638,499								
	Balance at credit thereof	88,322	3	8					Stores on hand, viz.—							
					324,939	3	7		Coals	235,081	5	4				
38,568	Depreciation Fund—							274,651	Coke	21,830	10	0				
	Balance at credit thereof . . . .	..			39,750	7	7	21,526	Tar and ammoniacal liquor and products	94,640	0	10			
59,543	Interest on debenture stocks and bonds, due on Dec. 31, 1891 . . . .	..			62,659	12	6	101,939	Sundry stores	244,503	5	9			
	Preference and maximum dividends due on Dec. 31, 1891 . . . .	..			121,534	10	0	173,008					596,055	1	11
110,779	Unclaimed dividends due on Dec. 31, 1891 . . . .	..			10,670	18	6		Accounts due to the Company, viz.—						
10,671	Sundry tradesmen and others, for amount due for coals, stores, and sundries. . . . .	..						917,896	Gas and meter rental—						
					311,773	12	6	13,654	Quarter ending Dec. 31, 1891. . . .	898,769	9	1				
344,357	Benevolent Fund			1,667	6	8	63,193	Arrears outstanding	14,950	12	1		913,120	1	2
1,667	Temporary Loan . . . . .	..			100,000	0	0	4,233	Coke and other residual products . .	37,011	4	5			
200,000									Sundry accounts	20,300	6	0		57,311	10	5
2,322,445					1,987,222	19	9	2,322,445					1,987,222	19	9	

from the rise in the price of coal and the advance in wages as The Gaslight and Coke Company has?

We have put the case of the latter Company too favourably; it, in fact, has very great advantages over the three others. It serves by far the largest part of the Metropolis, and, what is not less important, by far the richest part. It does business on a scale so immense that it ought to be able to practise economies which should not be within the reach of the smaller Companies; and it ought, furthermore, to be able to push business far more actively than they. Yet, as we see, it has suffered much more than they have. Our contemporary the JOURNAL OF GAS LIGHTING suggests that there is mismanagement; and we greatly fear that that is the only answer which will solve the problem before us. At all events, there is a very strong *prima facie* case to support the charge that there must be mismanagement. In addition to what we have already cited, our contemporary says: "It is notorious that there have been shifts and changes among the head-quarters and distributed staffs; and there is a notion abroad that these changes indicate the existence of grave troubles in and about the organization." The charge having been made, and being supported by such an array of facts, it is of the first importance that it should be quickly probed to the bottom. Measures should be taken to secure the appointment, without a moment's delay, of a Committee of Inquiry.

We do not take upon ourselves to say that there is mismanagement; we are merely pointing out what lends countenance to the charge that has been made. And certainly no one will accuse us of hostility to the Company. Persistently we have supported it; and at last we are brought to the conclusion at which we have arrived very unwillingly. We are satisfied, however, that silence, under the circumstances, would be the unwise policy in the interests of the Company. What is wanted is a change, if there is mismanagement; and if there is not, an assurance that will satisfy the shareholders and the investing public generally that there is no good ground for the allegations that have been made. There is only one way in which that assurance can be given; and it is by means of a competent Committee of Investigation. The Committee, we need hardly add, ought to consist of substantial shareholders in the Company, and likewise they should be men who will give the necessary time and labour to make the inquiry exhaustive, and in whose good faith the shareholders generally can trust. In short, the Committee should consist of men of the stamp of Mr. Livesey, of the South Metropolitan Company—men of business and men of integrity—at that time of life when they are capable of doing good and efficient work. The Committee, too, should not be too large (half-a-dozen would be quite enough—if it is too large it will do little or nothing); and, when once it is appointed, it should be given a free hand. The fullest authority should be extended to it to probe the whole matter to the bottom.

But if a Committee of the kind is to be secured—and we do not hesitate to say that it is imperatively required—the younger shareholders must sacrifice a little time and attend the meetings. Everyone who has been in the habit of attending the meetings of The Gaslight and Coke Company knows that nothing is to be expected from those who in the past have constituted the great bulk of the audience. Doubtless they were once upon a time good men of business; but now they are mere fossils. They have long passed the age when they were capable of efficient work; and they would be much more in place at home by the fireside, well wrapped up, and taking precautions against the influenza epidemic, than attending a meeting of a great Company. What usually takes place at these meetings is this: The Board is arranged at a raised table in a long line, with a number of officials behind them ready to prompt them if an unexpected question is suddenly put before them. The meeting sits in the form of an horseshoe; and the old gentlemen who constitute practically the bulk of it are most anxious to get as near as possible to the Chairman, so as to be able to hear what he says. It is painful to see how they crane their necks and form a kind of trumpet of their hands, in the hope of catching what their deafness prevents them from hearing properly; and if one of them is moved to speak, the cracked and weak voice shows how completely he has passed his working time. Now, it is evident that from a meeting of this kind determined opposition is not to be expected. The Chairman, with his usual crispness and amiable smile, will nimbly and blandly express his regret that the Board has not been able to earn the full rate of dividend; and will dismiss the matter with the usual reference to the hugeness of the operations conducted by the Company, and the hope that things will soon mend. But he will have little fear of anything that may be proposed by the antiquated fossils before him. We would therefore appeal to the younger shareholders to bestir themselves, to attend the meetings, and insist upon the necessary Committee. They ought, of course, to determine beforehand who are to constitute the Committee, and be prepared for other probable contingencies. If Mr. Livesey could be induced to lead the movement, he would be the fittest. But probably, for reasons that will be easily understood, he will not agree to take so pronounced a position. There must, however, be quite enough young men amongst the shareholders who are willing to take action; and if they take action, Mr. Livesey and other competent persons can easily be induced to form the Committee.

Failure of the Electric Light in Santa Fé.—The electric light has proved to be a failure in Santa Fé; and the Municipality have returned to the use of kerosene for the public lighting.

The Supply of Water for Fires in the Metropolis.—In the annual report of the Chief Officer of the Metropolitan Fire Brigade (Captain Sexton Simonds), he states that the quantity of water used to extinguish fires in the Metropolis during the past year was nearly 19 million gallons, or about 84,000 tons. Of this quantity about one-third was taken from the river, canals, and docks, and the remainder from the mains. During the year there were five cases of short supply of water, eight of late attendance of turncocks, and three of no attendance. Captain Simonds remarks that, as long as the supply of water is intermittent in some parts of the Metropolis, difficulties must occasionally arise. But each year the area under constant service is increasing; and the cases in which the water arrangements are unsatisfactory point to a proportionate decrease.

ASSOCIATION OF SULPHATE OF AMMONIA MANUFACTURERS.

The following are some extracts from the report of the Council of the above Association, which was read at the annual general meeting of members, recently held in Manchester, under the presidency of Mr. Joseph Hepworth, M. Inst. C. E., Gas and Water Engineer of the Carlisle Corporation:—

There was some hope, when the Association was formed in November, 1885, that prices would never recede to the figures of that month, though £10 5s f.o.b. Hull was the lowest point touched in December of that year. By March of 1886, prices had risen considerably—£14 10s. being touched by the 24th of the month; and the members began to congratulate themselves that the Association was doing some good.

There is no doubt that much of the improvement must be attributed to the formation of the Association. The weekly circular, giving the market reports from London, the Provinces, and Scotland, was a new thing, and was carefully studied by the recipients. A study of it revealed the fact that the periodical cry of "no foreign orders," "no demand," was untrue, and was only used by speculators to depress values, in order to enable them to cover sales previously made at low prices. By careful attention to the figures contained in the weekly reports, an improved value was brought about, and the 96 members forming the Association became centres of information of great value to the whole trade. Of course, there were, and always have been, many manufacturers of sulphate of ammonia unwilling to join the Association—believing, as they say, in absolute freedom in all trade matters; and this outside element has always been a source of weakness to the Association.

The sulphate market can scarcely be in a much worse position than it is at present, for those to whom the intrinsic value of gas liquor is everything. It will readily be seen that those who may be purchasing gas liquor on the sliding-scale basis have not the same interest in maintaining sulphate at a decent value as those who produce the liquor; and, further, most of the sliding-scale contracts were made at a time when sulphate was much higher in price than it is to-day, and a value approximating to £10, especially under £10, was scarcely dreamt of, and not adequately provided for.

In some cases, under the sliding-scale arrangement, it may pay the contractor better at £10 than at £14. He has less capital locked up in his business; and probably he has reckoned on a greater margin of profit at the lower price. In face of such a state of affairs, your Council can only call attention to these facts as one of the causes of low sulphate values, leaving those who have liquor to sell to apply the necessary remedy. It has never been an object of this Association to compel makers to sell at any given price. Perfect freedom has been the chief point in the conduct of the business of the Association; your Council believing in the policy of disseminating sufficient information to enable manufacturers to obtain a thorough grasp of the situation, and to act according to the best of their judgment. Your Council is now of an opinion that the time has arrived to make an effort to persuade all those manufacturers who have not before seen their way to join the Association, to do so; being convinced that such a step accomplished would be for the benefit of the whole trade.

Your Council has been seriously exercised by the recent fall in sulphate values, and has come to the conclusion that much good may be done by a quarterly meeting of the members in London, and has determined to try the experiment during 1892. It will give producers an opportunity of meeting and talking over trade matters in the same way as iron-trade matters are talked over; and some good will perchance come from such gatherings.

The Association has now been in existence for six years; it will therefore be interesting to give a short history of what has been done in that time. It commenced its first general meeting with a roll of 96 members. Since that time a few have resigned and others have joined; making the list to-day as 83, with an annual make of over 50,000 tons of sulphate. During the first year of the Association's existence, the work done was mainly that of disseminating market reports and the weekly shipments of sulphate from the five principal ports of the United Kingdom. Your Council had many meetings. But, the members of Council being situated at great distances from London, the attendances gradually fell off; and as sulphate had improved considerably, there did not seem to be that necessity for meeting there does now.

At this time there was a feeling in favour of offering a prize of £1000 for a treatise on the use of sulphate of ammonia as a manure; and upwards of £300 was promised in contributions. But your Council was not satisfied that £1000 so spent would be well laid out, and the project was abandoned. Another project was to offer money prizes at various agricultural shows for crops grown with sulphate of ammonia, to the exclusion of other nitrogenous substances; and your Council believes that such a course, if adopted now, would lead to a very largely increased consumption.

Believing in the efficacy of stimulating home consumption, your Council issued at cost price to members during 1886 no less than 80,000 handbills, which were circulated in their immediate neighbourhood by the various members ordering them. Your Council had every reason to believe that this handbill had produced good results; and they instructed the Honorary Secretary [Mr. G. E. Davis] to prepare some reliable information on the use of sulphate in pamphlet form. This was done, and issued in 1887; several thousands being distributed. Another call was made for the pamphlet in 1888; and this led to the production of another form. It may be interesting to inquire how the circulation of this handbook has affected home consumption. It is difficult to say exactly, as many elements have to be taken into consideration; but the fact may be noted that home consumption, which was nominally 20,000 tons in 1885, had risen to 40,000 tons in 1889. Home consumption should be a very important item in the sulphate trade; and your Council is very strongly of opinion that the judicious offering of prizes for crops grown by its aid would prove a good investment.

In 1886, statistics were collected from upwards of 60 works as to

the relative quantity of sulphate made in each of the four quarters of the year, which were as follows :—

January, February, March	34 per cent.
April, May, June	17 "
July, August, September	13 "
October, November, December	36 "

In the report for the second quarter of 1886, the expenses for making a ton of sulphate were given as shown in the second column below :—

	Old Stills.	Column Stills.
	£ s. d.	£ s. d.
Oil of vitriol	2 0 0	2 0 0
Fuel	0 7 6	0 3 6
Lime	0 3 6	0 1 6
Bags	0 4 6	0 3 4
Labour	0 8 0	0 3 6
Packing	0 1 0	0 0 10
Cartage	0 1 0	0 1 0
Broker's discounts	0 12 6	0 7 0
Carriage and f.o.b. charges	0 12 6	0 11 6
	4 10 0	3 12 2

The old stills have in many instances been replaced by column stills, which, working more economically than the old form, have perhaps lessened the loss to which manufacturers would otherwise have been subjected. The figures forming the third column will probably hold good for such places as Manchester for the new system of working. It will also be noticed that a difference in the shipping charges occurs in the two columns. Owing to the action taken by the Council, Messrs. T. Wilson, Sons, and Co. reduced their shipping charges from 1s. 9d. to 9d. per ton; or, in other words, put £1100 per annum into the pockets of the sulphate manufacturers.

During this year considerable discussion took place upon a project for placing money prizes at the disposal of the various Agricultural Societies throughout the country for crops grown with sulphate of ammonia; but the lack of necessary funds caused the matter to remain in abeyance. At the end of 1886 there was a balance due to the Honorary Secretary of £20 12s. 1d., which by the next year was turned to a credit balance of £17 14s. During 1887 the weekly circular was continued. The annual general meeting held at the Cannon Street Hotel was very thinly attended. During the year the Council had under consideration again the subject of a prize essay; but as it seemed that the Association's handbook was accomplishing the object sought, there was no necessity for further pursuing the matter. At this time the Council had many discussions on the advisability of endeavouring to sell sulphate according to its percentage of ammonia, with a 24 per cent. minimum.

The next annual meeting was held in Manchester, at which the balance in hand was declared to be £41 14s. 3d. During this year the Council had been considering the advisability of some uniform contract note for selling sulphate. A Sub-Committee was appointed, and many different forms were collected and examined; and the outcome was an Association contract note, which the members were asked to use.

During the year the weekly circular was regularly issued, and gave prices at which actual sales were being made at the chief ports of the United Kingdom. The annual report gave a summary of exports during the years 1886, 1887, and 1888, and a comparative table of prices. In 1889 the Railway Rates Committee were at their labours; and your Council used their endeavours to get the carriage of gas water in owners' tank waggons put upon a more equitable basis. After some correspondence with the Board of Trade and the Railway Companies, your Council were successful; and the carriage of gas liquor in owners' tank waggons was placed in a class lower than it would otherwise have been.

At the end of 1889 the credit balance stood at £85 3s. 4d.; and at the end of 1890 it was further increased to £99 2s. 6d. During 1889 the weekly circular was regularly continued as usual. Your Council wishing to see some uniform contract note adopted by the members, following the instructions from the annual meeting, sent each member a copy of the note already alluded to, recommending its adoption for sales of sulphate whenever possible.

Your Council had also under consideration several letters with respect to the charge for still licences, which the members generally considered was illegal. It was decided to take Counsel's opinion as to whether the Inland Revenue Act of 9 & 10 Vict. could be reasonably construed to mean and include ammonia stills.

Early this year one of the Supervisors of Excise sued one of the members of the Association (Mr. T. Illingworth) for penalty for using a still without a licence. The case was heard in the Halifax Police Court, when the Magistrates dismissed the charge on the ground that they were of opinion that the sulphate still was not within the meaning of the Act. The Supervisor appealed against the Magistrates' decision; and your Council agreed to make Mr. Illingworth an allowance from its funds towards his expenses. In the meantime, however, Mr. Illingworth died. When the appeal came on in London, the Judge decided that the matter was personal to the late Mr. Illingworth, and that the issue could not lie upon his successor; so the appeal was dismissed, and the matter is still in need of a final settlement. Your Council is now in communication with The Gas Institute upon the subject, with a view to co-operation in the matter, intending, if possible, to aid in defending the next prosecution of its members, to make it a test case, and to carry it to the Appeal Court if necessary, as your Council considers that the action of the Supervisors of Excise is a straining of the law never contemplated by the Act, harassing to trade, and perhaps illegal.

Your Council considers that, though the Association has not succeeded in holding up prices during the present year (1891), it has not been idle; and its labours as set forth must have been of benefit to the trade. It now remains to be seen whether the question of prices cannot be more satisfactorily dealt with. At the formation of the Association, Mr. R. O. Paterson said with reference to reasons given for the then depression (£10 10s.): "I never heard more contradictory statements; and it is certainly necessary to form an Association in

order to sift these mysteries to the bottom." In the main, this is what your Council has endeavoured to do. These particulars have been given to the members weekly and at intervals in the form of a summary; and on many occasions the members have been exhorted to disbelieve the cries of "No Demand."

After some difficulties, your Council has succeeded in obtaining the shipments of sulphate during 1890 from Gloucester, Bristol, Lynn, Boston, Newcastle, and Middlesbrough. From Plymouth and Southampton it has not been possible; but they may probably be obtained during 1892. It has also been possible to obtain the shipments from the first-mentioned ports for 1891.

Your Council has had under consideration the necessity of the members meeting together at more frequent intervals than heretofore. The necessity for such meetings is now more certainly established; and the experiment will be tried in 1892 not only of quarterly meetings, but of issuing a quarterly report, in the hope that the members generally will use their best endeavours to persuade all sulphate makers outside the Association to join, and also to attend the meetings. The Association is now six years old. It has funds in hand, and carefully organized machinery for collecting and disseminating information of use to the whole trade; and there never was more need for such an organization than at the present moment.

THE POSITION OF MUNICIPALITIES AND GAS AND ELECTRIC LIGHT COMPANIES IN FRANCE.

The French Council of State has lately given a decision of considerable importance to gas undertakings carried on under concessions granted by municipal authorities. The two places specially concerned are not very large; but the question at issue, which has now been settled by the highest authority, was of some magnitude, inasmuch as it turned upon the right of municipalities to authorize electric light companies to enter into competition with gas companies already sanctioned by these bodies. The circumstances that gave rise to the proceedings which culminated in the pronouncement above alluded to may be briefly stated as follows: By virtue of two Treaties, entered into respectively in 1851 and 1857, the Gas Company at St. Etienne had conferred upon them the right to supply public and private lighting in the town for a term of years closing in 1910. The prices and other conditions were duly set out; one being that the public lamps should be supplied gratis during the last 15 years of the concession. There ought not to have been any doubt as to the meaning of the Treaties, seeing that the one of later date contained an article which specially stipulated that to the Company alone would belong the right of furnishing light—whether public or private, whether by gas or any other system—in the town. In the same article there was a clause to the effect that if, owing to the advance of scientific knowledge, any new mode of lighting were discovered, and were generally substituted in Paris and Lyons for the system usually employed, the Company should be compelled to adopt it. In face of all this, the Municipality some time ago gave permission to the Edison Electric Light Company to place in the public thoroughfares cables and wires for the supply of the electric light to private consumers; stipulating for payment of a rent proportionate to the number of lamps fitted up. Thereupon the Gas Company took proceedings against the authorities to obtain damages for breach of contract; and the matter was argued before the Prefecture of the Loire. In the result, the Company failed to substantiate their claim. The reasons for this course appear to have been these: If, in entering into the contract with the Gas Company, the Municipality conferred on the concessionaire the monopoly of the public lighting, it was not in a position, neither did it intend, to give him a similar monopoly in respect to the private lighting. All it did was simply to grant a certain user of the public highways, which was not to be regarded as prohibitive of the bestowal of like privileges upon others. Failure in the Lower Court did not daunt the Gas Company, who, confident in the justice of their cause, appealed to the Council of State. There the decision was reversed; and the Municipality were condemned in costs. The other case was that of the Montluçon Gas Company against the Municipality of that town. By virtue of a Treaty entered into in 1865, the Company were accorded the exclusive privilege of supplying the public lighting; but, as regards the private lighting, they were only authorized to use the urban roads for the distribution of gas. Subsequently, the Municipality gave permission to the Montluçon Electric Light Company to put up their wires for the supply of electricity to private persons. The Gas Company appealed to the Prefectural Council of Allier, who decided that they had the exclusive right to place lighting plant in the urban thoroughfares; and assessors were appointed in order to settle the amount of damage sustained by the Company by reason of the authorization granted to their competitors. The Electric Light Company (who undertook to guarantee the Municipality against any expense attending the proceedings taken against them) carried the matter to the Council of State, where, as in the other case, defeat attended them. It was decided most unequivocally that, under the Treaty of 1865, the Gas Company had the exclusive right to use the roads for the supply of light for both public and private purposes, whether by gas or any other system; in return for which privilege, certain advantages were assured to the Municipality. The appeal of the Electric Light Company was therefore dismissed, with costs. The effect of these decisions appears to be, in few words, that where a municipal authority have granted a concession to a gas company, they have no power to sanction any undertaking that will be in competition with, and therefore prejudicial to the interests of, their concessionaire, and that if they do so, they will be liable for any damage sustained by their action.

South-East Essex Gas and Water Company, Limited.—This Company has been recently formed, with a capital of £50,000, in £10 shares to supply gas and water to towns and villages in South-East Essex, in accordance with the provisions of the Rochford, Rayleigh, and Leigh Order of last session. A commencement is about to be made with the water portion of the undertaking; and for this purpose £18,000 of the capital is being called up.

PARA GAS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Thursday, at the London Offices, 16, St. Helen's Place, E.C.—Mr. ULICK J. BURKE in the chair.

The SECRETARY (Mr. T. S. Borradaile) read the notice convening the meeting; and it was agreed to take as read the report and accounts, a summary of which appeared in the JOURNAL last week.

The CHAIRMAN, in moving the adoption of the report, said it was, of course, a matter of great regret to the Board that they should have to issue a report which was not quite so rosy even as usual; but he thought, as was suggested in the report, that the shareholders would have somewhat anticipated this, being familiar, as they were, with the position of affairs in Brazil. Owing to the serious drop in exchange, the private consumers had fallen off. The reason the exchange affected private consumers was that they paid the Company at a fixed rate of 27d.; and now that exchange was so very low, it was a losing game for them to pay at this rate. The revenue from illuminations had suffered from the same cause, as well as from the uncertainty of the political future. It would be interesting to the shareholders, perhaps, if he gave a few figures, showing what the consumption had been during the half year ended September last and the corresponding months of the previous year. During the latter period the make of gas amounted to 26 million cubic feet; while in the former period it was 28 million feet. In 1890, they sold 23 million cubic feet; and in 1891, 24 million feet. The unaccounted-for gas was slightly higher. The quantity of coal carbonized was more; while the percentage of cannel used was rather less. The production of gas per ton was a trifle lower. The cost of common coal and cannel was much about the same. The number of public lamps was a little higher, as was also the number of private consumers. The shareholders would naturally say, How is it that, although so much more gas has been sold, the revenue has fallen off? If the accounts for the half years to March and September, 1891, were taken together, it would be seen that the leading items which had changed were: Repairs, gas-fitting revenue and expenditure, public lights and illuminations, and private lights. As to repairs, the item was about £675 higher than before. This, of course, was due to the state of the works, and also to the expectation of the Board that, in view of negotiations with the Government, it would put them in a better position with regard to a new concession, and that therefore it would be worth while to undertake the repairs. The increase in the item of 'Gas-fitting revenue and expenditure' was due to a great extension they had made in the public lights, and which should have produced a larger revenue. The income from public lights was greatly reduced, because the Company were subjected to a number of fines, which, as he had before complained, were unjustly levied. In the past half year the fines amounted to £1900; so that the shareholders would see that they took away a considerable part of the Company's profits. When it came to this in a State like Pará (which they had every reason to suppose had a great future before it), it really made one rather uncomfortable, because they found that the more gas they sold, the more the fines were arbitrarily imposed. One of the members of the Board (Mr. Rumball) had been out to Pará on a mission, which he undertook partly at the invitation of the shareholders; and the Directors were full of hopes that his mission would be of the greatest possible benefit to the Company, and so they continued to hope. But just as things appeared to be going on well, there were, as the shareholders were aware, renewed disturbances in Brazil, which upset all their negotiations; and they were now waiting to see what course events would take. Reverting to the subject of the fines, he remarked that the Company had no check upon them; and they were made upon the *ipse dixit* of the rondas who went round to inspect the lights. In order to check the fines, Mr. Rumball, when at Pará, endeavoured to introduce a system whereby returns were made of the lights out by the Company's collectors, and these were countersigned by the inspector. In one instance, the returns showed four lights out, and no small lights; while the Government returned 34 lights extinguished, and 234 small lights. Of course, it was impossible for them to fight against this kind of thing; and, in spite of the fact that they had raised the illuminating power of the gas from 10 to 15 candles, the fines continued to be imposed. The existing contract, the Chairman continued, had been prolonged for twelve months; and to meet this, and also any further extension of the concession, it would be imperatively necessary for them to undertake certain alterations and repairs to the plant. But their treatment in the past did not give them much confidence in incurring fresh expenditure in this direction. Among other things, they would have to lay new mains; the plant also badly needed extension, and the gasholders required renewing. If they were assured of their position, and had confidence that they would be fairly treated by the Government and get their payments regularly, the Company would be perfectly willing to fulfil their obligations. There was one other matter he wished to touch upon. In the Company's contract, there was a clause which entitled them to introduce machinery for gas-making purposes free of duty. This was a most important clause; but the Company did not get the benefit of it. It had become a still more important matter to the Company now that the duty had been increased 25 per cent.; and the Board were doing all they could to obtain the advantage of the clause.

Mr. T. RUMBALL, having been asked by the Chairman to give some particulars as to his visit to Pará, said that his mission had for its principal object negotiations with the Government for renewing the Company's contract. He found there were other competitors; and he had a great many protracted negotiations on the subject. The result was that a proposal had been almost accepted—only subject to a decree of the Central Government at Rio respecting the import duties, because, although the Government at Pará could dispose of local affairs, when it was a question affecting in any way the fiscal rights of the Treasury they had to go to the Central Government. The matter had been before the Government; and the Directors had hoped that it would have been passed in the Company's favour. One of their most influential friends had done his utmost in pushing the thing forward; but owing to recent events, it had been somewhat retarded. He should prefer not to dwell minutely upon the negotiations at present; but

he might say that he believed they would lead to important results. As to the question of fines, the Board were extremely anxious when he went out that he should do everything possible to remove any complaint that the Government might have. They increased the illuminating power of the gas, and overhauled the services and public lamps, so as to move forward the good feeling with the Government. Then he inaugurated a system by which the Company's lamplighters could report each night as to the real state of the public lighting; and he (Mr. Rumball) checked their reports by a personal inspection, as day by day there appeared in the *Diario Oficial* very long accounts of imperfect lights. One instance had been referred to, in which he found four lights extinguished, and no defective ones. Judge of his astonishment when, the day after, he found that it had been officially reported that 34 lights had been extinguished, and 234 had been imperfect. He addressed a very strong letter to the President and the Camera on the subject. He also saw the President, who acknowledged that the Company had been harshly treated, and promised to make a very large reduction in the fines. (The August fines were reduced.) He pointed out to His Excellency that this was a matter of the future, and did not affect the past; and he mentioned that they had been very unjustly fined, and nearly £2000 had been deducted from the payments due to them. Further, he assured him that the city was then as well lighted as any city he knew of; and, he might say, brilliantly lighted in places. As the Chairman had observed, the state of the exchange influenced their returns very largely; and if it had not been for this dim shadow, with the improvements they had made, they would have had much better prospects for the future. He had prepared a plan showing how the private lights were distributed in the city, and with the object of counteracting and contending with kerosene, the sale of which was being pushed by the importers. This was one reason why he suggested that gas of higher illuminating power should be given; and that they should have a better selection of gas-fittings. The plan showed that the Company had before them a field in private lighting three times larger than they were now dealing with. The Board, he went on to remark, were very desirous of being on friendly terms with the Government; and his efforts were directed to this to a very large extent, with the result that he believed they were on the most friendly footing at the present time. He took the occasion when he was at Pará to invite the Government, the President of the Municipality, the Engineer-in-Chief, and the Chief of the Police, to visit and examine the works. They did so; and the Governor expressed himself as being exceedingly pleased with their condition, and with all the Company had done to improve them. Referring to the repairs to the works which they had made, he said that these would form part of what they would have to do as soon as the contract was granted to them, when they would have to renew a great portion of the plant, in order to properly carry on the business. He then proceeded to allude to two very important properties which the Company possessed—known as the St. Antonio property and the Cacaolino property. The former was situated in the city; it was in excellent condition, and ought not, in his opinion, to be sold for less than £4500. The other was purchased in 1874, but it had been quite unproductive. The larger portion of it was valuable for building purposes, but the remainder was swampy ground. A scheme had been drawn up for letting this land out in plots; and one plot had already been let for the erection of a sugar-mill. Before concluding his remarks, he said that unfortunately their Manager (Mr. J. G. Newbigging) was unable to return to Pará with him when he went out; and they were obliged to provisionally appoint the Sub-Manager in his place. He believed no Company were at present, nor had been for some time past, better served by their officers than their own Company.

Mr. CUFF seconded the motion for the adoption of the report.

Several questions relating to the accounts and other matters were asked by Mr. BLUNDELL, Mr. CUFF, General TUPPER, and Mr. NUGENT, the nature of the principal of which will be gathered from the reply of the Chairman. In the course of their remarks, two or three shareholders expressed their appreciation of the services Mr. Rumball had rendered to the Company during his visit to Pará.

The CHAIRMAN, in the course of his reply, said that the present contract was signed in 1862; and it expired during this year. He could not at present say how long a future concession would run; but the Directors had asked for 40 years. As to the raising of money for the payment of the contemplated extensions and repairs, that was a matter the Board would have to take into consideration. To make a call on the preference shares, on which they had to pay 7 per cent., would be a very expensive way of raising capital. Regarding the private lighting, he made a slight mistake when he said that it was paid for at the rate of 27d. He should have stated that it was paid half in currency, and half in sterling; but this was quite sufficient to affect the amount of gas the consumers took. In the case of the public lighting, they suffered in this way: They were paid at an agreed rate; and when payment was subsequently made, down went the exchange. Some time ago, he suggested, to overcome the difficulty with the public lighting, that they should adopt the average meter system; but this was met with the answer that they could not give a sufficient pressure, owing to the smallness of the mains. Respecting the extension of the contract for twelve months, the Camera had engaged that they would pay for any new mains and other like expenditure to which the Company would be put through the lengthening of the contract; and if they were good to their word, the Company would not lose by it. The Chairman also gave satisfactory explanations regarding various items in the accounts to which reference had been made by the above-named shareholders.

The motion was then adopted.

On the motion of the CHAIRMAN, seconded by General TUPPER, the payment of a dividend of 7 per cent. per annum, less income-tax, on the preference shares was agreed to.

The Directors retiring by rotation (Captain J. Walrond Clarke and Mr. A. H. Henry) were next re-elected.

The Auditor (Mr. P. Crellin) having been re-appointed,

Mr. CUFF moved a vote of thanks to the Chairman and Directors for their services. This was seconded by Mr. NUGENT, and carried.

A similar compliment was paid to the officers and the staff; the proceedings then terminated.

EDINBURGH AND LEITH GAS SUPPLY.

The Consumption of Gas.

At the Meeting of the Edinburgh and Leith Gas Commissioners on Monday last week, the minutes presented by the Finance and Law Committee contained the following: "The Collector submitted statement of the gas-rental from the 16th of May to the 15th of December last. The revenue amounted to £85,387 13s. 7d.; being £11,140 10s. 8d. in excess of the corresponding period of the year 1890. At the latter date there was outstanding the sum of £12,986 6s. 9d.; being £4582 18s. 5d. more than at the same period of the previous year. The Collector, however, reported that the collections were now up to the usual."

Mr. J. JAMIESON, directing attention to the above, remarked that it had been the former experience of the Commissioners, in the midst of all their difficulties, to find themselves with an expansive revenue. This had developed at a rate commensurate at least with the growth of the community and with the rise of rental. It was not possible to make an entirely accurate comparison with the earlier periods of the Commissioners' existence, because the first financial period was only 9½ months; but they could see, from the figures available, that there had been in the next year—from Whit Sunday, 1889, to Whit Sunday, 1890—a very large increase of revenue consequent on the greater consumption of gas. Comparing the completed years—the last two—there was clearly shown a considerable rise in revenue, about, he believed, equally divided between the natural growth of consumption and the advance of 3d. per 1000 cubic feet in the price of gas. The actual increase of gas made in the year 1890-91 was about 100 million cubic feet. Now, however, there was a turn in the tide; and it was not a turn that "leads on to fortune"—it was an ebbing tide. The £11,000 of increase was not a relative one, because if they considered the advance in price, they should, instead of having £11,000, show about £17,000. The collector, he remembered, reported that the sum outstanding was about £4000 in excess of that at the corresponding period of the preceding year; but even if they made this allowance, they were still something like £2000 behind the revenue of 1890-91. This was borne out by the fact that, as they were told, the consumption up to this time was 10 million cubic feet less than before. If this went on progressively, it would possibly be nearly 20 millions by the end of the year. How would this affect the revenue? Well, 100 million cubic feet of gas, at 4s. per 1000 feet, would come to £20,000; and at 4s. 6d. (the present price), £22,500. If the cost of manufacture—which might be fairly put at 2s. 10d. per 1000 cubic feet—were taken into account, about £14,000 would be absorbed; leaving a loss of profit to the Commissioners of some £6000 on the year, owing to the decrease in consumption. He took it that this was to be attributed to what he might call the excessive price of gas in Edinburgh and Leith; showing that some consumers were at least forced to exercise economy, or to look to other illuminants instead of gas. Of course, he did not expect the Commission could give any deliverance on the matter just now. He only stated the facts as an enlightenment, perhaps, to a good many members for the present; and probably it might lead to some guidance for the future, when they had to determine more exactly the price at which they were able to sell gas.

Bailie ARCHIBALD said he did not know what was the object of all these figures and calculations. He did not quite know whether or not Mr. Jamieson bewailed the enormous extent of their business.

Mr. JAMIESON: Decrease.

Bailie ARCHIBALD dissented. He saw the gas business did not always remain the same. It increased sometimes at a much more rapid rate than at others; and last year, as Mr. Jamieson had told them, they had an enormous increase—100 million cubic feet. This, he believed, was unprecedented in the concern, or in any business of the kind near Edinburgh. Though they should find at the end of this year a consumption of 10 million cubic feet less than that of the previous year, this would leave 90 million cubic feet increase in two years; and he considered this was something to be proud of. The preceding year they had an increase of, he thought, 44 to 45 millions; and he did not know that the gas companies had ever experienced anything like that. He should expect that the Commissioners would have a very handsome profit at the end of the current year. Comparing December, 1891, with the corresponding month in 1890, it would be found that there had been an excess of, in round numbers, a million cubic feet of gas consumed in the former as compared with the latter period. This surely did not look like a decaying business. On the contrary, it was in a very healthy and satisfactory state; and if they were enabled, at the close of the year, by means of a good profit, to reduce the price of gas, he was sure all would be delighted to make the reduction. But, so far as they knew just now, the price of first-class coal was as high as ever; and whether they could buy second-class coal, and still keep up to 26-candle power gas, was quite another question. He had made these observations in case the public might be led to think that the Commission was in a bad state, while the fact was that they were in a very satisfactory position.

Mr. POLLARD said Mr. Jamieson had given them no further information than they had actually had before them. He had argued that the diminution in the consumption of gas in the current year, as compared with last year, was attributable to the excessive price charged. Very likely it was; for if they raised the price of anything, they must certainly diminish its use. It was inevitable that the consumption should be affected by the price of gas going up. But there Mr. Jamieson had stopped; and having stopped there, he (Mr. Pollard) did not think he had aided them much in all he had said. Had he shown how they might lower the charge for gas, he would have made a real contribution to the business of the Commission. So long as the price of gas was maintained as at present, and they were unable to reduce it this year, they would have to lament that the consumption did not go up with such leaps and bounds as it did at a time when the figure was not so high. For his own part, he was quite certain that when the price was reduced, the consumption of gas would go up.

Mr. KINLOCH ANDERSON said, while it was a fact that the consumption at the last balancing period was smaller than at the preceding one, during the month of December, 1891, it had practically been a

million feet higher than the corresponding month of the previous year; and if there was one month out of the twelve which might be taken as a good criterion of the consumption of gas, it was December. He thought their position was quite satisfactory.

Mr. JAMIESON said it was exactly his contention that the tendency of a rise in the price of gas was to decrease the consumption; and in future they might obtain some guidance from this fact when fixing the charge. The decrease in the consumption ought to make them push forward with the remit under which they would ascertain the price of coals in Edinburgh and Leith relatively to other towns, and the discrepancy in the price of gas between Edinburgh and other large cities. It should also make them practise economy in all possible directions.

The minutes were then approved of.

At a subsequent period of the meeting, the report of the Gas Engineers (Messrs. Mitchell and Linton) for the past month was presented. It showed that, at the Edinburgh works, 146,093,000 cubic feet of gas had been made, as compared with 143,027,000 cubic feet during the corresponding month of 1890; and at the Leith works, 61,768,000 cubic feet, against 63,947,000 cubic feet. The average price of coal per ton at the Edinburgh works had been 18s. 0.8d. for the month, against 16s. 4.1d. for the corresponding month of 1890; while at the Leith works it had been 20s. 3d., against 17s. 9.25d. The cost of lime and wages for purification per 1000 cubic feet of gas made had been, at the Edinburgh works, 1.0rd. for the month, as compared with 0.97d. for December, 1890; and at the Leith works, 1.04d., against 1.07d. The average number of retorts working had been, at the Edinburgh works, 512 during the month, and 535 during December, 1890; and at the Leith works, 201, as compared with 206 during the corresponding month of 1890. The average illuminating power of the gas made at the Edinburgh works last month was 26.46 candles, against 26.34 candles in December, 1890; and at the Leith works, 26.84 candles, as compared with 26.57 candles.

THE PROPOSED PURCHASE OF THE SUTTON COLDFIELD GAS-WORKS BY THE CORPORATION.

A Meeting of the ratepayers and burgesses of Sutton Coldfield was held last Thursday night, to consider the question of the suggested purchase of the gas-works by the Corporation. The Mayor (Alderman J. T. Glover), who presided, made a few remarks in opening the proceedings, and then several speeches followed, both in favour of, and in opposition to, the proposed transfer. A number of questions were afterwards addressed to the Engineer who is advising the Corporation (Mr. E. H. Stevenson, M. Inst. C. E.). In reply, he said he had made his estimate of the allowance from Birmingham for the reconstruction of works in accordance with the arbitration in 1879, when the undertakings of West Bromwich, Smethwick, Oldbury, and Tipton were purchased from Birmingham. It had been laid down that no works to supply 11,500,000 cubic feet of gas could be built at a less cost than £500 per million cubic feet. He regretted to find that he had been termed a partizan of the scheme by the opponents, inasmuch as it was nothing to him whether or not the works were purchased. He should not have recommended the transfer if the Company had been well managed in competition with Birmingham; but seeing that it had been badly managed, it could be bought for "a mere song," and would be valuable to the Corporation. Birmingham was fortunate in having only 6 per cent. of leakage, seeing that it was largely undermined; and the same applied to West Bromwich, where it did not reach 9 per cent. No place not undermined, and having a subsoil like Sutton Coldfield, ought to have more than 5 per cent. of leakage. Great towns like London were too big, and became unwieldy. Gas undertakings were profitable up to a certain point, beyond which they lost money. If it went on as it had done, Birmingham would be the same; and then places like Sutton Coldfield would have to pay for it. He should be ashamed of any gas manager, himself included, who could not make, with practically new works, 10,500 cubic feet of gas per ton of coal, with 15 per cent. of coke for carbonizing, and with 5 per cent. of leakage. The Mayor then put the resolution approving of the application to Parliament for the necessary powers to purchase the gas undertaking, and he declared it carried by four votes to one. The opposition demanded a poll; and the proceedings concluded with a vote of thanks to the Mayor for presiding. The papers for the poll will be delivered on the 22nd inst., collected on the 26th, and the result declared at a public meeting on the following day.

Sunderland and the Electric Light.—A special meeting of the Highways Committee of the Sunderland Corporation has been held, to consider offers for lighting with electricity that part of the town comprised in the Provisional Order which was obtained by the Corporation in 1891. Applications had been invited by the Corporation from companies prepared to take over the powers which the Provisional Order vested in them, and two were received—viz., from the Brush Electric Supply Company and Messrs. Andrews and Co., of London. The former proposed to take over the Order with all its obligations, on condition that the Corporation assisted them to form a local Company, that at the end of 21 years the Corporation should have power to acquire the works as a going concern at a valuation and payment to be agreed upon for the goodwill, that they would pay a royalty of 10 per cent. on the balance of receipts over expenditure, that the Corporation should cause the main thoroughfares to be lighted at such a price as should be arranged hereafter, and that no concession of any kind be granted to any other company. Messrs. Andrews proposed to take over the area mentioned in the Order, to supply it with electricity for lighting purposes on the alternating current high-pressure system at a uniform charge of 3½d. per Board of Trade unit, and to pay the Corporation a rental of £100, together with a royalty according to the consumption. They required payment for the goodwill if, at the end of 21 years, the Corporation wished to acquire the concern. The terms of both offers were discussed; and it was ultimately agreed to submit them to Mr. J. N. Shoolbred, who had previously been consulted by the Committee with regard to the Order, and to await his report.

LONDON WATER SUPPLY FROM THE THAMES AND LEA.

Our readers may remember that, in July last, the Engineer of the London County Council (Mr. A. R. Binnie, M. Inst. C. E.) was instructed to prepare a report embodying the information contained in the various reports ordered by the Special Committee on Water Supply and Markets, and other recent information bearing on the question of obtaining a further supply of water from the Rivers Thames and Lea. The report was presented in due course, and was noticed at the time in our article on "Water and Sanitary Affairs." In view, however, of the approaching investigation of the Metropolitan Water Question by a Royal Commission, it may be useful to deal with it at greater length.

Mr. Binnie begins by stating that, in attempting to throw into a connected form the results of recent inquiries, he did not rely exclusively on the various reports he received, or upon information collected in the office of the Council, but sought to make his report a concise statement of all the data which had come to his knowledge. He likewise endeavoured to embody therein the opinions of the highest authorities who have expressed themselves on this matter. He then goes on to say that the subject is of the first importance in considering the question of the future water supply of London; because if the Thames and Lea can afford all the water likely to be required, it would be useless to look to more distant sources. On the other hand, should it be found that these rivers can yield, even after the construction of costly works, a quantity sufficient only for a comparatively short period, it may be deemed prudent to concentrate further expenditure on some new source, rather than on an attempt to increase the supply from the valleys of the Thames and Lea. Further, it may be found inadvisable to depend entirely on a supply derived from a thickly-populated area, which, under certain conditions, may possibly become a danger to the health of the community. The London Water Companies claim that the present state of their works is good, and will continue good for many years; and also that, in valuing the undertakings for purposes of purchase, future, but as yet unearned, profits ought to be included. But should investigation show that no further quantity of water can with safety be abstracted from the Thames and Lea areas, or that a large capital expenditure, either to increase the present or to bring in a new supply, is to be anticipated at an early date, then it is clear that the value of the undertakings of the Companies will be materially affected. Viewing the question broadly, it will be seen that it resolves itself into an inquiry into the quantity and quality of the water that can be derived from the Thames and Lea, including water from the springs, both surface and deep seated, which flow into those rivers; for, as pointed out by the Royal Commissioners of 1869, "it follows that any water obtained by tapping the chalk reservoirs that feed either the River Lea or the Thames above Hampton would only *pro tanto* diminish those streams, and would therefore be little or nothing gained to the general supply."

Proceeding to deal with the Thames Valley, Mr. Binnie states that above the intakes of the London Water Companies at Hampton, Molesey, and Sunbury, the area draining into the Thames comprises upwards of 3542 square miles, or 2,267,233 acres, embracing parts of the counties of Berkshire, Buckinghamshire, Hertfordshire, Hampshire, Wiltshire, Surrey, Oxfordshire, Middlesex, and Gloucestershire, with small portions of Sussex, Warwickshire, Bedfordshire, Worcestershire, and Northamptonshire. This area may, geologically speaking, be said to consist, first, of the London clay and other tertiary beds, which lie between London and a line passing through Newbury on the west, by way of Reading, Maidenhead, and Uxbridge, to near Watford on the east. The river then drains a district composed of the cretaceous formation of chalk, greensand, &c., the boundary of which is a line extending from Swindon on the west, by way of Wantage, Oxford, and Aylesbury on the east. Finally, above Oxford, in the upper part of the valley, it drains a district composed of the Oxford clay, great and inferior oolite, &c., which extends from near the Cotswold Hills on the west, to Priors Marston on the north-east.

The annual rainfall of the valley, as shown by the report of Mr. G. J. Symons, F.R.S., as far as Reading, Maidenhead, and Uxbridge, averages about 24 inches; between these places and Tring on the north, and Moreton, Witney, Fairford, Cricklade, Swindon, East Ilsley, Newbury, and Basingstoke on the west and south, it runs up to 27½ inches. Above these points, at the head of the valley, it probably averages as much as 32 inches. The average flow of the river at Teddington Weir, a few miles below the intakes of the Water Companies, would be about 79,000 million cubic feet per annum if it included the quantity abstracted for water supply. This flow would represent nearly 9½ inches of rainfall actually flowing from the whole of the catchment basin above the intakes. But it need hardly be pointed out that the flow varies very considerably in different years and during different months in the same year. For instance, the corrected discharge at Teddington sometimes rises as high as 3000 to 4000 million gallons a day during periods of autumn flood, and falls as low as 255 to 308 million gallons daily during the drier months of the year.

The valley of the Thames above the intakes of the Companies contained a population of some 762,000 persons in 1851, of 810,000 in 1861, of 887,000 in 1871, of 947,000 in 1881; and it is estimated that at present it considerably exceeds 1,000,000. Besides this human population, it is found, from the returns to the Board of Agriculture of 1890, that there are in the Thames Valley, above the Companies' intakes, 75,256 horses, 265,673 cattle, 1,101,095 sheep, and 187,534 pigs.

The average quantity of water abstracted from the Thames for the supply of London in 1858 amounted to 35,387,000 gallons per day, and was increased in 1890 to 90,400,000 gallons; showing a rise of more than 154 per cent. during that period. It should be noted that the whole question of the supply of water from the River Thames was fully investigated by the Royal Commission of 1869, who say, in the 141st paragraph of their report: "Considering the whole of the evidence above referred to, we believe we are justified in inferring, in the first place, that the quantity at present authorized—namely, 110 million gallons per day—might safely be drawn from the main stream of the

Thames in its present state; and, secondly, that, by means of proper works for storage, this quantity might be doubled if required." The Royal Commissioners based this opinion on the assumption that the flow of the river never fell below 350 million gallons per day; but as, from actual observation, it is found that the flow falls as low as from 255 million to 308 million gallons daily, and this not on exceptional days, but for periods of a month at a time during some of the drier months, the inferences of the Commissioners have not been justified by experience.

Having given the foregoing brief summary of the salient features of the Thames basin, Mr. Binnie goes on to deal with them in more detail; taking up first the quantity of water abstracted from the Thames by the various Water Companies. On this he says: Looking back to the report of the Royal Commission of 1869, I observe that the quantity of water authorized to be abstracted at that period amounted to 110 million gallons per diem. Very considerable obscurity exists as to how this quantity was authorized, and as to how it has since been increased; and although, at the recent inquiry before Sir Matthew White Ridley's Committee, the Companies and the Conservators of the Thames were invited very particularly to elucidate their legal powers, they carefully abstained from throwing any light upon the subject.

In a reply given to the Royal Commission of 1869, Captain Burstall, then the Secretary to the Thames Conservancy Board, stated that each of the five Companies were limited to a draught of 20 million gallons a day under arrangements made with the Corporation of London in 1852. By the "five Companies," he clearly meant the Chelsea, the Grand Junction, the Lambeth, the Southwark and Vauxhall, and the West Middlesex; but to these I must add the East London Company, who, under their Act of 1867, were authorized to draw 10 million gallons a day. This is confirmed by the remarks of the Official Auditor, Mr. Stoneham, in the 18th annual report of the Local Government Board (for 1888-9), from which I gather that, in consequence of an agreement made in 1886 between the Thames Conservancy and the five Companies above noted, they were permitted, in consideration of contributing certain sums of money to the funds of the Conservators, to increase their draught in the following proportions: The Chelsea Company, by 2 million gallons a day; and the Grand Junction, Lambeth, Southwark and Vauxhall, and West Middlesex Companies, by 4½ million gallons a day each—the 10 million gallons authorized by the East London Company's Act remaining as before. This brings the total authorized quantity up to 130 million gallons a day. Considerable doubt exists in my mind as to the legality of this agreement between the Conservators of the Thames and certain of the Water Companies, particularly the West Middlesex and the Chelsea Companies, as I perceive from the West Middlesex Company's Act of 1866, section 8, and the Chelsea Water-Works Act of 1875, section 25, that these Companies are restricted to drawing a quantity not greater than 20 million gallons a day. It is difficult to understand how a mere agreement can set aside a statutory provision in an Act of Parliament; and it is certainly most inexpedient that the Thames Conservancy—a body charged with the custody of the purity and flow of that river—should have a direct money interest in the quantity of water abstracted from it by the Companies. In fact, the whole question of the authorization to draw water from the Thames by the Companies must be fully and carefully investigated before any attempt is made to purchase their undertakings, particularly as there are strong reasons for believing that it would be most dangerous to abstract a much larger quantity than they at present draw, when we have regard to the sanitary state of the river below the intakes. That the maximum quantity which may safely be taken from the river has been reached, is shown by the fact that the quantities abstracted in August, 1885, amounted, on an average, to 31½ per cent. of the total flow, and on the 3rd of August of that year to 37 per cent. of the total volume; and the average quantity abstracted in August, 1887, amounted to 29·65 per cent., and on the 14th of that month to 39·6 per cent. The figures from which these percentages were derived are all of an official character; and although they were at one time impeached during the course of the inquiry, they were afterwards fully acknowledged by the Counsel for the Thames Conservators. The subject of the large quantity of water abstracted in dry weather from the diminished stream of the Thames is of the utmost importance to the health and well-being of the Metropolis as a whole; for as pointed out in my report on the London Water Supply of October, 1890, and in the joint report by Sir Benjamin Baker and myself on the subject of the Main Drainage of London, dated Feb. 19, 1891, the abstraction of so large a quantity at so critical a period in the height of summer decreases the power of the river to discharge downwards into the sea any polluting matter which may enter it in its passage through London. The tidal action does not at every tide discharge the whole quantity of polluting matter contained in the river into the estuary at the Nore, but causes it rather to oscillate backwards and forwards through the Metropolis; its downward course to the sea being determined by the volume of the upland waters which pass over Teddington Weir. If further abstraction of water is not carefully guarded against, I fear that a state of affairs may arise to the river which will be most unpleasant and disastrous to the inhabitants of London.

After a few remarks on the subject of the control exercised over the Water Companies by the Local Government Board, Mr. Binnie gives some statistics as to the population of the Thames Valley. He says the total population of the valley of the Thames above the intakes of the Water Companies has increased since 1851 from 762,000 to upwards of 1,000,000 persons, or at the rate of 32½ per cent. in 40 years. But this mode of stating the case does not clearly represent the actual facts; for the population is not equally distributed per square mile or per acre, but a large proportion reside in some 202 towns and villages, each with a population exceeding 1000 persons, and which amounted in the whole to 480,000 persons in 1851, to 532,000 in 1861, to 610,000 in 1871, to 684,000 in 1881, and is estimated at the present time to be 752,000. From these figures it will be seen that the urban population bore a proportion to the total number of inhabitants of 63 per cent. in 1851, 65 per cent. in 1861, 69 per cent. in 1871, 72 per cent. in 1881, and (say) 75 per cent. in 1891. So that not only has the total population increased since 1851 by 32½ per cent., but there has been a marked increase in the proportion residing in towns and villages. In the total 202 towns and villages of 1000 inhabitants and upwards,

we find that the population has increased from 480,000 to 752,000 persons, or at the rate of 57 per cent., during the past 40 years. If now, however, we turn our attention strictly to the towns and villages situated on the banks of the Thames, and which are 29 in number, we perceive that their population has increased from 122,247 in 1851 to 202,083 in 1891, or at the rate of 65½ per cent. Again, if we turn to the principal towns and villages situated on the tributaries of the Thames, and which amount to 83 in number, we observe that the population in 1851 was 189,964, and that in the present year it is estimated at 383,096; showing an increase at the rate of 101½ per cent. From these figures we see that, during the past 40 years, the total population of the Thames Valley has increased 32½ per cent.; the inhabitants of the 29 towns and villages situated on its banks have increased 65½ per cent. of the population; and those of the 83 towns and villages situated on the tributaries have increased at the rate of 101½ per cent. But if we look at some of the individual towns on the Thames, we find that Staines has increased during the past 40 years 106 per cent.; Egham, 125 per cent.; Reading, 128 per cent., Caversham, 139 per cent.; Clewer, 152 per cent.; and Weybridge, 196 per cent. The bearing of these facts on the question of the London Water Supply is of paramount importance, as it will be observed that the population is concentrating itself into towns and villages, which are increasing with great rapidity; and that these towns and villages are principally situated either on the Thames itself or upon its tributaries. Consequently, they must all inevitably drain directly into the streams and river from which the inhabitants of the Metropolis receive their drinking water. As before noted, besides this human population, there is a total animal population in the district referred to exceeding 1,600,000.

The flow of the River Thames and possible future increase of the supply by means of storage reservoirs is the next subject to engage Mr. Binnie's attention. On this he says: It will have been noted that the Royal Commissioners of 1869, in the paragraph above quoted, conclude with the words, "and that, by means of proper works for storage, this quantity might be doubled if required." I have already mentioned that in dry weather, for days at a time, the Companies draw upwards of 100 million gallons of water daily, representing some 30 to 40 per cent. of the total flow of the river at Teddington Weir. It is hardly likely that Parliament will long permit this state of affairs to continue; and if the suggestion of the Royal Commissioners of 1869 is to be carried out, the construction at some point in the valley of the Thames, above the present intakes, of reservoirs for the storage of flood water must be undertaken. In other words, some attempt will have to be made to store up flood water against periods of extreme drought, either to afford an increased supply, or to provide proper compensation for the quantity abstracted from the river. I must here draw attention to the nature of this flood water. It is always highly polluted, discoloured, and often obnoxious to sight, to taste, and to smell. The question arises how far it would be safe to store for future use this highly-polluted water; for, whatever may be said with regard to the purifying action of the flowing river on organic impurity that may be passed into it, the question is quite different when it is proposed to store up for many months, in large reservoirs, the most polluted water which comes down the stream. Considering how thickly inhabited the Thames Valley is, and how the present Water Companies have found it impossible to use flood water for domestic purposes, this proposal to store it up in large reservoirs hardly commends itself to my judgment as a wise or prudent step. I have known the Thames Valley for the greater part of my life. I have also for many years been engaged in the construction of large storage reservoirs; and I can safely say that I know of no sites in the valley suitable for storing water for the domestic supply of the Metropolis, and up to the present time no engineer who has had any considerable practice in the construction of large impounding reservoirs, such as those now under consideration would have to be, has ever given his opinion in favour of such a scheme. I therefore fear that the Council must not hope to find in the construction of storage reservoirs a solution of this most difficult question. Although the Water Companies who now supply London have often been in great straits to increase their supplies, and have had the advantage of the advice of competent and talented engineers, I am unaware that any of them have at any time suggested definite storage works in the Thames Valley. One fact, however, should be kept in mind—that, were such storage works possible or expedient, they could not be constructed at such an altitude as to deliver a supply of water by gravitation in the Metropolis; so that, in the future as in the past, pumping would have to be resorted to, with its continued annual cost of more than £127,000, in addition to the enormous initial expenditure which storage works would inevitably render necessary.

Mr. Binnie next deals with the chalk and other spring water in the Thames Valley. He says: We have seen that at present, in dry weather, the Water Companies draw upwards of 100 million gallons a day, or (say) 40 per cent. of the total volume of the Thames, at Teddington. Were this or any similar quantity drawn from wells in the upper valley of the Thames above Reading or Oxford (and in the future we certainly shall require a larger amount if the consumption is to increase at the rate of 154 per cent. in the next 40 years, as in the past), it would not mean that 40 per cent. only was taken out of the stream. On the contrary, the volume of water in the river would be enormously decreased; and as its flow above those points is, owing to its more limited drainage area, comparatively small, there would probably be taken from the upper valley a supply more than equal to the total average summer flow of the river. Were this done, two things would have to be provided for—one, the construction of suitable storage reservoirs to compensate the river below the point at which the water was abstracted; and the other, securing that the abstraction of the water from the wells did not injure the general water supply of the district lying at higher levels than the places whence it was drawn. The practicability and the prudence of constructing storage reservoirs in the Thames Valley, I have previously dealt with; but I must point out that there are already grave complaints to the effect that the pumping now going on in the valley of the Lea is affecting not only the springs and rivers, but also the general character of the water supply to the county of Hertford. We know also that powerful combinations of

millowners and residents on the banks of the Mole, the Wandle, and the Colne, are fully organized to prevent the abstraction of further quantities of water from those rivers; and like combinations would undoubtedly result on any serious attempt to abstract, from the valley of the Upper Thames, the spring and other subterranean waters which now feed the tributaries of that river. One of the difficulties sure to arise would be that claims for compensation in kind would be made which it would be impossible to meet. On the chalk and oolite formations, out of which we are supposing the water to be abstracted, it is impossible to construct reservoirs; and as the abstraction of so large a volume of water by means of headings and wells, as suggested by Sir R. Rawlinson, would have the effect of lowering the line of saturation in the district generally, it would be necessary to provide for the cases arising from the drying up of the springs, wells, and streams which at present flow down to the river, but which would be intercepted by this mode of abstracting the water. Looking nearer to London than the upper valley, I find that the intra and extra Metropolitan areas are, according to the report of the Water Examiner for May, 1891, supplied with water to the extent of 179,908,849 gallons a day, of which only 25,383,525 gallons, or 14·11 per cent., are drawn from springs and wells, which is but a small proportion of the total quantity supplied. London is also surrounded by small Companies or corporate bodies, who at present derive their water supplies from the chalk, greensand, &c.; and we can hardly expect that they would stand passively on one side were it proposed to take from their several districts the large volume of water which would be required in the future for the supply of London. The Kent Company, which at present supplies a portion of the county of London and a considerable area outside, draws its water entirely from chalk wells; and it has increased its supply from this source from about 3½ million gallons daily in 1858, to nearly 12½ million gallons daily in 1890, or by more than 260 per cent. Such an extensive draught on this district cannot long be continued; and complaints are made that certain of the streams in the area of the Kent Company, which formerly broke out at higher levels, now flow at a considerably less altitude. From the Upper Lea Valleys similar complaints are heard, owing to the excessive pumping from the wells of the New River and East London Companies. This is an indication that the general line of saturation in the chalk is being lowered; and it would therefore hardly be prudent to calculate upon obtaining any very large increase from this source, such as would be contemplated were it proposed to abandon the open rivers—Thames and Lea—as a means of supply.

With regard to supplies to be obtained from the gravel-beds of the Thames Valley, Mr. Binnie says: It has been suggested that a large amount of water could be obtained by pumping from the gravel-beds which extend over the Thames Valley at points between Slough and Windsor and the present intakes of the Water Companies. It is alleged that these gravel-beds are supplied from the chalk formation, which is said to outcrop beneath them; that the water so derived does not join the Thames until it reaches some point below Teddington Weir; and that, consequently, a large volume could be abstracted for the supply of London without in any way interfering with the natural flow of the river. The whole subject of this proposed supply was discussed during March, 1891, before the Institution of Civil Engineers, on a paper read by Mr. J. Thornhill Harrison, M. Inst. C.E.* The result of that discussion was not very favourable to this mode of obtaining a supply of water. As I before noted, and as pointed out by the Royal Commissioners of 1869, any water abstracted from the springs which feed the Thames is *pro tanto* abstracted from the river itself; and it is clear that, should the water in the gravel-beds be pumped to a lower level than that in the adjacent river, it would not only be intercepting water which would otherwise flow into the stream, but be actually abstracting direct from the river a considerable quantity of the water flowing in it. To my mind, however, it is not clearly proved that the water exists in the quantities estimated by Mr. Harrison; and I also fear that it has not been proved on a sufficiently solid basis that the water breaks out in the bed of the Thames in volumes large enough to warrant us in expecting to obtain a supply adequate for our wants from this source. When I come to speak of the pollution of the subsoil of the Thames Valley at present existing, and which may be expected generally to increase, it will be seen that, under any circumstances, even supposing the water to be available, it only could be obtained at a certain amount of risk. This would be especially the case in dry weather, as then doubtless a large amount of drainage and cesspool water flows into these gravel-beds.

(To be continued.)

THE ARTESIAN WELL IN THE CITY OF LONDON.

At the Meeting of the Commissioners of Sewers of the City of London last Tuesday, Mr. Malthouse brought forward one of two motions, adjourned from Nov. 3 last, as follows: "That if the water from the artesian well be found, by analysis, to be pure and fit for domestic purposes, it be referred to the Engineer to take the necessary steps to supply the same to the artisans' dwellings." Mr. Sayer suggested that the portion of the Medical Officer's report relating to the analysis of the water should be read at this juncture. This having been agreed to, the Medical Officer (Dr. Sedgwick Saunders) read his report, to the effect that the chemical constituents of the water were characteristic of the analysis he submitted to the Court on Nov. 17 last; and he congratulated the Commissioners upon the success which had attended the completion of the well. The supply of water was abundant, and exceedingly wholesome for every purpose of domestic life. Mr. Malthouse, in moving the above resolution, claimed that the existence of this well formed a great factor in the future settlement of the water question, so far as the citizens were concerned. The Medical Officer had proved that the water was far purer than that obtained from other sources near London; and the Engineer had told them that the well was capable of supplying 100,000 gallons of water per day. It was true that the cost of the new supply would be greater

* See JOURNAL, Vol. LVII., p. 512.

than the present; but he set off against this the fact that the citizens would be delivered from the injustice from which they had long suffered through the statutory powers of the Water Companies. Mr. Sayer seconded the motion. Mr. King, in moving an amendment to the effect that the matter should be referred to the Finance and Improvement Committee, as being the custodians of the artizans' dwellings, to consider as to the advisability of obtaining a supply from this well, pointed out that the cost would be very much greater than was ever anticipated. Mr. Woodrow seconded the amendment. Mr. Edmeston said he thought the Engineer should give the Court some information as to the cost of new pipes and fittings in the artizans' dwellings. The Engineer (Mr. W. Haywood), in reply to several questions, said the cost of pipes and fittings would be £1690; but this had nothing to do with the cost of pumping, which would be from £137 to £140 per annum, exclusive of depreciation account or interest on capital. The whole of the water could, he thought, be raised in six hours a day, and would be placed in the cisterns at the tops of the houses from which the supply was now obtained. As to the total cost of the well, the accounts were not yet made up; but up to now it had been about £3500. A large part of this was for a clerk of the works. He had only estimated the cost of serving the artizans' dwellings; but if the supply went beyond this, it would involve serious considerations. The water needed for the dwellings was 20,000 gallons per day; and the quantity available from the well was 70,000 or (probably) 100,000 gallons. Mr. Sly asked whether the alteration in the supply would affect the arrangements in case of fire. The Engineer replied that, in the event of fire, the water from the mains of the New River Company would be used, as the Company were compelled to supply water for extinguishing conflagrations. Mr. Bedford said it seemed to him that, having secured a magnificent supply of water, it would be ridiculous to abandon it. This was not a small question, but the beginning of a very large one; for if they could sink a well in one part of the City, they could do the same in other parts. As to the assertion that the Commissioners could not sell water, he denied it. The Companies had no monopoly of the sale of water. Mr. Sly pointed out that the well had already cost the ratepayers £5190; and Mr. Wallace argued that it would not be prudent to pledge the ratepayers to any other excessive expenditure. After further remarks, the amendment was put, and lost by 22 votes to 30. A second motion standing in the name of Mr. Malthouse, to the effect that the Engineer should report upon the advisability of supplying water from the well to the inhabitants of the Ward of Portsoken for domestic purposes, was held over.

Referring to the above project, a correspondent writes as follows: "The Corporation have sunk their artesian well at a cost of £3500; a further expenditure of £1600 is required for pipes and mains to the artizans' dwellings; and they contemplate an annual outlay of £130 to £140 a year as the cost of pumping. Allowing for the repayment of the capital in 50 years, on the 3½ per cent. table, the annual sinking fund required would be £41 16s. 5d.; the interest upon the capital expended, £178 10s.; and the annual expenditure, £130—making a total of £350 6s. 5d. The present supply is afforded by the Company at about £80 a year; thus leaving a deficit of £270, upon which the Corporation congratulate themselves, as having 'broken down the monopoly of the Water Company.'"

THE NEW FILTRATION WORKS OF THE BELFAST WATER COMMISSIONERS.

An interesting lecture on the above subject was delivered last Wednesday evening, in connection with the Belfast Natural History and Philosophical Society, by Mr. L. L. Macassey, C.E. Having given some statistics as to the growth of the population and the demand for water, he proceeded to describe the new filter-beds which are being constructed by the Water Commissioners. Before they decided upon the class of filters they should adopt, a full examination was made of nearly all the water-works filters in the United Kingdom; and they determined to follow the same lines as London, Dublin, Bradford, Edinburgh, Liverpool, and a number of smaller towns. In these places the water authorities had adopted vertical filtration through a layer of sand, supported on other layers of gravel and broken stones, the total thickness of the filtering materials varying from 4 feet to 8 feet. Throughout England the speed of filtration per 24 hours per square yard of filter surface was from 1000 down to 500 gallons; and in the new works about to be described the speed would be 500 gallons. For dealing with that portion of the Belfast supply which came from the Carrickfergus district, and which amounted to 7½ million gallons per day, five filter basins were being constructed at Oldpark, near the present high-service reservoir. One bed, he said, would be always out of use for cleansing; so that four would have to do all the work of filtration. The average effective area of each basin would be about 3800, and the total of all the beds something like 19,000 square yards. The quantity of water to be dealt with here would vary from 3 million to 4 million gallons per day. Each bed would have an effective area of about 2700 square yards. Thus at both stations there would be in all some 30,000 square yards of sand area. The mode of construction of all the filters was the same. The basins were formed by cutting or filling, according to the levels of the ground. The bottom and slopes were lined with 9 inches of concrete; and a neat cope was formed above the ground-line. Along the centre of the floor there was a drain or channel for collecting and conveying the filtered water to the outlet. The filtering material began at the bottom with a layer of whinstone larger than road metal, gradually reducing in size to chip-pings, then to gravel. Afterwards came a 2 ft. 6 in. layer of Dundrum sand, finishing fine on the top. The total thickness was about 5 ft. 6 in.; then there was 1 ft. 6 in. water space, and 2 feet margin. In total depth the filter-basins measured 9 feet. The works would cost in all about £70,000; and they would be capable of filtering some 11,500,000 gallons of water per day. The working expenses and cost of capital would come to about £3650 per annum, or £10 a day. This worked out at 17s. 4d. for filtering each million gallons of water, or one-fifth of a penny per 1000 gallons.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

But for the astonishing speech of Mr. John Jamieson at the meeting of the Edinburgh and Leith Gas Commission on Monday last, there would be little in the proceedings that would be worthy of notice in this column. I feel inclined to say that, if ever there was an instance of a round man being in a square hole—not the other way—that man is Mr. Jamieson. Why he should be a Gas Commissioner, I cannot understand. It was he who, in the beginning of last year, when the Commissioners were in straits for coals owing to the railway strike, sought, for a body of strikers, an interview with Mr. Mitchell, with a view to having a stop put to arrangements which had been made for the supply of coal to the gas-works. He acted then professedly in the interest of the working man. It is Mr. Jamieson who, along with Mr. Manclark, has given notice of a motion which virtually means that when the collectors are laid aside by sickness, their pay shall be stopped. The working classes will not thank him for that motion. Mr. Jamieson's voice was one of the loudest in the complaints that were made a year ago regarding the reduction in the illuminating power of the gas. Now, when he has had his way and gas of higher illuminating power is being manufactured—necessarily at a higher price—he is the only man in the Commission who has expressed dissatisfaction with the results of the policy which the Commissioners adopted to please him. He is a man of such contradictions, that it is altogether impossible to understand him. His speech on Monday was intended for the enlightenment of "a good many members," which was rather a conceited thing for him to say, when his record is taken into account. It is not necessary to follow him into all his rigmarole; his statement that in the decreased consumption of gas "they might get some guidance from that fact when fixing the price," is sufficient to set him aside. The sentiment conveyed in that sentence would seem to be that hitherto the Commissioners have taken no thought of such a matter when arranging the price they should charge for gas. This displays a juvenility of mind which I would not have expected in any Gas Commissioner. Laying aside Mr. Jamieson for the present, it is to be observed that the Commissioners have earned £11,140 more than they had at this time last year, upon a decreased consumption of about 10 million cubic feet of gas. The augmented revenue is, of course, derived from the increase of 9d. per 1000 cubic feet which was imposed last April; and the decreased consumption has partly followed this increase. There are, however, other causes for the falling off, one of which is that in the summer of 1890 there was an exhibition in Edinburgh which required a lot of gas, and another is that the gas being now of higher illuminating power, less of it is consumed. Taking both these circumstances into account, it is satisfactory to find that the consumption in December last showed an increase over the previous December of 887,000 cubic feet. This fact alone speaks volumes for the elasticity of the Commissioners' business; and should be quite sufficient to silence all croakers, whether within or without the Commission.

The least satisfactory part of the business before the Commissioners was that which had reference to the sale of spent lime. Not quite two years ago, if I recollect aright, they acquired a plot of ground at Loanstone, near Pennicuik, on which to store their lime. So rapidly has it accumulated that last July I observed there was room for little more. That in itself was bad enough; but worse has happened in the complaint that the County Council makes, of the water supply of a village being contaminated by it. There are many hundreds of tons of lime stored there; and if the County Council succeed in establishing a nuisance, it will be a costly affair to remove it. The sale seems to be a stiff proceeding. Probably it has not been pushed; but now that greater activity is being displayed, the inconvenience of rapidly growing stocks of what is practically refuse, may be reduced. I am afraid the farmers in this part of the country do not care for gas lime. Lime in its pure state is plentiful, and I suppose cheap; and there may be a prejudice against that which has been used in gas-works. I am not aware whether any of the Commissioners are cultivators of land to any extent; but if they are, they might take the initiative in introducing its use. With farmers an ounce of practice is worth a pound of precept; and if a beginning were once made, the disposal of spent lime might not be such a serious affair in future as it has been.

The last return of the Glasgow Stove-Hiring Department shows that there were about 9370 gas-stoves and range-fittings on hire; and that the stoves, fires, and other gas-heating appliances that had been sold to date, numbered about 12,000.

Even though the price of gas in Glasgow still remains at 2s. 6d. per 1000 cubic feet, the revenue in the shape of gas-rents continues to mount up by leaps and bounds. On the 27th of January the collection of gas-rents for the financial year commencing June 1, 1891, stood at rather over £170,000; whereas at the same time last year, it was almost £141,460, thus showing an increase of nearly £28,600.

I understand that some important extensions of the retort-house and coal-store at the Dawsholm gas-works have recently been suggested and designed by Mr. Foulis, the Engineer-in-Chief, and have been approved of by the Sub-Committee on Works. Mr. Foulis has been instructed to take the necessary steps for obtaining tenders for the execution of the proposed work.

The annual meeting of the shareholders of the Coatbridge Gas Company was held last Tuesday, when, on the recommendation of the Directors, the maximum dividends of 10 and 7 per cent. on the old and new stocks respectively were agreed to. In their report and statement of accounts for the half year ending Dec. 31, 1891, the Directors stated that the total income had been £8103; and that the profits amounted to £1789, which, with the balance of £1638 brought from the preceding half year, made the sum of £3427 applicable to dividends. In consequence of continued subsidences through mining operations in the Calder district, the unaccounted-for gas during the half year was exceptionally heavy—being at the rate of 17 per cent. The average illuminating power of the gas sent out from the works was 26 standard candles. During the past half year the works were extended at an outlay of £730; and 85 meters were supplied to new

properties at a cost of £117—both of which sums were charged to works account. The repairs over the period embraced in the report were very heavy, owing to the renewal of the ironwork of the old retort-bench. The half-year's sales of gas amounted to 34,522,000 cubic feet, which, at 3s. 9d. per 1000 feet, yielded £6472. For the public lighting, there was obtained £309; and for meter and stove rents, £220. The sales of sulphate of ammonia (less cost of manufacture) yielded £335; and the revenue from tar, naphtha, &c. (less cost of distillation), was £504. Coke realized £155. The rents and various other items brought up the total to £8103. On gas coal and shale used, there was expended £2758; while the cost of the lime and oxide of iron used was £141. For repairs of works, mains, meters, &c., the expenditure was £1598, and that for salaries and wages was £1267; while the Directors' and Auditors' fees amounted to £78. Railway dues and cartage, taxes, interest, general charges, &c., brought up the total expenditure to £6313. The liabilities are set down at £58,594; and the assets, at £50,446.

It is frequently said that modesty has gone out of fashion in these days. Judging by a couple of applications which have been made to the Dundee Gas Commissioners, it would appear that it is not only unfashionable but that it is unprofitable as well. The Glasgow Alum and Ammonia Company, Limited, and Messrs. John Dobbie, Sons, and Co., of Leith, the contractors for the residual products of the gas-works, have made application for a reduction in the prices which they have contracted to pay during the current year. The Alum and Ammonia Company regret exceedingly the necessity for their communicating with the Commissioners on the subject. With a drop of 10 or 12 per cent., they say they would have continued to carry out their obligations; but the fall in prices has been unprecedented and ruinous, amounting to about 45 per cent. Crude naphtha, when they entered upon the contract, was 1s. 3d., and it is now only 8d. per gallon; and pitch oil has fallen in price from 2½d. to 1d. per gallon. In April last, when the contract was being negotiated, they suggested the mutual advantage of a sliding scale for the residuals; but it was not acted upon. They point out, too, that in Edinburgh and Glasgow the sliding scale was adopted when the contracts were last renewed. They expressed the hope that the Gas Commissioners would see their way to give some concession, and to adopt the sliding scale as from Jan. 1 last. This the Finance Committee of the Gas Commissioners have refused to do; and they have passed a resolution that they adhere to their contract. The application of Messrs. Dobbie, who are contractors for the naphtha, is on a different footing. They say that the result has fallen short of what was represented to them, when they were making inquiries previous to tendering, by £1500; and that had the return of naphtha been anticipated as it has turned out, they could only have offered 2s. 9d. instead of 3s. 6d. for the contract—which would have been £1820 less upon the whole contract than they have to pay. This letter has been placed in the hands of the Conveners of the Finance and Works Committees, with powers. There would appear to be some reason in Messrs. Dobbie's application; but in that of the Alum and Ammonia Company, there is none whatever. They have made their bed, and must lie upon it. Suppose the price of their products had risen 45 per cent., would they have consented to augment the price they had agreed to pay to the Commissioners? I fancy not; and the Gas Commissioners should not give any concession where they have no reason to expect that they would have got one. The sliding scale would, of course, prevent either party suffering disadvantage by the rise or fall of the market; but it has not been adopted in Dundee yet, and until it has been by both parties, it cannot be held to apply to one of them.

The piping times which owners of gas coals are experiencing, is well illustrated by the position of the Rosewell Gas Coal Company—a Fifeshire undertaking, which has its headquarters in Edinburgh. The annual meeting of the shareholders was held on Tuesday; and the dividend declared was at the rate of 10 per cent. per annum, with another 10 per cent. of bonus. According to the Chairman, the present output of the Company realizes about £200 per day, about half of which is profit. It is sometimes possible to divulge too much; and in this instance, I think that was certainly done, for most commercial people will agree that a profit of 50 per cent. upon the earnings of a business indicates an unfair distribution of the gains.

One of the anomalies attendant upon the present system of assessing public works cropped up in the Finance Committee of the Dundee Water Commission on Thursday, when claims were intimated by the heritors of the parish of Newtyle upon the Commissioners for £20 19s. 5d., and by the heritors of the parish of Meigh for £8 8s. 5d., as the Commissioners' share of the costs of repairing the parish churches. Both parishes are purely rural. Neither of them is within ten miles of Dundee; and in neither of them do the Dundee Water Commissioners earn any revenue. The imposition, as I would call it, is made on the ground that the Commissioners' main-pipe from Lintrathen to Dundee passes through the parishes. The Clerk to the Commissioners stated his opinion that they were not liable; and he was instructed to reply to the claimants, denying liability.

South Staffordshire Water-Works Company.—At the meeting of the Directors of this Company, last Thursday, it was resolved (subject to the examination of the accounts by the Auditors) to recommend to the proprietors the declaration of a dividend for the half year ending Dec. 31 last, on the ordinary stock at the rate of 5½ per cent. per annum, less income-tax. This will leave a balance to be carried forward amounting to £3531, after appropriating a further sum of £1000 for the depreciation fund, which now stands at £5186.

Accident at the Wolverhampton Gas-Works.—Shortly after eleven o'clock last Thursday night an alarm was occasioned at the Stafford Road Gas-Works, Wolverhampton, by the bursting of a main. At the time of the occurrence, the retorts were being drawn; and the gas immediately ignited, causing a tremendous sheet of fire. The workmen, fearing an explosion, rushed out of the works into the street; and the alarm became so great that the inhabitants in the vicinity were afraid to go to bed. After the flames had somewhat subsided, the men again resumed work, and put out the retorts which were in close proximity to the damaged main.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, Jan. 30.

Sulphate of Ammonia.—Notwithstanding reports to the contrary, the market remains perfectly steady; and it is certainly an undisputed fact that every parcel offering has been rapidly bought up, by either consumer or speculator. Hull quotations remain at £10 12s. 6d.; at Leith, business has been done at £10 11s. 3d.; Liverpool quotations are a little lower for ordinary quality (£10 10s.); but superior high-testing makes have realized extreme prices, being required for Colonial orders. A habit has grown up to predict at the close of each month lower prices for the succeeding month. But it has been seen that this statement is rarely reasonably supported, nor does this prophecy always prove true; and an unprejudiced spectator must certainly take a contrary view at the present moment, as there seems barely enough sulphate, as far as the country generally is concerned, to supply the demand, and very heavy shipments continue to be made. With a continuance of the present mild weather, the demand will set in more sharply presently; and it may therefore be expected that prices will harden before we get very far into February. Nitrate is firm; but last week's prices can hardly be realized. It can be bought on spot at 9s. 6d. per ton.

LONDON, Jan. 30.

Tar Products.—Values continue much the same as last week, although in benzol there is a better feeling. Pitch, on the other hand, is not quite so firm. Anthracene is lifeless, with but little prospect of improvement, as buyers seem to have covered pretty well their requirements. Creosote and oils remain very dull; and, in many districts, they form now a cheaper source of fuel than coal. Prices are: Tar, 19s. Pitch, 33s. 6d. Benzol, 90 per cent. 2s. 3d.; 50 per cent., 1s. 8½d. Toluol, 1s. 4d. Solvent naphtha, 1s. 2d. Crude benzol naphtha, 30 per cent., 11d. Creosote, 1d. Crude naphthalene, 35s. Crude carbolic, 60s. 1s. 1½d.; Crystals, 5½d. Cresol, 8½d. Anthracene, 30 per cent. (nominal), "A" quality, 1s.; "B," quality, 8½d.

Sulphate of Ammonia is stronger, and £10 10s. to £10 12s. 6d., less 3½ per cent., is easily realizable for forward delivery. Gas liquor (10 oz.) is quoted at 6s. 9d. to 8s. 3d. per ton, according to position.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—During the past week there has been a pretty general quietening down in the demand for nearly all descriptions of fuel, especially for the better qualities, suitable for house-fire purposes; but there is still no pressure of surplus supplies upon the market, which to some extent is probably due to the restriction of the output owing to the very indifferent manner in which the miners are working at many of the pits. Prices have been steadily maintained at about late rates. For house-fire coals quotations remain firm, at 12s. 6d. for best Wigan Arley coals; 10s. 6d. to 11s., for Pemberton four feet and second qualities of Arley; and 9s. to 9s. 6d., for common house-fire coals. The lower descriptions of round coal are in fairly active demand for shipment; and good ordinary steam qualities have been readily fetching 10s. 6d. to 11s. per ton delivered at the ports on the Mersey. Inland requirements, for iron-making, steam, and general manufacturing purposes, continue only moderate, and supplies are becoming more plentiful; although quotations are not yet appreciably affected, and at the pit mouth remain at about 8s. to 8s. 6d. per ton for good qualities of steam and forge coals. The better descriptions of engine fuel still meet with a ready sale, and colliery proprietors have no difficulty in disposing of their present production. But common sorts are again beginning to hang upon the market; and though the recent improvement in prices is still being firmly maintained, there is not quite so firm a tone. At the pit mouth, burgy ranges from 6s. and 6s. 6d. for ordinary qualities, up to 7s. for some special sorts; best slack, 5s. to 5s. 6d.; medium, 4s. 3d. to 4s. 9d.; and common sorts, about 3s. 3d. to 3s. 9d. per ton.

Northern Coal Trade.—The coal trade has been very dull during the last few days; but doubt as to the future of the working at some Durham collieries is causing consumers to increase stocks of late. Northumbrian steam coals are rather slow of sale at about 10s. per ton free on board, up to 10s. 3d. Small steam coals are also extremely quiet, at from 3s. 3d. to 4s. per ton, according to quality, &c. Some of the collieries have had of late a few days' idle time; and the prices have been lowered to obtain more orders. For gas coals the demand is very good, for the reason named. The price varies from 9s. to 9s. 6d. per ton, free on board, with a very full production, which is well taken up just now. Household coals are dull and weak, owing to the lower prices ruling in the London market. For bunker coals, the inquiry is lower, and the price weaker—at from 8s. for unscreened upwards. Manufacturing coal is dull; and the demand is less on account of local strikes. For best blast-furnace coke, there is a good demand, at from 16s. up to 16s. 6d. per ton, free on board. Gas coke, however, is very dull just now; and with a large output, the consumption is lessened by strikes at cement and other works.

West of Scotland.—There is no material change to report in regard to the coal trade in the West of Scotland; the demand being about equal to the production. For forward delivery there is little business passing. Coal-masters are not seemingly disposed to meet buyers, who are holding back in anticipation of a fall in price. At current rates, however, they are willing to do business. Dross is easier; the supplies being plentiful, especially for the commoner sorts. The bulk of the trade is of a hand-to-mouth kind, at the following rates: Main, 8s.; ell, 8s. 9d. to 9s.; splint, 9s. 3d.; and steam, 10s. 6d. to 10s. 9d.—all f.o.b. Glasgow. The shipments of Scotch coal for the past week amounted to 117,996 tons, an increase of 55,218 tons over those of the corresponding week last year; but traffic at that time continued in a very dislocated state, owing to the railway servants being on strike. For the portion of the year now gone the exports amount to 318,898 tons—an increase of 127,393 over those of the same period of last year.

Electric Lighting in Liverpool.—The Liverpool Electric Supply Company, Limited, recently desired the consent of the Corporation to an application they are making for a Provisional Order, which would empower them to allow certain concessions to consumers, and more especially to enable them to reduce the prices at present charged for the electric light. Their request was supported by a very influential memorial, which was signed by the principal local firms and the representatives of the insurance and banking companies. The subject has been fully considered by the Corporation Watch Committee, who had before them a report specially prepared by the City Engineer; and it was resolved to recommend the Council not to accede to the request, on the ground that the change was not desirable in the interests of the ratepayers.

Softening the Water Supply at St. Helens.—The St. Helens Corporation Water Committee last Tuesday week accepted the tender of Mr. J. Whittaker, of Sutton, for the buildings, and of Messrs. Woodhouse and Rawson, of Kidsgrove, for the ironwork in connection with a scheme for softening the borough water supply. The buildings and plant will be erected on land adjoining the Brownedge reservoir; and the water from Collins Green, Knowsley, and Kirkby will there be treated with lime water, for the purpose of removing the bi-carbonate of lime and iron, which at present make it hard. The water from Eccleston Hill and Whiston pumping-stations is already considered soft enough. The process to be adopted has been already sanctioned by the Council. The cost will be about £10,000; and it is expected the system will be in operation before the end of the year.

Purification of Water by Electricity.—Dr. Fermi, of Munich, has been testing Mr. Webster's method of purifying water by electricity. The dissolved organic substances are reduced about one-half, and the suspended substances are either precipitated to the bottom by the ferric hydrate formed on the surface of the iron electrodes, or gather on the surface of the water. The smell of the water is also perceptibly improved. After detailing the process and explaining the chemical action that arises during purification, Dr. Fermi says the organic substances contained in a litre of water can be reduced by two-thirds in an hour by an electric current of 0.5 to 1.9 amperes, with flat iron electrodes 80 square centimetres and 5 centimetres apart. The number of germs is thus diminished fifty or a hundred fold. The purifying effect of such current, however, is less reliable than that of the addition of 1 per cent. of lime, which completely frees the water of germs, and keeps it free; whereas in the electrified water the germs multiply again fivefold in 48 hours.

Saratov Water-Works Company, Limited.—The seventeenth annual general meeting of this Company was held last Tuesday, at the London Offices, King's Arms Yard, E.C., under the presidency of Mr. J. Morris. The Chairman proposed the adoption of the report and accounts, and said the Board were very much disappointed at the slow progress things were making in Russia, which was suffering now not only from the severe depression, but from a terrible famine. A deplorable state of things was reported by their Manager. He said the Company had great difficulty to contend with, owing to the hostility of the local authorities, whom he described as obstructive and litigious. The Directors were determined not to spend any more capital in the country, except on equitable terms; but they hoped eventually to see an improved state of things. Out of the year's revenue, the Directors proposed to pay 1½ per cent. on the ordinary shares. The £300 of debentures were paid off in February last; and the Company were now free from debenture debt. Mr. H. Kimber, M.P., seconded the motion, and it was carried.

Water Supplies in Mexico.—One of the great drawbacks to Pachuca City has always been its insufficient water supply. The city has a population of 38,000, and yet up to the present the only available way it possesses for obtaining water is by means of an old aqueduct constructed of masonry. As a consequence, the inhabitants in the dry season have to pay 15c. for a cantaro, or 18 litres, of water. For some time past endeavours have been made to obtain a better service of water. As a result a huge reservoir dam has recently been constructed, which has a capacity of 82 million gallons. A concession for bringing this water in Pachuca was originally granted to Messrs. Napoleon Valdez and Benito Marin, who ceded their rights to Mr. R. Honey, and he constructed the reservoir at a cost of \$60,000. This gentleman has recently formed a company in Mexico to carry out the scheme; and the first meeting has been held for the purposes of constituting the concern and of electing Directors. The capital is \$250,000, divided into 1000 founders' shares and 4000 ordinary shares; and all have been applied for and allotted.

The Lead-Poisoning Inquiry by the Local Government Board.—Mr. W. H. Power, Dr. Barry, and Mr. T. W. Thompson, the authorities selected by the Medical Department of the Local Government Board to inquire into the question of the action of certain waters upon lead, have, since their appointment in October, 1890, collected a considerable amount of information on the subject from a large area of Yorkshire and Lancashire. This information applies to moorland waters which act upon lead, and also to similar waters not known so to act; and with this basis of procedure, a beginning is about to be made of the detailed investigation which has been contemplated by the Board. In this it is proposed "to select a number of different gathering grounds, furnishing some of them water which acts, some of them water which does not act, on lead; definite and limited areas wherein are found the two sorts of water common in moorland regions—viz., water issuing from springs in the soil, and rain-fall water accumulating in, or flowing over, or through, the peat substance—with a view to subjecting certain local circumstances of each selected area to systematic observation; and for the purpose of obtaining therefrom at regular intervals samples of the different sorts of water for testing as to differences and variations in their chemical and biological characters, and in their lead-dissolving properties." The portion quoted is an extract from a communication addressed by Mr. Power to Dr. Whitelegge, Medical Officer of the West Riding County Council, appealing for his help in the laboratory investigations that are to be made after weekly visits to the gathering-ground and the collection of samples. The County Council have, in response, voted £100 towards the laboratory expenses.

New Water-Works for Duffield.—For some months past the Duffield parish authorities have been engaged in the work of supplementing the present water supply. A spring has been procured at Handley, belonging to the Duke of Devonshire; and tenders have been sent in for constructing the reservoir, laying the mains, and the other incidental operations. The Local Committee held a meeting last Friday week, and accepted contracts amounting to £2663. The Belper Rural Sanitary Authority confirmed their proceedings on Saturday; and the work will commence forthwith. The Engineer is Mr. W. H. Radford, of Nottingham.

The Electric Fires in Liverpool.—Regarding the paragraphs which have appeared in our last two issues on this subject, it appears, from a report submitted by the City Engineer to the Health Committee of the Liverpool Corporation last Thursday, that the fires were due to imperfect insulation of the main wires near the boxes laid in the pavements by the Electric Supply Company. There are 700 of these boxes; but at only two of them has there been any accident. The City Engineer expressed his intention of conferring with the Company's Engineer, to see if some means could be taken to prevent any further mishaps.

The Water Supply of Bridgnorth.—In the course of a discussion on the water supply at the last monthly meeting of the Bridgnorth Town Council, Mr. Beach drew attention to the new water scheme of the Birmingham Corporation, and pointed out that the mains from Wales would run through the district. The Corporation would be willing to supply water to the district the pipes passed through; and Worcester and Bewdley had made application for a supply. The mains would come within 10 miles of Bridgnorth; and it would cost about £5000 to construct a line of pipes to the town. Mr. Morrall suggested that a practical engineer should go over the district before considering the Birmingham scheme. He thought the charge for the supply of water by Birmingham would be permanent; while the Cridden supply after a few years would be self-supporting. Mr. Beach then proposed—"That the Town Clerk be instructed to communicate with Birmingham, Worcester, Bewdley, and Wenlock with regard to the probable cost of supplying the town with water." Mr. Morrall seconded the resolution, which, after further discussion, was carried unanimously.

Sales of Shares.—At Sheffield last Wednesday, Messrs. W. Bush and Son sold by auction 960 "D" £6 shares in the *Sheffield Gas Company*, with £1 4s. per share paid up, and a call of £1 due on the 1st inst. There were a large number of buyers present. The result of the sale was as follows: Forty of the shares sold at £6 5s. each; 90, at £6 7s. 6d.; 270, at £6 10s.; 60, at £6 12s. 6d.; 30, at £6 15s.; 30, at £6 17s.; 30, at £7 1s.; 30, at £7 4s.; 30, at £7 5s.; 90, at £7; 90, at £7 2s. 6d.; 60, at £7 1s.; 20, at £7 3s.; 14, at £7 4s.; 16, at £7; 30, at £7 2s.; and 30, at £7 1s.—the total amount realized being £6503 16s.—At a recent sale, £250 stock in the *Victoria Newmarket Gas Company, Limited*, on which the dividend last year was at the rate of 11 per cent., realized £600. The stock was put up in ten lots, all of which were secured by the Chairman of the Company (Mr. R. Stephenson).—In accordance with an announcement which appeared in the *JOURNAL* a few weeks since, 300 £15 new ordinary (7 per cent.) shares in the *Cirencester Gas Company, Limited*, were sold by auction by Messrs. Moore and Hill on the 18th ult.; 205 of them fetching £20 7s. 6d. each, and the remainder selling for £20 10s. each. The total amount realized by the sale was £6124 7s. 6d., for shares of the nominal value of £4500.

Claim by Messrs. Lupton and Sturgeon against the Leeds Corporation Water Committee.—At a special meeting of the Leeds Corporation Water-Works Committee last Friday, a matter of some importance and interest with regard to the Blackmoor Tunnel came up for consideration. In April of last year, Messrs. Lupton and Sturgeon wrote to the Corporation making a claim for 2½ per cent. commission on the contract price of the work of constructing the Blackmoor tunnel, for which they, in common with other engineers, submitted a scheme, which they alleged had been substantially carried out. The contract price, they understood, was £21,000; their claim consequently being for £525. On Friday, the matter again came before the Committee; a communication referring to the subject being read from Mr. E. B. Lupton, Solicitor to Messrs. Lupton and Sturgeon. It appeared that the firm were willing to have the dispute referred to arbitration; but if the Corporation would not agree to this amicable arrangement, they were prepared to support their claim by legal proceedings. The Committee decided that an acknowledgment of the receipt of the communication should be sent, and that Messrs. Lupton and Sturgeon should be informed, through their Solicitor, that the Committee declined to recognize any liability in the matter, and that they were prepared to accept service in any proceedings which Messrs. Lupton and Sturgeon might think fit to institute.

The Abergele and Rhyl Water Bills.—At the meeting of the Abergele Local Board yesterday week, the Clerk (Mr. J. W. Davies) read a communication from the Rhyl Improvement Commissioners, enclosing a resolution passed by that body in reference to the water supply of Abergele, and asking that, in consideration of certain clauses inserted in the Commissioners' Bill for ensuring a constant supply of water at constant pressure, the Board would withdraw their Bill; the Commissioners undertaking to pay all costs (not to exceed £100) already incurred in promoting it, and the Board to assist them in getting their Bill passed and to oppose that of the Rhyl Water Company. The Clerk said that, if the Rhyl Commissioners had intimated to them, before they had proceeded to take the steps they had done in introducing a Bill of their own, what they were now going to do, the Board, he could safely say, would have adopted the proposals, and not incurred the expense they had done. Immediately the Commissioners found that the Board were perfectly serious in their intention to promote a Bill of their own, they at once came to amicable arrangements; and he thought that the terms offered were very fair. Mr. Williams proposed that the Board withdraw their Bill from Parliament, and undertake to assist the Commissioners to pass their Bill. The Rev. D. Evans seconded the resolution, which was carried unanimously. It was also decided to oppose the Bill of the Water Company.

Gas at the Tasmanian Exhibition.—One of Sugg's patent flat-flame shadowless lamps, developing an effective illuminating power of 700 candles, has been fixed at the entrance to the Tasmanian Exhibition at Launceston, where it is doing satisfactory duty.

Brentford Gas Company.—The Directors of this Company state that the balance to the credit of the net revenue account will enable them to recommend dividends for the past half year at the rates of 5 12½, and 9½ per cent. per annum.

The Gas Exhibition and Cookery Lectures at Sheffield.—The exhibition of gas appliances, with demonstrations in cookery, which, Messrs. Richmond and Co., Limited, of Warrington and London, lately, opened, in conjunction with the Gas Company, in the Music Hall Sheffield, has been so successful (a large number of people being unable to gain admittance) that it has been arranged to hold another exhibition the first fortnight in May. Since this exhibition was noticed last week, we learn that the number of gas-stoves out on hire in Sheffield is upwards of 1200.

Fatal Accident at the Formby Gas-Works.—At Bootle yesterday week, the Deputy County Coroner (Mr. W. T. Husband) held an inquest touching the death of Owen Donohue, who had been engaged as a labourer at the Formby Gas-Works. It appeared from the evidence that on Jan 14 deceased was employed with two other men in deepening and widening a drain which ran along a wall. They had gone about a foot below the foundation of the wall, which was built on a sandy ground, but thought there was no danger of its falling. About ten o'clock the wall fell in; and the deceased and another man named Bradshaw were so seriously injured that they had to be conveyed to the Bootle Hospital, where Donohue succumbed on the 21st ult. The jury returned a verdict of "Accidental death," expressing the opinion that there should have been some official present to see that the wall was properly supported.

Electric Lighting Questions in Belgium.—We learn from a Brussels correspondent that the question of establishing a central electric light station for the supply of the city, to which several references have been made in our columns, is likely to come before the Municipal Council shortly in something approaching a definite shape. In response to the invitations sent out a few months ago, six tenders have been submitted, and they are now under examination by the Electric Lighting Department, of which M. Wybauw, who formerly superintended the distribution of gas, is chief. This work is nearly complete; only a few particulars, which the firms tendering have been requested to furnish without delay, being needed. The idea entertained by the Administration is that the first installation of plant at the central station should be equal to the supply of 10,000 lamps in winter and 5000 in summer. In addition to these, 80 arc lamps would be required for the lighting of the Park, and 120 lamps for the boulevards. This project matures very slowly; but our correspondent says there is reason for hoping to see the capital of Belgium lighted by electricity before the end of the century. In Antwerp also there is an electric lighting scheme on foot; but it seems that the new Company who are promoting it will find some difficulty in making headway in face of the opposition they will encounter from the two Companies who now have the monopoly of the public lighting and the supply of water. The Imperial Continental Gas Association will, our correspondent says, assuredly not agree to give up any of their rights unless they are granted an extension of their concession; and this will be vigorously opposed by certain members of the Municipal Council. Instead of distributing electricity direct, which is a costly and rather difficult undertaking, M. Van Rysselberghe will send out motive power (in the shape of water), and produce the electricity at the place of consumption. This new water service could, he suggests, be utilized for industrial purposes; and it is stated that the system reduces the cost of an electric light to 3.5c. per hour—that of gas being actually 4.5c.

The Scotch Mineral Oil Companies.—A new arrangement which has been come to between the Scotch and the American Oil Companies as to the output and price of paraffin scale, has been welcomed by the shareholders of the Scotch Companies, although it means a reduction in their output of last year by 10 per cent. According to a Scotch contemporary, the capital in the Scotch oil industry is about £2,500,000. Almost the whole of the shares are held in Scotland, and a great proportion of them by small investors. The market for oil shares has always been more or less speculative, and liable at times to violent fluctuations. Since the establishment of the industry 40 years ago, quite as much money has been lost beyond recall in oil companies as is now invested in them. At first it was the production of oil for burning—the paraffin of commerce—which was the object of enterprise. When, with the flood of American petroleum, the making of burning oil ceased to be profitable in itself, it became an incident in the manufacture of various oils for machinery purposes, of sulphate of ammonia, and of paraffin wax, or "scale." The industry picked up again as these products were developed, but received another blow when American lubricating oils began to flood the kingdom and the Continent, as petroleum had already done. Relief this time was found in the increased output of sulphate of ammonia from the waste liquids. Some ten years ago this fertilizer was selling at about £20 a ton; and, on an estimated product of about 13,000 tons per annum, this meant a new source of income of about £260,000 per annum. This was an advantage which the American competitors did not possess; and it is one of the compensations which Scotch makers enjoy in distilling from shale instead of gathering in from spouting wells. But from £20, sulphate of ammonia receded, before the increasing imports of nitrate of soda and from other causes, to about £10. The Scotch Companies next found compensation in the steadily-growing demand for solid paraffin. The entire consumption of Europe five years ago was 35,000 tons; and last year it increased to 52,300 tons. Of this quantity, Scotland provided about one-half—say, 25,000 tons; and it is upon this product that the existence of the industry now practically depends. Under the new arrangement, this output is to be reduced by 10 per cent.; and the Standard Oil Company are to send an additional 5600 tons this year to the Continent. As the American production of scale is expected to increase very largely, the difficulty will necessarily arise again at some future date.

Fatal Accident at the South Shields Gas-Works.—A sad accident occurred at the Jarrow Gas-Works last Saturday. A man attempted to pass between two shafts of cranes while they were running, and was caught by the loose jacket he was wearing, and killed on the spot; being dreadfully torn and mangled. A Coroner's inquest was held yesterday, when a verdict of "Accidental death" was returned.

Barcelona (Besos) Water-Works Company.—A Company under this title has been registered with a capital of £100,000, in £20 shares, to acquire the undertaking of the Spanish Company known as the Compania General Anonima de Aguas de Barcelona ladera derecha del Besos, with all its rights and privileges; to extend and complete the water and irrigation works, and to maintain and work them; and generally to carry on all the business of a water-works, land drainage, and irrigation company, either in the City of Barcelona or the adjacent country.

The Quality of the Metropolitan Water Supply in December.—Messrs. Crookes, Odling, and Tidy, in the course of their report to the Official Water Examiner for the Metropolis (General A. de Courcy Scott) on the quality of the water supplied by the London Water Companies during the month of December last, as shown by samples taken daily for analysis, say: "Of the 166 samples examined, 160 were found to be clear, bright, and efficiently filtered. Four were recorded as slightly turbid; two as very slightly turbid. Although the generally turbid and flooded condition of the rivers throughout November was appreciably exceeded during the following month by reason of the heavy rainfall, the state of the December water supply showed upon the whole a distinct improvement. Thus, taking the Thames-derived supply for comparison, the mean degree of colour-tint was found to be reduced from 22.1 : 20 to 18.7 : 20; the mean amount of oxygen expended in oxidation, from 0.101 grain per gallon to 0.079 grain; the mean amount of organic carbon, from 0.250 to 0.240 part in 100,000 parts; and the maximum amount of organic carbon in any single sample examined, from 0.391 part to 0.319 part. Similarly, in the case of the New River and East London Companies' supplies for the two months respectively, the results obtained during December showed a similar improvement over those recorded in our previous month's report."

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 193.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Invest. ment.
£			p. c.					£ s. d.
GAS COMPANIES.								
590,000	10	15 Oct.	10½	Allance & Dublin 10 p. c.	10	16-17	..	6 3 0
100,000	10	"	7½	Do. 7 p. c.	10	11½-12½	..	6 0 0
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105-107	..	4 13 5
100,000	20	27 Nov.	8	Bahia, Limited	20	12-14	..	11 8 0
200,000	5	12 Nov.	7½	Bombay, Limited	5	6½-7	..	5 7 1
40,000	5	"	7½	Do. New	4	4½-5½	..	5 14 1
380,000	Stock	13 Aug.	12½	Brentford Consolidated . .	100	210-220	..	5 11 4
125,000	"	"	9½	Do. New	100	157-162	..	5 14 2
220,000	20	16 Sept	11½	Brighton & Hove Original .	20	40-42	..	5 9 6
888,500	Stock	16 Sept.	5	Bristol	100	98-103	..	4 17 1
320,000	20	15 Oct.	11½	British	20	43-45	+1	5 0 0
50,000	10	28 Aug.	11½	Bromley, Ordinary 10 p. c.	10	18-20	..	5 15 0
50,380	10	"	8½	Do. 7 p. c.	10	13-15	..	5 13 4
328,750	10	"	—	Buenos Ayres (New) Limited	10	5½-6½	—½	—
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	93-96	..	6 5 0
150,000	20	13 Aug.	8	Cagliari, Limited	20	25-27	..	5 18 0
550,000	Stock	15 Oct.	13½	Commercial, Old Stock . .	100	240-250	..	5 10 0
165,000	"	"	10½	Do. New do.	100	190-195	..	5 10 3
130,000	"	30 Dec.	4½	Do. 4½ p. c. Deb. do.	100	117-122	..	3 13 9
800,000	Stock	30 Dec.	13	Continental Union, Limited.	100	225-230	+2½	5 13 0
200,000	"	"	10	Do. 7 p. c. Pref.	100	185-195	..	5 2 7
75,000	Stock	16 Sept.	10	Crystal Palace District . .	100	190-200	..	5 0 0
486,090	10	29 Jan.	10	European, Limited	10	19-20*	+1	5 0 0
354,060	10	"	10	Do. Partly paid	7½	14-15*	+¾	5 0 0
5,470,820	Stock	13 Aug.	12½	Gaslight & Coke, A. Ordinary	100	219-224	+3	5 7 1
100,000	"	"	4	Do. B, 4 p. c. max.	100	95-98	..	4 1 7
665,000	"	"	10	Do. C, D, & E, 10 p. c. Pf.	100	248-253	..	3 19 1
30,000	"	"	5	Do. F, 5 p. c. Pf.	100	118-123	..	4 1 4
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	172-177	..	4 4 9
1,300,000	"	"	7	Do. H, 7 p. c. max.	100	152-157	..	4 9 2
463,000	"	"	10	Do. J, 10 p. c. Pf.	100	245-250	..	4 0 0
476,000	"	"	—	Do. K, 6 p. c. Pf.	100	147-152	..	3 18 1
1,061,150	"	11 Dec.	4	Do. 4 p. c. Deb. Stk. . . .	100	110-114	..	3 10 2
294,850	"	"	4½	Do. 4½ p. c. do.	100	118-123	..	3 13 2
908,000	"	"	6	Do. 6 p. c. do.	100	160-165	..	3 12 9
3,800,000	Stock	12 Nov.	12	Imperial Continental . . .	100	223-228	-1	5 5 3
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4-4½	..	6 13 4
560,000	100	1 Oct.	5	Met. of Melbourne, sp. c. Deb.	100	109-111	..	4 10 1
541,920	20	27 Nov.	6½	Monte Video, Limited. . .	20	15-16	..	8 2 6
150,000	5	27 Nov.	10	Oriental, Limited	5	8½-9	..	5 11 1
60,000	5	30 Sept.	7	Ottoman, Limited	5	4-5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited.	10	2½-3½	..	—
People's Gas of Chicago—								
420,000	100	3 Nov.	6	1st Mtg. Bds.	100	98-102	..	5 17 8
500,000	100	1 Dec.	6	2nd Do.	100	98-102	..	5 17 8
150,000	10	15 Oct.	10	San Paulo, Limited	10	10-11	..	9 1 10
500,000	Stock	28 Aug.	15½	South Metropolitan, A Stock	100	270-275	+2½	5 12 9
1,350,000	"	"	12	Do. B do.	100	222-227	..	5 5 8
200,000	"	"	13	Do. C do.	100	235-240	+2½	5 8 4
700,000	"	30 Dec.	5	Do. 5 p. c. Deb. Stk. . . .	100	138-143	..	3 10 0
600,000	Stock	16 Sept.	11½	Tottenham & Edm'nton, Orig.	100	—	..	—
WATER COMPANIES.								
729,331	Stock	30 Dec.	10	Chelsea, Ordinary	100	256-261	-4	3 16 7
1,720,560	Stock	15 Oct.	8	East London, Ordinary . .	100	204-209	-2	3 16 7
544,440	"	30 Dec.	4½	Do. 4½ p. c. Deb. Stk. . .	100	136-140	..	3 4 3
700,000	50	11 Dec.	8	Grand Junction	50	101-106	..	3 15 6
708,000	Stock	13 Aug.	10½	Kent	100	268-273	..	3 10 11
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max. . .	100	225-235	..	4 0 10
406,200	100	"	7½	Do. 7½ p. c. max.	100	185-194	..	3 17 4
260,000	Stock	30 Sept.	4	Do. 4 p. c. Deb. Stk. . . .	100	120-123	..	3 5 0
500,000	100	13 Aug.	12½	New River, New Shares . .	100	335-345	..	3 20 4
1,000,000	Stock	29 Jan.	4	Do. 4 p. c. Deb. Stk. . . .	100	123-126*	+½	3 3 6
902,300	Stock	30 Dec.	6½	S'thwk & V'xhall, 10 p. c. max.	100	147-152	-2	4 5 6
126,500	100	"	6½	Do. D 7½ p. c. do. . . .	100	140-145	..	4 9 8
1,155,066	Stock	11 Dec.	10	West Middlesex.	100	245-255	..	3 18 5
*Ex div.								

† Next dividend will be at this rate.

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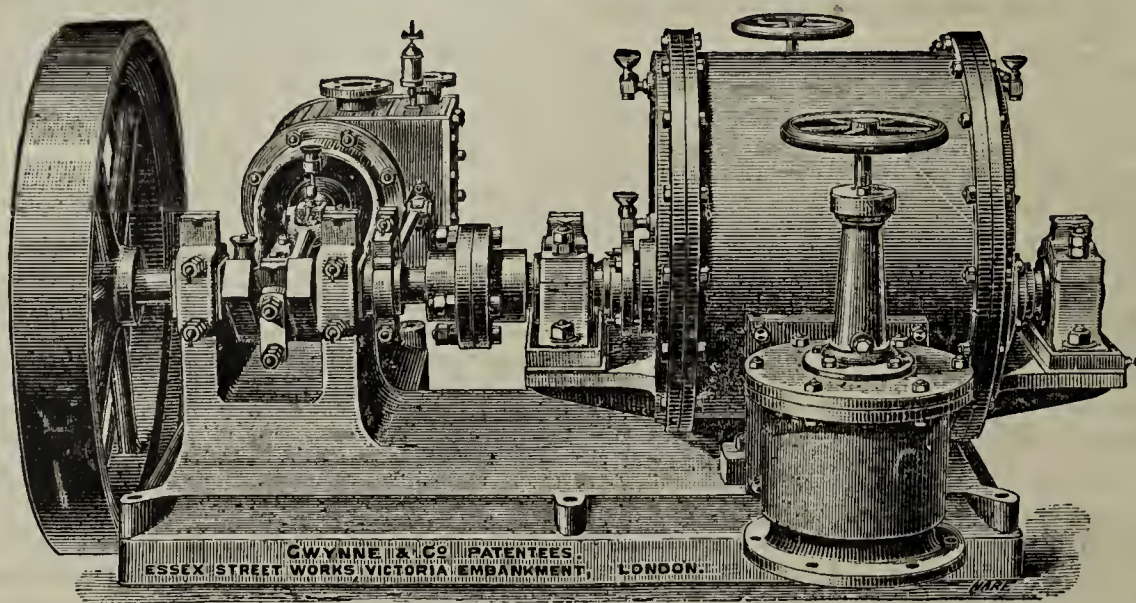
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This Work (which is a continuation of that published in 1879 by the late Mr. G. W. Stevenson) contains information as to the practice of Parliament during the past twelve years, in regard to most of the points on which differences arise in Opposed Bills for Gas and Water Undertakings. The greatest care has been taken in its compilation; and it is arranged in a very handy form.

* * The Work by the late Mr. G. W. Stevenson is still on sale, price One Guinea.

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THE

JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, FEBRUARY 9, 1892.

The Chartered Meeting.

THE meeting of The Gaslight and Coke Company on Friday last had been looked forward to with much interest; and the event justified all the anticipations. The attendance was considerably larger than usual, and included most of those shareholders who have on previous occasions figured as critics of the management of the Company. Colonel Makins, M.P., presided, supported as usual by his faithful Deputy and prompter, Mr. H. C. Ward, on his right hand, and by Mr. J. Orwell Phillips, the Secretary and General Manager, on his left. The Governor lost no time in broaching the main business; and within two minutes of the hour stated for convening the meeting, he was valiantly, yet somewhat nervously, as it seemed, grappling with the figures of the capital account.

He went to work conscientiously; and all that he said with regard to the apportionment of capital expenditure, and the circumstances of the Company's business, was very much to the point. He borrowed from the electricians the term "load factor," to explain the nature of the strain that comes upon a gas undertaking during times of fog; and he had evidently taken pains to post himself with the necessary material for proving that the Chartered arrangements in this regard are as nearly perfect as can be expected. From this point he travelled into the revenue account, and denied, as in duty bound, that there had been any mismanagement of the Company's affairs, or that "a single £5 note" could have been economized anywhere in their business. He then gave some interesting and important information respecting the effect of the progress of electric lighting upon the rental. On the subject of staff changes, Colonel Makins spoke very kindly of Mr. G. C. Trewby, whom he described as the "Engineer-in-Chief," and explained the arrangement whereby the Board have become the head of the Executive. He made little of the rise in price; and he sat down with a general appearance of having talked himself into a belief that the accounts and the position of the Company are something for a Chairman to be proud of. If this had been his idea, he was very speedily undeceived; for the next quarter of an hour must have been a particularly bad one for the Board and their advisers on the platform. First Sir F. Mappin, and then Mr. G. Livesey tore the thin veil of complacency from the unfortunate Governor; and before the meeting rose, words were said that will echo in the Horseferry Road for many a day. It is not our intention to paraphrase the attack and defence in which the speakers of Friday last took part. Our report stands upon record; and every reader can see for himself where the advantage of the controversy lay. Heavy as the onslaught was, however, and unjustified as was the gay optimism of the Governor's speech, we cannot leave this part of the subject without expressing great admiration of the adroitness of Colonel Makins when driven to bay by his opponents. If his speech was uneasily laboured, and the worst things were slurred over, the Governor was really admirable later on as a verbal fencer. So long as the state of the Chartered organization needs a plausible defender, Colonel Makins is the man for the part; and probably if he knew as much about gas making as he does of the art of parrying a home thrust during a debate, or hitting the weak places in an adversary's indictment, there would be little occasion for displays of the latter kind of dexterity.

Colonel Makins had something to say about the journalistic criticism to which the Chartered Board are subjected; and he was so exceedingly candid and genial in his acknowledgments of the office of this kind of criticism, that we take leave to explain the position in which the JOURNAL stands. We are evidently included, in Colonel Makins's estimation, in that "Opposition" which were good-humouredly asserted to have a habit of "smiting the Board over the head and ears" before the accounts are issued. This complaint must have referred to the article which appeared in these columns upon the increase in the price of gas and the declaration of the 12 per cent. dividend. With regard to the other criticisms of the Chartered Board which have been published in our financial contemporary *Money*, of course our responsibility is limited to that of having reproduced them. We might, however, if it had been a case of throwing any stone at the Board, have repeated all the newspaper abuse of their policy and position which has circulated through London during the past few weeks. If we are for the time being "in opposition" to the Chartered Board, is it too much to ask Colonel Makins and his colleagues to put themselves in our place to the extent of seeing things as we see them, and as they appear to most observers outside the magic circle of the Horseferry Road Administration? Why are independent technical and financial organs of opinion, which cannot be imagined to have any interest in attacking a particular Gas Company, compelled to say unpleasant things of the Chartered magnates? Simply because, tested in any way that lies open for the purpose, the results of their management do not reflect credit upon the responsible heads of the concern, whoever they may be. Hostile criticism, when deserved, is very much more friendly to the management of a gas undertaking than any amount of adulation. We might join in the pæan in praise of bigness which is so constantly raised

at the Horseferry Road, and dilate as fervently as others upon the magnitude of the Chartered Company's transactions; but what would be the good of it? When the vestrymen and county councillors and other customers of the Company meet together in their public, or write to the newspapers in their private capacity, complaining of the high price of gas in the Chartered district, do they care how many hundreds of thousands of pounds their collective gas bills amount to? Not they; it is the individual pocket that feels what is called the "extortion" of the Gas Company. And so, when we criticize the Chartered management, we do so just as though it were the management of any other Gas Company.

Colonel Makins says, when he is asked why the Chartered working does not compare well in any particular with that of another Gas Company, "You must not judge us by that." Yet when he wants to excuse the rise in price, he can descend to the example of Cambridge; and he is not above twitting Sir F. Mappin with the alleged unfavourable returns for sulphate of the Sheffield Company. Without unduly elaborating this point, however, the graveness of our complaint of the Chartered Administration is that they fail to realize the seriousness of the position in which the Company actually stands. It is not a question of what the accounts for any one half year show, but of whither the Administration are drifting. They have acted, to all appearances, too lightly in the matter of the last advance in price. Of course, they are legally entitled to put up the rate; and they can go to 3s. 9d. per 1000 cubic feet if they like, without incurring any immediate risk to their 10 per cent. dividend. Colonel Makins remarks, with some unction, that "12 per cent. is not a bad rate of dividend, as times go;" neither is 10, when it comes to that, or 9, or even 8 per cent. But has it never occurred to the Chartered Board that, although things may be lawful, it does not follow that they are expedient? The only consideration that seems to have operated in the minds of the Directors is the "brutal fact," as the French say, that they can at any time square their revenue account by the simple expedient of putting up the price of gas. Where is the evidence that they have so much as discussed the question whether this advance *ought* to have been necessary? The sliding scale of price and dividend is a great and notable device; but its legalization has been merely experimental. There is no finality about the action of Parliament; and when the sliding scale was sanctioned as a means to an end, the door was not shut to all further parliamentary interference with gas supply, in the event of this particular device proving unsuccessful in procuring the end sought, which was the cheapest possible gas. The rate of dividend received by gas shareholders is quite a secondary consideration in regard to the working of this arrangement; its main benefit is that it enlists the powerful influence of self-interest on the part of the management to aid the process of cheapening gas to the public. Not to put too fine a point upon it, it is obvious that stupidity can baulk even this influence; for the history of the world is full of illustrations of persons and corporations who have been "fools to their own interests." Is this the case of the Chartered Administration? The Governor declared that he could not see where £5 could have been saved; Mr. Livesey stated that £500,000 had been lost because the Chartered management had not been so prudent as that of the Commercial Company. This is assuredly independent criticism; for, if Mr. Livesey had wished to assert himself, he could have quoted from the figures of the South Metropolitan Company. He did nothing of the kind; and therefore his criticism must be faced upon its merits. Nobody accuses the Board of having wilfully consented to the waste of money; but they simply did not see what was going on.

The matter is so urgent, and the importance is so great of redeeming the repute of amalgamation, the sliding scale, and wholesale trading in gas, that we venture to offer the following suggestions to the Chartered Directors in general and to Colonel Makins in particular. A great philosopher once was in the habit of adjuring his pupils to "clear their minds of cant" before attempting to study things aright. In a similar spirit, let the Governor and his colleagues clear their eyes of the Horseferry Road glamour, which would persuade all who submit to it that there is nothing to be amended in that huge and unwieldy

organization over which they preside, like the Gods of a gaseous Olympus. The fact that several of these honourable gentlemen have occupied these serene heights for many years, is all the stronger reason for their being aroused to the sense of what is going on beneath them. Let the capital account be fully investigated first. Has this been wisely treated? Colonel Makins pleads that the capital per ton of coal must be heavy because the undertaking is very old, and the Company once built new works down the river. But just twelve months ago Mr. Livesey reminded the Board that in 1860—long after the early days—the capital of the Company was £5 1s. 6d. per ton; and that since then they have amalgamated with "seven Companies, every one of them being in a better position than their own, with lower capitals, and better able to supply gas." It is not merely old age, therefore, that accounts for the bloated capital of The Gaslight and Coke Company at the time of which Colonel Makins spoke on Friday. Is it Beckton? Surely, the increase in gas consumption, with the extra profit on new business, which enabled the South Metropolitan Company to buy land and build works at East Greenwich without feeling the cost, ought by this time to have liquidated the outlay for Beckton, or this huge establishment must be ranked as a gigantic failure. Then how is it that, even when the contemplated extensions are completed, the storage capacity will only amount to 84 per cent. of the maximum daily output? Speaking at the meeting of the Incorporated Institution of Gas Engineers last May, Mr. C. Hunt remarked that the idea of 80 per cent. of storage being sufficient was long outgrown. How does this statement affect the present question? Insufficient storage is usually held to entail extravagant working; and the figures relating to the "load factor" given by Colonel Makins mean, if anything, that the Chartered district wants more storage capacity than any other in London. Again, how much does the necessity for barging coal to what may be called the inland stations really add to the cost? And when this is allowed for, is there any other reason why the Company's coal should be bought so dear? Once more, what is the rate of output of the works per mouthpiece?

Our contemporary *Money* suggests the holding of an independent inquiry into the working and management of the Company. This is out of the question for the present. The sliding scale is supposed to constitute the Board an efficient and perpetual Investigation Committee; and nobody who remembers the Metropolitan Gas Inquiries of the past can look favourably upon such a means for enforcing good management. It is so very easy to throw dust in the eyes of a Commissioner. On the whole, it is more reasonable to argue that the springs of good management must be internal; and that, where these do not exist, nothing can supply their place. Bit and spur are of no use upon a dead horse. Is it impossible, however, to set Chartered affairs straight upon the existing basis? We do not think so. Supposing that, instead of an outside inquiry, the Governor would create a sort of Departmental Committee charged with this duty, reporting directly to himself. The working members of such a Committee would, of course, need to be independent of Horseferry Road, or their report would merely be a whitewashing of that establishment. Let the inquiry begin at the top, and go right through the organization to the bottom. Let it demonstrate the presence or absence of "log-rolling" among members of the Board and the higher officials, whereby these gentlemen may or may not help one another to directorships and other tit-bits. Let it establish the mutual independence and good faith of all the Company's agents, contractors, and servants. In brief, let Colonel Makins shake off the parts of apologist for the Company and target of criticism, and become the head of the undertaking *de facto* as well as *de jure*, and we promise him that his pains will be amply repaid.

The Report and Accounts of the South Metropolitan Gas Company.

IN another column will be found the report of the Directors of the South Metropolitan Gas Company, which, with the accounts for the past half year, will be presented at the general meeting to be held to-morrow week. The report is very ample; explaining at some length the position and prospects of the undertaking. The full dividend of 13 per cent., permitted under the sliding scale by the selling price

of gas, is to be paid. The money has not, however, all been earned, owing, as the report shows, to poor returns from coke; so that a deficiency of £25,189 has to be made up by the interest on the reserve fund and the profit realized on investments sold, amounting to £8168; and the rest is taken from the reserve. The truth about gas dividends under the sliding scale is told in the report, to correct the common misrepresentation on the score of the imaginary excessive dividends received by the shareholders; and it is pointed out that to reduce the price of gas by 6d. per 1000 cubic feet means giving £160,000 a year to the consumers, and enabling the shareholders to divide £30,000 in the shape of increased dividends. With regard to the accounts, it appears that the total receipts for the past six months amounted to £531,660, as compared with £535,461 for the corresponding half of last year, although the price of gas was raised from 2s. 3d. to 2s. 6d. from Michaelmas last. Gas returned £384,786, as against £359,513; but, as the report admits, coke has been very low, having dropped from £116,708 to £84,145—a loss of £32,563 of revenue, which is worse, after the rate, than the falling off in the returns for coke of The Gaslight and Coke Company. It is known, however, that the Directors have reduced the price of their coke, partly to clear the yards, and partly to force down the price of coal, which they consider to be still unnaturally high. Time will show how much justification there is for this belief, and for the policy which it has inspired. The sales of gas continue to exhibit an increase, notwithstanding the enormous expansion of last year. The advance has been small indeed—not exceeding $5\frac{1}{2}$ million cubic feet; but that the figures should show a balance on this side at all is gratifying. The cost of gas manufacture was brought down to £332,464 from the former amount of £368,315—coal and oil having dropped from £250,557 to £221,903; and the report somewhat maliciously adds the remark that the coal “has been of good quality.” As to the labour, the report is quite jubilant; and well it might be, for the carbonizing wages actually show a reduction from £54,107 to £51,200. This is indeed astonishing, for the times, and works out to little more than 3s. per ton. Some allowance ought probably to be made for the saving in labour due to the use of petroleum spirit to the extent of 136,253 gallons in substitution for cannel; but we do not know what it is. At any rate, the Directors have every reason to be pleased with the result as it stands, while the Gas Workers’ Union are in a different case.

The question of the repair and renewal of stoves and the rental derived from this class of property was raised at the meeting of The Gaslight and Coke Company last week; and as similar criticism might be directed upon the South Metropolitan policy in this regard, perhaps the Chairman (Mr. G. Livesey) may think well to look into the matter, and explain whether gas-stoves are, in his experience, such perishable, undesirable property as is sometimes alleged of them. We confess to entertaining a suspicion that these articles are not quite so durable as might be desired. The report claims that the distributing plant has been put into good order for meeting increased demands from the fast-growing outskirts of the Company’s district. The rate of growth of the population of Clapham, Peckham, and other parts of South London, is truly phenomenal; and as there is not much scope for the enlargement of the Company’s western manufacturing stations, they are compelled to build at East Greenwich. The report accordingly states that another 5 million section is being added to this station, where also a gasholder in five lifts, to contain 12 million cubic feet, is in course of construction. It is remarkable to a student of contemporary gas engineering practice, how the South Metropolitan “goes in,” as it may be said, for gasholders. Would it be a fair distinction to draw between the engineering practice of this and the larger neighbouring Company, to say that one stores gas and the other coal? All these and some other points of interest we may expect to see handled by Mr. Livesey at the forthcoming meeting.

The Judgment in the Chartered Rating Appeal.

JUDGMENT was given yesterday by Sir Peter Edlin, Q.C., Chairman of the County of London Magistrates, at the Sessions House, Clerkenwell, in the great appeal of The Gaslight and Coke Company against their assessment by the City of London and Metropolitan rating authorities. There were 123 respondents; and although these had

united their forces to meet the appellants’ case, their interests were by no means identical. In many instances, indeed, the respondents took divergent views of what their respective shares of the total rating borne by the Company should be; and they only agreed on the general opinion that the appellants wanted to get off too lightly on the whole quinquennial valuation of their property. The effect of these complications was to vastly increase the work of the Court. The amount of money at stake upon the result of the appeal was immense; but the figures, of course, varied in different estimates. According to the Chairman, the greatest discrepancy between the estimates of rating submitted to the Court was £150,000 per annum; while the lowest difference was £50,000. Seeing that there was no question of principle involved in the dispute, but only a conflict of opinion regarding such details as the amount of tenant’s capital, &c., the Court expressed surprise at the extent of the differences between the amounts with which they had to deal. In the event, the Court have found that, subject to rates and deductions, the landlord’s share of the hereditament shall be taken at £620,500. For the value of the stations and indirectly-productive mains, Mr. Ryde’s figure of £250,000 has been adopted; and his method of discriminating between directly and indirectly productive mains is to be followed. Then the value of the directly-productive part of the hereditament is fixed at £370,500. The shares of the different parishes are to be worked out upon this basis, in proportion to the amount of revenue drawn from them by the Company; and the net result is to be brought up before the Court next Friday week, when, if there is no further question of law, the assessment books will be settled for the quinquennium. Broadly speaking, the result is a “splitting of the difference.” The totals, however, are distinctly favourable to the respondents. How much each parish has gained or lost by the appeal cannot appear until the separate allocations are defined, upon which also the apportionment of the costs will turn.

WATER AND SANITARY AFFAIRS.

AN article—one which is scarcely up to date—appears in the *Nineteenth Century* for the present month, from the pen of Sir J. Lubbock, on “The London Water Supply.” A footnote on one of the pages gives the letter addressed to Sir John, as Chairman of the London County Council, in which Mr. Ritchie announces the intention of the Government to advise the appointment of a Royal Commission on the subject. With this exception, the article is written without any knowledge that the Government were about to intervene in the matter. Consequently, sundry suggestions are offered as to the mode in which the Metropolitan Water Question should be dealt with. Referring to the notion which has been promulgated from time to time, and which is espoused by a majority of the County Council, that the entire water supply of London should be placed under municipal management, Sir John Lubbock says: “Notwithstanding this consensus of opinion, I must confess that I am unconvinced.” Moreover, such are the difficulties that stand in the way of settling terms of purchase between the County Council and the Companies, that Sir John thinks any resolution in favour of a transfer simply falls into the category of “a pious opinion.” On this point we may observe that purchase by arbitration, in the absence of agreement, may be rendered compulsory by Act of Parliament, however much the County Council may object to such a method. A recommendation from the Royal Commission in favour of that course, would prepare the way for such an issue; and the Council would have to yield. In the absence of any such hope as this, Sir John Lubbock proposes a plan embodying the following conditions: That the increase arising from the quinquennial re-valuation of property in London should be abandoned; that the County Council should provide an additional supply of water; and that an arrangement should be made, “as is now the case with the Gas Companies,” under which future profits realized should be shared equitably between the Companies and the people of London. Sir John Lubbock does not fail to see that there would be “great difficulties” in effecting any such settlement as this; but, on the other hand, he considers that we cannot “leave matters as they are.” Arguing that the present

sources of supply will soon prove insufficient, Sir John appeals to the Water Companies, "in the interest of their "shareholders," urging that they will "incur an immense "responsibility" unless they take care that the supply in the future is equal to the demand. He assures the Companies that they will find the Council "quite willing to "enter into negotiations with every desire to arrive at an "amicable and equitable settlement." If this be so, why is there so much difficulty in the way of the purchase of the water undertakings by agreement, and such an unwillingness to abide by arbitration?

Sir Thomas Farrer had a letter in the *Pall Mall Gazette*, cautioning the public against supposing that the article on the London Water Supply in the *Quarterly Review* is "a complete or impartial statement of the case." Sir Thomas need not quarrel with the article, but rather with the authorities which it cites; for the strength of the article lies in its quotations. The objection is urged, both by Sir T. Farrer in the *Pall Mall Gazette*, and by Sir J. Lubbock in the *Nineteenth Century*, that the figures given by the Duke of Richmond's Commission in 1869, with respect to the flow of the Thames and the growth of the population, are incorrect. Population, it is said, has increased much more rapidly in the area of supply in the last twenty years than was expected; and the minimum flow of the Thames is much less than the estimate of 1869. This is really Mr. Binnie's argument; and we find Sir J. Lubbock relying largely on Mr. Binnie. Actuated by the belief that the limits of the present sources of the London Water Supply are nearly reached, and that very shortly it will be absolutely necessary to go elsewhere for a further supply, Sir John considers that "the best and most economical course" would be that an additional supply should be secured "either by the "Companies with the aid of the Council, or by the "Council under an arrangement with the Companies." The County Council must be a very changed body for such a scheme to work; and there must be security for a reasonable County Council over a term exceeding three years. But as to the coming water famine, what is the evidence? We are not entirely dependent on the Duke of Richmond's Commission. A few years later we have the sixth report of the Rivers Pollution Commission. This report objected to the river supply *in toto*; but while proposing that the Thames and the Lea should be entirely abandoned for the purposes of a drinking supply, there was no proposal for going to a remote source. It is remarkable that, while the Commissioners say, "We are "of opinion that the whole of the Metropolis and its "suburbs should be supplied exclusively with the spring "and deep-well water of the Thames basin," they add, "We base this opinion, firstly, upon the excellency of the "quality of the water, and, secondly, upon its abundance "within a moderate distance of the Metropolis." The Commissioners enter at great length into the subject, and give facts and figures in support of their recommendations. Should it ever be necessary to reach out beyond a radius of 50 miles round London in search of water, they say: "There are still vast quantities of pure water available "within the Thames basin outside that circle, in the "springs thrown out from the chalk and oolite beds by "the gault and Oxford clays." Sir J. Lubbock, speaking from recent information, including that given in a special report to the County Council by Mr. Whitaker, of the Geological Survey, associated with Professor A. H. Green, says: "As regards wells in the districts around "London, the supply is limited, and is claimed by "the inhabitants of those districts." If the wells only supplied those particular districts, there would be something gained. But in all probability there would be enough and to spare. The sources of supply at the command of the Metropolis within its own watershed will doubtless be clearly demonstrated by the investigations of the Royal Commission. That a very large and good supply is already available, is established beyond doubt. It is worthy of note that General Scott reports the supply from springs and wells last December to be 16.40 per cent. of the total, compared with 15.45 per cent. a year earlier. In the consumption last July, the proportion was as high as 17.23 per cent., compared with 15.07 per cent. in July, 1890. At the same time the quality of the river supply is subject to no tangible objection. As for shrinking the rivers by drawing from wells, so much taken from the wells requires less to be abstracted from the rivers.

THE INCORPORATED INSTITUTION OF GAS ENGINEERS.

PROCEEDINGS AT THE ANNUAL GENERAL MEETING,

HELD IN

LONDON, SATURDAY, FEB. 6, 1892.

Mr. G. C. TREWBY, M. Inst. C. E., in the chair.

The Annual General Meeting of this Institution was held at the Offices, 11, Victoria Street, Westminster, last Saturday. Owing to the announcement which had been sent to the members, that merely formal business would be transacted, and that after the election of officers and members the meeting would be adjourned to May 11 and 12 next, there was only a small attendance.

MINUTES OF LAST MEETING.

The SECRETARY (Mr. T. Cole) read the minutes of the annual meeting held at the Institution of Civil Engineers on May 12 and 13 last; and they were confirmed.

ELECTION OF OFFICE-BEARERS AND MEMBERS.

The next business was the appointment of Scrutineers to examine the ballot-papers.

Mr. THOMAS MAY (Richmond) moved that Messrs. W. E. Price, J. Tysoe, and A. C. M'Minn be appointed.

Mr. J. METHVEN (London) seconded the motion, which was carried.

The Scrutineers then retired to examine the papers. On their return,

Mr. M'MINN said their investigation showed that the following gentlemen had been elected to take office:—

President—Mr. Charles Hunt, of Birmingham.

Vice-President—Mr. J. Methven, of Beckton.

Members of Council—Mr. Edward Baker, of Reading; Mr. William King, of Liverpool; Mr. R. O. Paterson, of Cheltenham.

The whole of the gentlemen nominated as members and associates had also been elected, as follows:—

MEMBERS.

Allan, Alexander, Engineer, Gas-Works, Effingham Street, Sheffield.
Fiddes, Walter W., Chief Engineer, Bristol United Gaslight Company.
Gibbons, G. B. A., Manager, Gas-Works, Eccles Street, Liverpool.
Goulden, T., Assistant Engineer, Beckton.
Hammond, J., Resident Engineer, Gas-Works, Eastbourne.
Horton, George, Resident Engineer, Gas-Works, King's Cross.
Jago, Harold, Resident Engineer, Gas-Works, Fulham, S.W.
Lacey, Thomas S., Resident Engineer, Gas-Works, Pimlico.
M'Ewen, C. J., Manager, Gas-Works, Athol Street, Liverpool.
Meunier, S., Manager, Gas-Works, Adderley Street, Birmingham.
Peaty, Henry, Engineer and Manager, Gas-Works, Burslem.
Phillips, Arthur F., Engineer of the St. Albans, Maidenhead, and Tuscan Gas Companies.
Randall, William S., Assistant Engineer, Gas-Works, Horseferry Road, S.W.
Randall, John W., Resident Engineer, Shoreditch and Haggerston Gas-Works.
Stelfox, J., Engineer and Manager, Gas-Works, Belfast.
Stevenson, George E., Gas Engineer, Manchester.
Watson, James C., Superintendent, Gas-Works, Lower Sydenham.
Young, J., Manager, Gas-Works, Etruria, Stoke-on-Trent.

ASSOCIATES.

Armitage, Fred., Manager, Gas-Works, Market Harborough.
Broadberry, Arthur E., Assistant Engineer, Gas-Works, Tottenham.
Cripps, F. S., Gas Engineer, Sutton, Surrey.
Drury, Charles D., Assistant Engineer, Gas-Works, Vauxhall, S.E.
Hounsham, A. G., Secretary, Monte Video Gas Company.
Travers, Thomas P., Assistant Engineer, Gas-Works, Cork.

The PRESIDENT said this was all the business on the agenda. In accordance with the rules, they were bound to call the meeting, in order that they might know who was to be their next President, so that he might have an opportunity of preparing his address for the adjourned meeting. With Mr. Hunt as President, they should expect, and in all probability would have, a very admirable address. From the promise of papers which they already had for the meeting, he anticipated that they would have a very good list of subjects to put before the members. He was much obliged to the gentlemen who had attended that day; and all they had now to do was to adjourn the meeting.

Mr. ALFRED COLSON (Leicester) then proposed that the meeting be adjourned till May 11 and 12, at the Institution of Civil Engineers.

Mr. C. C. CARPENTER (London) seconded the proposition, which was unanimously carried.

The PRESIDENT said he might mention that, with the gentlemen whom they had elected that day, they had now 97 members; and they anticipated that there would be several new names to propose at the adjourned meeting.

The proceedings then terminated.

Mr. T. Wilkinson has resigned the position of Manager of the Halstead (Essex) Gas-Works, having been appointed to a similar, but more important, position at Tamworth.

Mr. G. Scriven, Manager of the Stroud Water Company, has been appointed Secretary; and the offices have been removed from Coleman Street, E.C., to Kendrick Street, Stroud.

Institution of Civil Engineers.—At the monthly ballot for membership of this Institution last Tuesday, Mr. J. Ebbs, of the Victorian Water Supply Department, Melbourne, was admitted as an associate.

Mr. J. T. Clay, the Chairman of the Rastrick Water Company, died on Sunday morning of last week at Cannes, where he had gone to spend a portion of the winter season. The deceased gentleman was approaching his ninetieth year.

Values of Stocks.—The *Bankers' Magazine* publishes a table of appreciation and fall in stocks, which shows that water-works, telegraphs, American railway bonds, and British railway shares exhibit the chief improvement; while shipping shares, coal and gas companies' shares, and foreign Government stocks have experienced most marked falls.

Mr. John Thompson, of Bishop Auckland, died yesterday week at the age of 77 years. Deceased was one of the founders of the Spennymoor Gas Company, and was a Director from the formation of the concern to the time of his death. He also held a large interest in the Bishop Auckland Gas Company, and for several years was a member of the Board.

The Wenham Lamp Patents.—In the JOURNAL for the 26th ult. (p. 154), we stated, at the request of the Wenham Company, that they had instituted proceedings against the Lamp Manufacturing Company, Limited (Fullford's lamp), for alleged infringement of Mr. F. W. Clark's patent of July 1, 1881. We learn from the Managing-Director of the latter Company that it is their intention to contest the action; and he is advised that there can be no doubt as to the issue.

Death of M. Raoul Duval.—We regret to have to record the death of M. Ferdinand Raoul Duval, Chairman of the Paris Gas Company, which took place suddenly last Tuesday afternoon, from aneurism of the heart, while he was presiding (according to a telegram received through Reuter's agency) at a meeting of the shareholders. The deceased gentleman occupied a high position in Parisian circles; being a civil engineer of great repute and a Director of the Bank of France. He was cousin to M. Léon Say.

Death of Mr. W. H. Bennett.—It is with much regret that we have to announce the death, on Sunday last, at the age of 64, of Mr. W. H. Bennett, formerly Secretary of The Gas Institute. The deceased succeeded Mr. James Blackburn in this office in 1869, and resigned the position in 1888. From Mr. Bennett's early connection with the late Mr. T. G. Barlow, as well as through his public work, first for the British Association of Gas Managers, and, subsequently to the conversion of this organization into The Gas Institute, for the latter body, he was well known personally to most of the gas engineers and managers of the United Kingdom, by whom he will be remembered as a thoroughly conscientious, upright man.

The Gaslight and Coke Company's Rating Appeals.—Yesterday Sir Peter Edlin delivered judgment in the rating appeals by The Gaslight and Coke Company, heard during seventeen days last year, as fully reported in the JOURNAL at the time. The text of the judgment will appear next week; but meanwhile it may be stated generally that the Court found the landlord's share, subject to deduction for rates, to be £620,500. It separately assessed the stations and the other indirectly-productive portions of the works at £250,000; assigning to the productive portion, or the "live mains," as they had been called, the rateable value of £370,500. The distribution between the several parishes would be proportionate to the receipts of the Company in each parish; and for this purpose it was suggested that an accountant should be agreed upon, or would be appointed by the Court. The question of costs was reserved until the Court had before it, in juxtaposition, first the rateable value in each parish as now assessed; secondly, the value assigned by the Assessment Committee; and, thirdly, the deduction therefrom claimed by the appellants. The proceedings were adjourned till Friday week, when questions of apportionment, costs, and any other matter which may be raised upon the judgment, will be discussed.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 263.)

BUSINESS in the Stock Exchange during the past week was extremely limited; and the tone throughout was very dull and depressed. All sorts of rumours touching the instability of certain institutions were flying about, and found ready ears in sensitive and highly-wrought markets. Happily the situation did not become so intense and unnerving as to induce men to throw their securities upon markets which did not want them; so that in result the general attitude was one of passive inaction. Before the week closed, the worst was over; but enough combustible material remains on hand that would take only a spark to set everything ablaze again. Meanwhile, the Gas Market, taking its own course, has been fairly active and remarkably steady. Changes in quotation are unusually few in number, but those few are all for the better. Gaslight "A" was steadily done at about 222 every day of the week; and the busiest day was Saturday (the day after the general meeting), when also the best price—223—was obtained. All things considered, the meeting passed off in a manner possibly regarded as fairly satisfactory by the responsible authorities; for the criticism brought to bear upon them was (if we except one powerful antagonist) scarcely so formidable as they may have had reason to apprehend. In the market, the Company's issues were all well sustained—the "J" 10 per cent. preference being repeatedly done at top price. South Metropolitan were not quite so extensively dealt in as the week before; but they continue very strong generally, and the "B" has advanced 3. A little business was done in Commercial, at about middle figures; and the debenture stock was put up 1. The Suburban and Provincial Companies show no variation. Very little business was effected in them, although on Thursday there were several transactions in British at improved prices. The Continental undertakings were moderately busy; but they did not command very good figures. However, their quotations were allowed to stand unchanged. All the rest put together furnished no more than three or four transactions; and the prices obtained were not remarkable. The best were in Chicago Bonds, both issues of which improved 2½. The Water Companies have been extremely quiet. The Kent Company meet to-morrow to declare their usual 10½ per cent. dividend.

The daily operations were: Gas opened unchanged from the closing prices of the preceding week, and remained quiet and steady all day. There was a slight increase of activity on Tuesday, the old prices holding good. The same characteristics continued through Wednesday generally, South Metropolitan "A" and "B" being particularly firm. Thursday's business was much about the same. Commercial debentures rose 1; and Chicago Bonds, 2½ each. Friday brought no change; fair prices obtaining throughout generally, though Imperial Continental was scarcely up to the mark. Saturday was unusually active, especially for Gaslight "A." All quotations closed without further change.

ELECTRIC LIGHTING MEMORANDA.

The Wreck of the "Eider" and Electric Lighthouses—The Operations of the City and South London Railway—Mr. Tesla's Experiments—What becomes of the Gas?

THE loss of the Atlantic mail steamer *Eider* off the coast of the Isle of Wight, on the evening of last Sunday week, by reason of a thick fog which rendered it impossible for anyone navigating the Channel to tell his whereabouts, has naturally attracted attention once more to the whole question of lighthouse illumination. Here was a glaring case of a well manned and officered vessel, not only missing a perfectly familiar course like that between Hurst Castle and the Needles, but actually going miles to the eastward, and finally running on the rocks within a short distance of St. Catherine's Point, where the most powerful electric light in the world is focussed in a flashing beam for the express purpose of warning vessels off that dangerous shore. Judged by the case of the *Eider*, it must be concluded that the electric light proves no better than any other when its nominally superior power would be most highly appreciated. Professor Tyndall has written to *The Times* to point out this fact, and has fallen back upon his well-known views respecting the superiority of Mr. Wigham's group-flashing gas-lights for penetrating fog. The Professor seems to have entertained the erroneous impression that the electric light at St. Catherine's Point is a steady shining ray, instead of being, as it is, a 6-million candle flash of five seconds' duration, suddenly appearing and disappearing every half minute. However, the fact remains that, flash or no flash, the look-out on board the *Eider* saw nothing of the great electric light, which is ordinarily visible for 20 miles up or down the Channel, and ran aground within two or three miles of it. A correspondent sums up the matter for readers of *The Times* by asserting that beams of the intensity that can be produced by oil or gas lighthouse lamps are quite powerful enough for navigation purposes. In a fog, a flashing light of this power—say, of half-a-million candles intensity in the direct concentrated beam—will be just visible at a distance of one or two miles; and increasing the intensity of the ray to two or three million candles will not make it penetrate more than 200

or 300 yards farther, which is hardly worth talking about. This being the case, it is idle to pretend that electric lights are of any real assistance to mariners, who, the correspondent declares, should not be encouraged to depend upon any lights in foggy weather. It is suggested that the large cost of the uselessly powerful electric lamps might be better expended on sound-signals, in which our coasts are notoriously deficient.

Electric traction has been warmly discussed in connection with the half-yearly meeting of the City and South London Railway Company, whose accounts show working expenses amounting to 76 per cent. of the receipts. Of course, it can be pleaded that this is always the case with a new line of railway; but a more serious reproach to the management is that the cost of electrical haulage has proved to be very much heavier than was anticipated. When the construction of the line upon Mr. Greathead's system of burrowing through the earth at a sufficient depth to be out of the way of everything was decided upon, it was upon the understanding that the traffic would be worked by rope haulage. Then the electricians gained the ear of the Board; and something was said about a contract to do the hauling by electricity for 3½d. per train mile. It turns out, however, that instead of this figure, which would compare very favourably with the cost of steam locomotives, the electrical haulage costs 8d. per mile; and there is not much prospect of this being materially reduced. Moreover, the electrical locomotives do nothing like the work of steam-engines; and they are yet very far from satisfactory machines. In face of this fact, the Directors have not thought fit to write off anything for depreciation, which has drawn down upon them a good deal of hostile criticism. Some observers, apparently well-informed, have gone so far as to state point-blank that electrical hauling has signally failed in this instance, as in so many others. Such a conclusion would be very disappointing to the public generally, who are looking with vague aspirations to electricity for help in solving the problem of safe and comfortable passenger traffic in and about London; but it would be absurd to pretend that the working of the South London Railway has a healthy look.

Mr. Nikola Tesla, the young Hungarian who has settled in the United States, and whose most remarkable experiments with electricity at high potentials and frequent alternations have several times been mentioned in these columns, has arrived in England, and exhibited at the Royal Institution some of the brilliant phenomena for the production of which he has become famous. By a series of ascending transformations, as they may be termed, Mr. Tesla obtains currents of enormous voltage and extremely rapid oscillation, which are yet perfectly harmless in operation because of the smallness of the quantity of electricity involved. When such currents are passed through a piece of bare wire, it is seen to glow in the dark, although it is not hot; and an appearance like a gas-flame at high pressure arises at the end of a charged point. There is no flame in reality, however, no combustion, nor waste of material; it is only the electrical energy which is disappearing in this way with production of ozone. Extremely beautiful effects are produced when phosphorescent bodies are exposed to the action of Mr. Tesla's apparatus; the results being in some sort referable to the old Geissler tube electricity with which the lecturers of our youth made us acquainted. Exactly how much commercial value there may be in Mr. Tesla's revival of this class of phenomena cannot, of course, be stated as yet. He seems to think they will lead to something practically useful in the way of lighting; and it was with this aim that he took them up, because, as he told his audience last week, he had looked at gas-burners and "saw no hope of advance." It may be that we shall light our shops and houses in the future with the "electrical effluve," or some phenomena of incandescence produced by "influence at a distance." For the present, however, it may be remarked that the very appearances of insubstantial flames at the ends of charged conductors, which are so striking an effect of Mr. Tesla's operations in connection with these conductors, show the impossibility of keeping the current, or whatever it is, within the material substance of the wires of the circuit. He must tame his wild energy before it can be called useful; and this is the acknowledged *crux* of the matter. Phenomena that cannot be turned off and on—electricity or gas, or anything else, that cannot relied upon to stay where we put it until wanted—may be as beautiful and impressive as any *belle sauvage* of fiction; but, like her, it is not suited to be "human nature's daily food."

Electrical speculators will not find much comfort in what Colonel Makins, M.P., had to tell the proprietors of The Gaslight and Coke Company at the half-yearly general meeting on Friday last. He had been moved, as Governor of the Company, to get out some figures illustrative of the effect of the creation of the electric lighting interest in London upon the gas-rentals of various classes of consumers and in several districts; and the result is most instructive. The statements will be found in our report of the Governor's speech, given in another column; and we should esteem it a favour if our electrical contemporaries would let us and the world know their opinion of these figures, taken in conjunction (say) with Mr. W. H. Preece's remarks about the marvellous effects that have followed the introduction of electric lighting into the Post Office. It is a query what the users of electric lighting want with the gas for which they continue to pay The Gaslight and Coke Company so largely. These things are mysterious.

PROVISIONAL ORDERS FOR 1892.

THE parliamentary programme for the year, so far as gas and water undertakings are concerned, is completed by the following Draft Provisional Orders.

The Bideford Gas Order is to empower the Bideford Gas and Coke Company, Limited, to maintain and continue their undertaking under statutory conditions. The Company's district comprises the parish of Bideford and part of the parish of Northam, in Devonshire. The capital is fixed at £13,000, of which £7,000 is already raised, and the usual borrowing powers. Gas of 15-candle power is to be sold at the standard price of 4s. per 1000 cubic feet. Interest at the rate of 5 per cent. is to be paid on consumers' deposits; and, notwithstanding the provision contained in the Gas-Works Clauses Act, 1871, the annual statement of accounts is to be made up to March 31. The Cullingworth Gas Order is to invest with statutory powers the Cullingworth Gas Company, Limited, who supply the parish of Bingley and the township of Wilsden, in the parish of Bradford, in the West Riding. The capital is to be £18,000, whereof £10,000 is original capital, together with the usual borrowing powers. Additional land is required, and the works are to be extended. Gas of 15-candle power is to be supplied at the standard price of 4s. 6d. per 1000 cubic feet. Section 140 of the Companies' Clauses Consolidation Act, 1845, is to be incorporated with the Order. The Glastonbury and Street Gas Order is to authorize the maintenance of the undertaking of the Glastonbury Gas and Coke Company, Limited, who supply the united parishes of St. John the Baptist and St. Benedict, Glastonbury, and the parish of Street, in Somersetshire. The capital is to be fixed at £12,000 already authorized, and now consisting of £2575 of original capital, additional capital to the amount of £2000, and a further sum, to be sanctioned, of not exceeding £7425. The two former sums are to carry a 10 per cent. dividend; and the latter, the customary 7 per cent. The usual borrowing powers are required. Gas of 15-candle power is to be supplied at a standard price which "may be" 5s. per 1000 cubic feet. It is provided that the undertakers are not to be liable to any penalty for defect of illuminating power or excess of impurity, unless the information shall have been laid before two Justices within six weeks of the event. The Kempston Gas Order is to empower the Kempston Gas Company, Limited, to continue and extend their works which supply the parishes of Kempston, Biddenham, Elstow and Wootton, all in Bedfordshire. The capital is to be fixed at £6000, to carry a 10 per cent. dividend, with the usual borrowing powers. Gas of 15-candle power is to be supplied at the standard price of 6s. 8d. per 1000 cubic feet. The Mitcham and Wimbledon District Gaslight Order is to empower the Company of the same name to extend their present works for manufacturing gas and converting residual products to certain additional and adjoining lands.

The Newington Water Order is to authorize the Newington Water-Works Company, Limited, to raise £50,000 more money, which increases the total capital of the Company to £120,000 with the usual borrowing powers. Additional lands are to be acquired; and new works, comprising a well and pumping station thereon, are to be constructed. A clause is inserted for the protection of the Corporation of Kingston-upon-Hull. The Pocklington Water Order is intended to enable the Pocklington Water Company, Limited, to make additional water-works in the parishes of Pocklington and Millington in the East Riding. Further capital to the extent of £1000 may be raised; and the amount of all money borrowed is not to exceed £1000, of which £750 was authorized in 1889. The new works are to consist of a collecting chamber at or near a group of springs in the Givendale Valley, and the connection between it and the existing water-main. The Poole Water Order is to confer powers upon the Poole Water-Works Company for the maintenance, continuance, and extension of water-works for the supply of the borough of Poole and the neighbourhood. The Company were incorporated by an Act of 1859, and procured Orders in 1881 and 1887. They now desire to raise £40,000 of additional capital, to carry the ordinary borrowing powers. Dividends on the new capital are to be limited to 7 per cent. ordinary, and 5 per cent. preferential. The whole borrowing powers of the Company are to be limited to £10,000. Authority is sought for the issue of debenture stock. New works are to be constructed, comprising two engine-houses, &c., fitter-beds, and water-towers, with the necessary connecting-mains. In addition to these works, another reservoir may be constructed, if so required by the Board of Trade, in view of the demands of the district. An application to the Board of Trade to make such Order may originate either with the Company, with any local authority interested, or with twenty ratepayers within the limits of supply. Surplus land may be sold. Rates for water for domestic use are not to exceed 7½ per cent. Arrangements may be made for the supply of vessels in Poole Harbour; and road and sewer authorities are to be furnished with water on demand, but not to the prejudice of the domestic service. Power is desired for the purchase or supply of water in bulk. Water may be supplied by meter, and the rental is not to exceed 15 per cent. of the cost. No sale or assignment of the undertaking as a whole is to be valid without the assent of the Board of Trade.

The Prestatyn Gas Order is to enable a named undertaker, his executors, administrators, or assigns, to employ a capital of

£7000, with a loan capital of £1750, upon the construction of gas-works in the parish of Melindon, for the supply of that parish and the parishes of Cwm Dyserth and Newmarket, all in Flintshire. Profit of 10 per cent. may be made on the capital, which, so long as the undertaking is privately carried on, is to be reckoned as the money actually expended upon or used for the purposes of the concern. Gas of 15-candle power is to be supplied at the maximum price of 6s. per 1000 cubic feet. If at any time when the total amount of gas consumed during the twelve months ending on the previous 31st of December shall have exceeded 2 million cubic feet, the price charged shall be more than 5s. per 1000 cubic feet, any local board within the limits of supply may give notice in writing to the undertakers that they consider, in the interests of the public, that such price is too great. And if within two months from the giving of the notice no agreement as to price shall have been come to between such local board and the undertakers, the question of the price of gas is to be referred to arbitration, in the manner provided by the Public Health Act, 1875; regard being had to any difference between the price of coal, the cost of manufacturing gas, the rates of wages, and the facilities or difficulties of obtaining and retaining labour at the time of such arbitration and at the date of this Order respectively.

The Ross Water Order is to authorize the maintenance and continuance of existing water-works and the supply of water by a private undertaker, his executors, &c., within the parishes of Ross and Bristow, in Herefordshire; the limits being so much of the parishes named as lies within a radius of 60 chains from the junction of the four roads at the top of or west end of Alton Street in the town of Ross. If at any time after the expiration of three years from the commencement of the Order the undertakers are not furnishing a sufficient supply of water, in accordance with the terms of the Order, in any part of the district included within the limits of supply, the local authority having jurisdiction within such neighbourhood may supply, in accordance with the provisions of the Public Health Act, 1875, or any company, body, or person may apply for an Act or an Order for the purpose of supplying water, just as if in either case there were no Company authorized by this Order to supply water therein. Any difference that may arise as to the application of this provision is to be referred for settlement by the Board of Trade. The local authority for the time being of any district covered by the undertaking may, at any time within twelve months after the expiration of ten years from the commencement of the Order, by six months' notice in writing, require the undertakers to sell their property in the concern for a price to be agreed upon, "or paying the then value of all lands, buildings, works, powers, rights, materials, and plant, effects, and property of the undertakers held or used by them for the purposes of the undertaking." In case of difference, unless both parties concur in the appointment of a single arbitrator, they shall, before the arbitrators enter upon the reference, make application to the Board of Trade to nominate an engineer or other fit person as umpire; and the expenses of the reference shall be borne and paid as he directs. It is also provided that "the value of such lands, buildings, works, powers, rights, materials, and plant, effects, and property shall be deemed to be their fair market value at the time of the purchase; due regard being had to the nature and then condition of such buildings, &c., and to the state of repair thereof, and to the circumstance that they are in such a position as to be ready for immediate working, and to the suitability of the same for the purposes of the undertaking, and regard being had to the circumstances under which the works were originally undertaken and carried out by the undertakers." The Board of Trade are to determine any other question which may arise in relation to such purchase, including the date from which it is to take effect. The capital is not to exceed £15,000, carrying a 10 per cent. dividend; this expression meaning the sum actually expended upon, or employed for the purposes of the undertaking. The borrowing powers are limited to £3750. The authorized works comprise three artesian wells and a pumping-station, with the ordinary accessories, situate in the parish of Ross; and there are also works for pumping and distributing water from the River Wye. Rates for a domestic supply are to range from 10 to 6 per cent.

The Sevenoaks Water Order is to enable the Sevenoaks Water-Works Company to raise £12,000 of additional capital, and to borrow £3000. Power is required for the creation of debenture stock. The South Normanton, Blackwell, and Hucknall-under-Huthwaite Gas Order is to confer statutory facilities upon a limited Company supplying a district lying on the border between the counties of Derby and Nottingham, and adjoining that of the Riddings Gas Company. The share capital of the Company is fixed at £15,000, whereof £12,000 is original capital; and all the usual borrowing powers are applied for. Gas of 15-candle power is to be supplied at the standard price of 5s. per 1000 cubic feet. The period of error for defective meters is limited to one quarter of a year. Four per cent. interest is to be paid on deposits. The Sutton and Hooton District Gas Order is to empower the Sutton and Hooton Gas Company, Limited, to maintain and continue their undertaking, which is for the supply of a district embracing eight townships in the county of Chester, with a capital of £10,000, of which one-half is original capital, and the usual borrowing powers. Additional land is required. Gas of 14-candle power is to be supplied at

the standard price of 6s. per 1000 cubic feet. Four per cent. interest is to be paid upon deposits. The Willenhall Gas Order is to empower the Willenhall Gas Company to raise £21,250 of additional capital, and to borrow £10,000 in all. When issued as ordinary capital, the new issue is to bear a $7\frac{1}{2}$ per cent. dividend, or a 5 per cent. preferential dividend. Power is desired to create and issue debenture stock. Additional lands are to be acquired, and extended works erected. Permission is also sought for dealing in gas-fittings, &c., and for selling gas in bulk. No penalty for defect of illuminating power or excess of impurity is to be incurred, unless the complaint shall have been laid before two Justices within six weeks after the event.

NOTES.

Coke-Breeze Concrete.

The subject of inexpensive fireproof construction is attracting much attention at the present time; and the modern use of coke-breeze concrete with this object appears to supply a long-felt want. The growing tendency to collect population thickly in tenement dwellings necessitates the extension of fireproof building construction, in order that every floor or flat shall be rendered incapable of communicating fire to the next. But, unfortunately for builders of dwellings intended to be let at moderate or low rentals, the ordinary methods of constructing non-combustible floors are very much more costly than common wooden flooring. Coke-breeze concrete is the cheapest and lightest of known substitutes for wooden floors; and it has the great advantage of taking nails kindly. There has been some correspondence in the *Builder* as to the best way of covering a breeze concrete floor with wood, which is insisted upon by most householders. Block flooring or parquetry would, of course, be best; but this is expensive. It is suggested that ordinary flooring-boards can be nailed directly upon the concrete; but the latter must first be allowed plenty of time to dry, or the timber will be liable to rot. It is also stated that breeze concrete must not be carried into fireplaces or very near flues, because it is too good a conductor of heat, which will accumulate in it sufficiently to char wooden skirtings or other combustible work, if too close to the fireplace. It must not be forgotten that the breeze is combustible; and mere admixture of cement with it does not deprive it of this quality. At the same time, for flooring or walling purposes this mixture is practically unflammable when kept out of fireplaces and flues. It should be more experimented with than it is in the minor constructions of gas-works.

Aitken on Dust and Haze.

Mr. John Aitken, F.R.S., continues his interesting researches on the number of dust particles in the atmosphere of various places in the United Kingdom and on the Continent, with special reference to the comparison of the air of inhabited places and low-lying lands with that of the Alpine regions, the Scottish Highlands, and other places known for the purity of their air. A great number of observations have been made by Mr. Aitken; and the latest paper in which he communicated them to the Royal Society of Edinburgh was very voluminous. By special permission of the Society, however, a full abstract of the papers was recently published in *Nature*. The general drift of these results was to still further accentuate the connection between the well-known condition of the atmosphere called haze and the number of dust-particles in the air. Thus, to select some observations made on the Rigi Kulm, it is reported that on one occasion the weather was generally fine, and the air had the crisp clearness which gives the hard outline and crude colouring usually associated with Swiss scenery. The dust-particles then did not exceed 2000 per cubic centimetre. On another occasion, when the air appeared to be remarkably thick and heavy, the number of particles was found to be as high as 10,000 per cubic centimetre. The effect of thunderstorms in clearing the air of dust is also discussed, with the result that, though the effect is indisputable, it is not certain whether it is produced by the storm itself upon the air affected by it, or is due to a downrush of purer air from higher levels of the atmosphere which naturally follows a heavy hail-shower. An anticyclone lying over Europe is certainly attended by a great increase in the dustiness of the atmosphere, which again reacts upon the climate by increasing the day and night temperatures.

The Recovery of Cyanogen from Coal Gas.

Mr. Leybold has written a brief review of the methods for obtaining cyanogen from coal gas. He states that the coal as carbonized usually contains about 1.2 per cent. of nitrogen, more than half of which is lost. The coke contains about 31 per cent. of it, the ammoniacal liquor returns less than 11 per cent., and there is some in ferro-cyanide and tar; but the remainder is supposed to escape in the gaseous state, mixed with the coal gas. It would be worth recovering as cyanide, in which form nitrogen is seven times more valuable than in ammonia. When the gas leaves the retorts, it contains ammonium cyanide, a small fraction of which is converted into sulpho-cyanide in presence of the large excess of ammonium sulphide. Ammonium cyanide and hydro-cyanic acid being both capable of dissolving iron, a little ferro-cyanide is formed in the pipes. Very little cyanogen is retained in the condensers; but in the purifiers, when there is plenty of area, as much as 71 per cent. will be

arrested. A special cyanogen purifier was tried; the mass of purifying material being spongy iron, containing about 33·7 per cent. of iron, and 1 per cent. of calcium carbonate. This will not arrest hydro-cyanic acid until saturated with sulphuretted hydrogen, or sulphided. Then cyanide of iron is formed, which is converted by aëration into Prussian blue, which is not, however, a regular compound, but may contain several ferrocyanides, some combined with ammonia. A sample recovered in this way gave 12·69 per cent. of Prussian blue, and 2·6 per cent. of ammonium sulpho-cyanide; the two compounds representing 8·094 per cent. of hydro-cyanic acid. The best results would be obtained by the use of a perfectly neutral purifying material, and removing the ammonia as perfectly as possible. This method of recovering cyanide is far from perfect; and the most successful experiments have not retained more than 83 per cent. of the cyanogen actually reaching the purifiers—17 per cent. being still lost. Moreover, it says nothing about increasing the formation of cyanogen compounds, which seem to require higher temperatures than coal gas is usually exposed to.

Cylinder Oils.

In an article upon cylinder oils published in the *Chemical Trade Journal*, it is pointed out that the proper lubrication of a steam or gas engine cylinder is a matter of very great importance to power users, especially with regard to the influence of good lubrication upon the working life of the machine. In a steam-engine cylinder, water and high temperature combine to act upon the lubricant, with the result that fats and fatty oils of animal or vegetable origin are decomposed into glycerine and stearic acid; the former passing away in the steam, while the latter remains to attack the metal work with which it is brought into contact. The high temperatures prevailing in gas-engine cylinders forbid the use of anything but mineral oils for the purpose of lubrication. These oils are almost entirely produced from crude American petroleum. They are of two classes, black and green in colour; the latter being more thoroughly purified. They vary in consistency from the viscidness of castor oil to the plasticity of butter; and their specific gravity ranges from 0·890 to 0·895. The flashing-point may also vary from 530° to 580° Fahr. The most important feature of these cylinder oils is their viscosity, and especially their power of retaining this quality when heated. Other things being equal, the oil that is most viscous, as tested in Hurst's standard viscometer, at the highest temperature, is the best for gas-engine cylinders.

The Standards of Light Committee.—In the list of the members of this Committee given in the *JOURNAL* for the 19th ult., the name of Mr. G. Rose-Innes, representing the Corporation of London, should have been included.

Mr. John Lochtie, the Superintendent of the Vartry works of the Dublin Corporation Water Department, died suddenly last Sunday week. The deceased, who was 61 years of age, had held his late position from the time the works were constructed.

Richards and Payne on "The Metropolitan Water Supply."—We have received from the publishers (the Argus Printing Company, Limited, Temple Avenue, E.C.) a copy of a neatly got-up book on the Metropolitan Water Supply, by Messrs. H. C. Richards and W. H. C. Payne, Barristers-at-Law. It is a compendium of the history, the law, and the transactions relating to the London Water Companies from the earliest times to the present day. The work comes very opportunely just now; and it will bear a more extended notice than we are now able to give.

The City Gas Examinership.—In addition to the candidates for this appointment whose names have been already given, Mr. Charles E. Groves, F.R.S., F.I.C., F.C.S., is in the field. This gentleman bases his application on a thirty years' study of chemistry in its various branches, especially those relating to gas and water. He is Lecturer on Practical Chemistry at Guy's Hospital, Chemist to the Conservators of the River Thames, and Editor of "Fuel" (the first volume of "Chemical Technology"); and he is at present engaged, in conjunction with Mr. W. Thorp, in editing the volume on "Lighting."

Mr. Henry Willis Smith.—We learn that this gentleman, who has for some time filled the position of Secretary and Manager of the Caterham Gas Company, was married last week to Miss Agnes Kelman, the well-known lecturer on cooking by gas; and that Mr. and Mrs. Smith are about to leave England for Singapore. Referring to the latter subject, a correspondent writes: "The Directors and shareholders of the Caterham Gas Company are about to lose the services of Mr. H. Willis Smith, the Secretary and Manager. It is some nineteen years since Mr. Smith entered the service of the Company, whose prospects then looked extremely gloomy. His management, however, soon put a different aspect on affairs; and in a few years the shareholders were in possession of large dividends, and the shares were at a high premium. Mr. Smith has received many tempting offers of more lucrative appointments; but he has rejected them—preferring to remain at Caterham. But now he has accepted the onerous duties of Engineer and local Secretary to the Singapore Gas Company, and sails next week for the Straits Settlements. Mr. Smith has been a Director of the Singapore Gas Company for several years; and his services will be much missed at the Board."

COMMUNICATED ARTICLE.

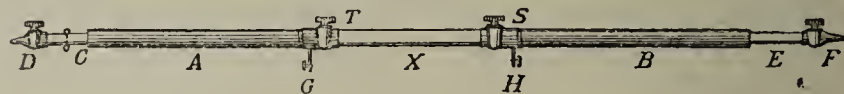
EXPERIMENTS ON THE TRANSMISSION OF EXPLOSIONS ACROSS AIR-GAPS.

By Harold B. Dixon, M.A., F.R.S.,

Professor of Chemistry in the Owens College, Manchester.

How far the shock produced by the explosion of a gaseous mixture can be transmitted through a column of air, so as to ignite a gaseous mixture beyond, is a question often asked in the discussions raised as to the nature of colliery explosions. Some practical men have expressed the opinion that the shock can be transmitted through air along great lengths of straight gallery, so as to cause the explosion of accumulations of fire-damp at the farther end. Others hold that a few score yards of gallery free from fire-damp and dust will effectually prevent the propagation of an explosion in a mine. As I am not aware of any experiments which bear directly on the subject, I have tried, with the assistance of Mr. B. Lean, B.Sc., the following experiments on a small scale, to obtain some data by which to decide the question.

The apparatus (shown in the accompanying illustration) consisted of two lead tubes, 880 mm. in length, and 17½ mm. internal diameter, which could be connected together by glass tubes of varying dimensions by means of brass junctions.



A and B are the two lead tubes. C is a glass firing-piece, fixed to A by Faraday's cement. D is a steel tap fixed to the firing-piece by Faraday's cement. E is a strong glass tube fixed in between B and a steel tap F by Faraday's cement. X is a glass tube fixed to the two brass junctions by Faraday's cement. G and H are small brass tubes, provided with taps, by means of which A may be placed in communication with B, without making use of X. T and S are large taps in the brass junctions, connecting X with A or B. The passage in each tap is 11 mm. in diameter.

The explosive mixture employed was one of two volumes of hydrogen mixed with slightly more than 1 volume of oxygen. The mixture was kept over water in an iron gasholder. The hydrogen was made from zinc and sulphuric acid, without any special purification; and the oxygen was prepared from potassium chlorate.

After passing a current of air through the apparatus, air was enclosed in the tube X by turning off the taps T and S. G was then connected with H by means of an india-rubber tube, and the explosive gas passed in at D, and through the apparatus, until a sample taken at F was found to explode violently. The taps at D, F, G, and H were then all turned off, and the platinum wires in the firing-piece connected up with a Ruhmkorff coil. One observer then stationed himself opposite the tube X, and immediately before giving the command to fire, quickly turned on the taps T and S. A second observer, placed opposite E, thereupon broke the primary circuit of the coil, producing a spark at C, and at the same time closely watched E for any flash indicating that the mixture in B had been fired across the air-gap by the explosion in A.

Though the glass tube E was very strong, it was found necessary to wrap wire gauze around it, inasmuch as it was several times shattered to pieces by the violence of the explosive wave; but though the glass tubes employed between A and B were frequently comparatively weak, experience showed that the pressure produced by the explosion against the wall of the tube X was so small that the tube was in no case burst.

First Series of Experiments.

A number of experiments were made with glass tubing 20 mm. internal diameter and of various lengths. After fixing the glass tube by means of Faraday's cement to the two brass junctions, the distance from the centre of the tap T to the centre of the tap S was measured. Only those experiments in which this distance TS is exactly the same, are made under the same conditions. It is not sufficient to make experiments with a particular tube of (say) 200 mm. length at one time, and again at a subsequent period, without making sure that the tube is fixed on to the brass pieces in the same manner. Differences in the length of TS with the same glass tube, to the extent of 10 to 15 mm., may easily occur, which subsequent experiments will show to be very important. I shall therefore class experiments according to the length of TS. The volume of the air-gap was determined in each case by titration with water.

- (1) TS = 283 mm.; volume of air-gap, 73 c.c. The flash produced by the explosion in A traversed the whole length of X; but the mixture in B was not fired. Six experiments made, with the same results.
- (2) TS = 215 mm.; air-gap, 53·6 c.c. The mixture in B was not fired by the explosion in A. Six concordant experiments made. (May 6, 1891.)

On May 9 this experiment was repeated; employing the same glass tube, the same mixture of hydrogen and oxygen—TS being 215 mm. as before. In four successive experiments, B was fired by the explosion in A; but in two of these the glass tube DF exploded with great violence, and in the other two the cement at one or

the other junction was cracked. Thus, in these four experiments, in which B was fired, the pressure in the apparatus was relieved. Since, therefore, it appeared conceivable that, in cases in which the limit had been nearly reached, a relief of the pressure might enable A to fire B across the air-gap, it seemed advisable in future experiments only to accept as conclusive those in which every junction had stood intact the shock of the explosion. Four more experiments were made, in which the apparatus stood the explosion, and in each case B was not fired.

(3) T S = 175 mm.; air-gap, 38.2 c.c. B fired by explosion in A. Three experiments made on May 9; five experiments made on May 12. Thus the desired limit is to be found when T S lies between 215 and 175 mm.

(4) T S = 205 mm.; air-gap, 48.5 c.c. B not fired by explosions in A. Two experiments made—cement intact.

(5) T S = 184 mm.; air-gap, 40 c.c. B fired. Two experiments made.

(6) T S = 192 mm.; air-gap, 43 c.c. B fired. Two experiments made.

(7) T S = 196 mm.; air-gap, 44.7 c.c. B not fired. Three experiments made.

Thus the limit is to be found between (6) and (7).

Second Series of Experiments.

A number of experiments were next made, employing much narrower tubing to enclose the air-gap—viz., 8 to 8½ mm. internal diameter, instead of 20 mm. as was the case in the former experiments.

(1) T S = 275 mm.; air-gap, 17.5 c.c.; bore, 8.5 mm. B fired. Three experiments.

(2) T S = 389 mm.; air-gap, 27 c.c.; bore, 8.5 mm. B fired. Four experiments.

(3) T S = 532 mm.; air-gap, 32½ c.c.; bore, 8.5 mm. B fired. Four experiments.

(4) T S = 588 mm.; air-gap, 31½ c.c.; bore, 8 mm. B fired. Four experiments.

(5) T S = 665 mm.; air-gap, 38.2 c.c.; bore, 8 mm. B not fired. Three experiments.

(6) T S = 656 mm.; air-gap, 37.6 c.c.; bore, 8 mm. B fired. Two experiments.

(7) T S = 663 mm.; air-gap, 38.1 c.c.; bore, 8 mm. B not fired. Two experiments.

Thus the limit is found between (6) and (7).

We can now advantageously compare the main results of these two series of experiments.

In series No. 1—

If T S = 196 mm., and air-gap = 44.7 c.c., B is not fired.

If T S = 192 mm., and air-gap = 43.0 c.c., B is fired.

In series No. 2—

If T S = 663 mm., and air-gap = 38.1 c.c., B is not fired.

If T S = 656 mm., and air-gap = 37.6 c.c., B is fired.

It would appear, therefore, that the question as to whether or not B shall be fired by A through a given air-gap depends upon the volume of air interposed, rather than upon the length of the column of air.

To test this conclusion, a bulb was blown upon a portion of the glass tubing (bore 8 mm.) used in series No. 2, and this was substituted for a plain glass tube between the two brass junctions.

(1) T S = 198 mm.; air-gap, 83.5 c.c. B was not fired.

(2) T S = 144 mm.; air-gap, 78.8 c.c. B was not fired; but the bulb was filled with flame.

These two experiments bear out the conclusion that, for a given mass of a gaseous explosive mixture, there is a certain minimum mass of air which will, if interposed between it and another explosive mixture, guard this last in the manner of a protective shield or plug; and that it is immaterial whether this air be enclosed as a short and broad, or as a long and narrow column.

From these results it seems reasonable to conclude that the air in the central tube is driven bodily forward by the expansion of the burning gases into the second leaden pipe. In this pipe the air forms a layer, the depth of which depends upon the volume taken, and, of course, is irrespective of the shape of the vessel originally containing it. How the ignition is propagated through a column of air to the explosive mixture beyond is a question not directly answered by these experiments; but I think it likely that it is brought about by the diffusion of the burning and yet unburnt gases through the column of air from different sides. Le Chatelier has clearly shown that to ignite hydrogen and oxygen by pressure, the gases must be compressed some 20 or 30 times. Such pressures accompany the explosion wave; and thus strong glass tubes are shattered by the detonation of electrolytic gas. But in the experiments now recorded the glass central air-tube was not broken in any of the explosions, although in some cases it was comparatively weak. It could not therefore have been exposed to any shock comparable with that of the explosion wave in hydrogen and oxygen. Its immunity may be explained as follows. The explosion wave which traversed the first leaden tube ended when it reached the limits of the explosive mixture; and since the explosion wave travels faster than sound, each layer of the explosive gases would have undergone no forward movement at the time the front of the wave reached it. Every layer would thus be ignited *in situ*. The forward movement of the mass of burning gas would follow

the wave, and consequently the flame which filled the central vessel would be due to the residual combustion of the gases after the wave had gone by. The feeble light given by this flame, compared with the brilliance of the explosion wave in the same gases, confirms this view of the phenomenon. It would be interesting to photograph this residual flame, which is usually masked in photographs of explosions by the greater brightness of the wave, and to determine its motion and duration.

TECHNICAL RECORD.

THE COMPARATIVE VALUE OF GAS, WATER, AND STEAM FOR THE SUPPLY OF MOTIVE POWER.

At the Meeting of the Institution of Mechanical Engineers last Thursday, Mr. J. PARRY, M. Inst. C.E., Water Engineer of the Liverpool Corporation, read a paper dealing with the supply of water for motive power from the street mains, and its cost to consumers as compared with other kinds of power. As the statistics collected by the author are specially interesting, and moreover may be regarded as in a measure supplemental to those contained in the article on the "Comparative Expenses of Small Motors," in the last number of the JOURNAL, we give the principal portions of the paper.

Schemes for the distribution of power from a central station, by means of water pressure, compressed air, steam, gas, and electricity, have of late years occupied attention in Liverpool as elsewhere; but up to the present time only water pressure and gas have got beyond the experimental stage. It is probable that at no distant date a supply of power transmitted through a pipe or wire from a central station will be looked upon as a necessity of urban life, for domestic service as well as for the purposes of trade. Already there has been sufficient advance in this direction to claim for the subject the serious attention of engineers, and to invest with interest any facts which relate to it. In towns where much machinery is employed for manufacturing or commercial purposes, and especially where power is required intermittently, a strong *prima facie* case can be made out in favour of a system of distribution from a single station; but it is a matter of common experience, among those who have been engaged in such schemes, that there is great difficulty in obtaining accurate information with regard to the cost of doing work under the detached, as distinguished from the combined or centralized system; and this difficulty is due as much to the absence of exact records as to the reluctance of power users to give details of their expenditure.

The comparative figures here given were obtained in the course of an investigation made by the writer about two years ago, for the purpose of reporting to the Corporation of Liverpool on a proposal of the Hydraulic Power Company to extend their mains outside of an area within which they had been allowed to supply power under an Act passed in 1884. Liverpool would appear to offer a particularly favourable field for the establishment of a system of power distribution, because there are so many large warehouses, where goods for import and export are stored, occupying a limited and well-defined area, in streets which are entirely devoted to trade. The weight of goods imported into and exported from the port of Liverpool in one year exceeds 14,000,000 tons; and the weight of goods stored at one time in the Liverpool warehouses is estimated to be about 750,000 tons. There is therefore a large amount of lifting and lowering to be done, into and from ships, railway waggons, and warehouses, apart altogether from the trading and manufacturing needs of the city population. A great deal of this work, too, is of an intermittent character. Bales and boxes are carted to the warehouses as the ships arrive; and as the deliveries are irregular, the hoisting machinery is often idle, and is seldom in steady use for a day.

Use was first made in Liverpool of pressure from the street mains for the working of hydraulic machinery about the year 1847, when Lord Armstrong (then Mr. W. G. Armstrong) erected a hydraulic crane at the Albert Dock. This form of power does not appear to have been much in demand by Liverpool warehouse-owners down to thirty years later; for in 1877 the number of hydraulic machines supplied from the public mains was only 89. The Mersey Docks and Harbour Board introduced a high-pressure system of their own; and they have for many years had a very extensive and efficient hydraulic plant extending along the whole line of docks. The number of hydraulic machines now worked by direct pressure from the street mains of the Corporation is 162; their total consumption of water per annum being 125,600,000 gallons.

The pressure of water in the mains in the warehouse districts varies from about 50 to 80 lbs. per square inch. On the line of docks, it is seldom less than 70 lbs. per square inch; but notwithstanding that this excellent pressure is available, and that the water is sold at a lower price per 1000 gallons than is generally charged for trade uses, it has been used to only a very limited extent for power purposes in the warehouses near to the docks. The great bulk of the loading and unloading work in Liverpool is done by steam power. Gas-engines have of recent years been fixed in many of the new warehouses, and have replaced steam

in some of the old warehouses. The total number of gas-engines now in use is about 650. Compressed-air machinery was tried in a few warehouses several years ago; but it has not been sufficiently successful to lead to its adoption on a large scale.

The average amount paid per annum for working a goods hoist from the Corporation mains is £13; and, as this represents an average payment of only 10d. per hoist per working day, the cost is very small for the convenience afforded. With an available pressure in the mains of 60 lbs. per square inch, properly utilized, and at the present rate of 7d. per 1000 gallons, the cost of lifting one ton to a height of 50 feet is 1d., equal to about 1s. 1½d. per horse power per hour.

One of the principal objects of the writer's investigation was to obtain trustworthy statistics for enabling him to calculate the actual cost in practice of similar work done by different classes of machinery; and for this purpose observations were made and measurements taken by his assistants, with the co-operation of the owners or occupiers of warehouses. The comparative results are contained in Table I. The cases which are quoted were selected as being of a typical character; and they represent the average weights lifted, though these were often much below the full capacity of the machines. No counterbalance weights are attached to the hydraulic goods lifts; and consequently the weight of the platform and ram has to be added, to arrive at the total weight lifted by the water pressure. None of the hydraulic machines in Liverpool are fitted with devices for varying the expenditure of water according to the variation of load.

Most of the mechanical work in the warehouse district of Liverpool is done by steam power. To a large extent the warehouses have been built in blocks, each block under one ownership; and the hoists are worked by shafting driven from one central steam-engine. In such cases the cost of skilled attendance per hoist is reduced. But where steam is employed for only one or two warehouses, the loss in getting up steam and in stoppages, added to the wages of an engine-driver and the repairs, makes the total cost of steam considerably higher than that of gas or hydraulic power. Two typical examples of steam machinery in blocks of warehouses are given in Table I. In the first, the engine and boiler are on the top floor of a fire-

proof warehouse. The engine is horizontal, with single cylinder 12 inches in diameter by 2 ft. 4 in. stroke; its speed 60 revolutions per minute; and the steam is supplied from a tubular boiler. The estimated annual expenditure is £135. In the second example, the estimated annual working expenses are £134. In Table II. the results are given of three days' observations of the working of two gas-engines, each of 8-horse power nominal, lifting bales of cotton into warehouses adjoining the docks. In connection with these observations, it transpired that it was the practice of the attendants to start the engines in the morning, or when delivery of goods was first expected, and to let them run throughout the day, or so long as they were likely to be wanted, rather than take the trouble to stop and re-start them. Two men were required to start each engine. For comparison with the results obtained under the conditions dealt with in the table, the following two cases are given, in which the consumption of gas also corresponded with the specific performance of the duty stated. (1) 70,000 lbs. lifted 30 feet high in 1¼ hours. Speed, 120 feet per minute; gas consumption, 200 cubic feet, costing 6¼d., or 0.34d. per ton raised 50 feet, or 1d. per nominal horse power of engine per hour. (2) Gas-engine of 8-horse power nominal, working three hoists, load 5 cwt. each. Speed, 120 feet per minute; gas consumption, 180 cubic feet per hour. Into another warehouse (C), 605 bags, each of 200 lbs. average weight, in eleven waggon-loads, were lifted 10 ft. 8 in., at a speed of 80 feet per minute, by a 3½-horse power gas-engine working a geared hoist by open and crossed belts. The delivery of the eleven loads extended over 4½ hours; and the consumption of gas, as read at the beginning and end of the time, was 1300 cubic feet—the cost being 41.6d. The cost per foot-ton for gas was therefore 0.07d., or 3.5d. per ton lifted 50 feet. In this instance, it was found that the engine was allowed to run all day, though hoisting was required only at intervals. If the engine had been stopped, and re-started for each load, the cost for gas would have been reduced by about one-half. In a large block of offices, an 8-horse power gas-engine is employed to pump water into an accumulator for working by water pressure two passenger and two goods lifts. The passenger lifts travel 55 feet, at a speed of 220 feet per

TABLE I.—Cost of Working Warehouse Hoists by Steam, Gas, and Compressed Air.

Motive Power Employed.	Nominal Horse Power.	Number of Years at Work.	PARTICULARS OF HOISTS.						Total First Cost.	COST OF WORKING.		
			Total.	Average Working at one Time.	Load per Hoist. Maximum.	Load per Hoist. Average.	Speed. Feet per Minute.	Height of Lift.		Total per Annum.	Per Hoist per Annum.	Per I.H.P. per Hour.
			No.	No.	Cwt.	Cwt.	Feet.	Feet.		£ s. d.	£ s. d.	d.
Steam. . .	12	4	7	4	8	5	180	55	1000	135 0 0	19 6 0	0.62
	8	10	5	3	7	4½	158	54	600	134 0 0	26 16 0	1.00
Gas. . .	8	10	4	3	6	5	120	69	600	44 0 0	11 0 0	0.33
	3½	3	1	1	2½ to 10	4	{ 300 } to 75	58	140	28 10 0	28 10 0	0.52
Compressed air. . .	—	20	9	6	8 to 10	5	250	60	—	184 0 0	20 9 0	1.00
	20	3	18	8	6	5	250	33*	2700	133 0 0	7 8 0	0.40

* Average height of lift.

PARTICULARS OF MACHINERY.

Steam.—In the first example, the hoists were driven by a horizontal engine, with single cylinder 12 inches diameter and 28-inch stroke, running at 60 revolutions per minute; boiler pressure 60 lbs. per square inch. In the second example, they were driven by an engine with single cylinder 10½ inches diameter and 21-inch stroke, running at 90 revolutions per minute; vertical boiler with 45 lbs. pressure.

Compressed Air.—First example, one steam cylinder 12 inches diameter and 24-inch stroke, two compressors 12 × 24 inches; boiler 5½ × 20 feet, with 45 lbs. steam pressure; air pressure, 20 to 45 lbs. Second example, two steam cylinders 12 × 22 inches, two compressors 14 × 22 inches; boiler 6 × 24½ feet, with 40 lbs. steam pressure.

TABLE II.—Results of Three Days' Working of Two Gas-Engines, each 8-Horse Power Nominal, Driving Hoists in Warehouses.

Duration of Test.	Height of Lift.		Load Lifted to Each Floor.	Total Load Lifted.	Total Number of Lifts.	Average Load per Lift.	Total Work.	COST OF GAS.					
								Total.	Per Hour.	Per Nominal Horse Power per Hour.	Per Foot-Ton.	Per 50 Foot-Tons.	Per Lift.
	Feet.	In.	Tons.	Tons.		Cwt.	Foot-Tons.	d.	d.	d.	d.	d.	d.
6	49	2	23.6	44.4	200	4.4	1824.7	35.2	5.86	0.73	0.0193	0.965	0.1760
	31	9	20.8										
6¼	49	2	97.2	169.6	720	4.7	7225.9	43.2	6.91	0.86	0.0059	0.295	0.0600
	31	9	41.5										
5½	40	6	26.5	176.0	775	4.5	7068.0	40.0	7.27	0.91	0.0056	0.285	0.0516
	10	0	4.4										
6	40	9	171.5	21.2	100	4.2	673.1	19.5	3.25	0.41	0.0290	1.450	0.1950
	12	0	4.5										
6½	40	9	10.6	28.3	184	3.1	897.1	25.9	3.98	0.50	0.0289	1.445	0.1407
	22	6	10.6										

The mean speed of lifting was 118 feet per minute in each test. There are four hoists worked by each engine.

TABLE III.—Cost of Working Warehouse Hoists by Steam and by Gas.

Motive Power Employed.	Number of Hoists.	AVERAGE COST OF WORKING.				Example of Cost of One Day's Working.	
		Per Hoist per Annum.	Per I.H.P. per Hour.	Per Foot-Ton.	Per Lift.	Per Foot-Ton.	Per Lift.
		£ s. d.	d.	d.	d.	d.	d.
Steam (A)	6	21 10 10	1.27	0.0689	0.443	0.0104	0.101
Steam (B)	3	19 0 11	0.74	0.0907	0.673	0.0147	0.129
Steam (C)	4	29 5 3	0.59	0.1902	1.510	0.0163	0.135
Gas	4	12 6 6	..	0.0542	0.323	0.0152	0.096

minute. They run nine hours per day, during which they make about 400 journeys each; and the average load per lift is 3.75 cwt., including the weight of the lift. The goods lifts travel 20 feet, at 100 feet per minute; and the average load per lift is 8 cwt. The working expenses per annum are as follows: Gas, £80; oil, waste, tallow, &c., £50; engine-driver, at 26s. per week, £67 12s.; repairs, £2 4s.—total, £199 16s.

Two examples of compressed-air machinery are given in Table I. The first comprises one steam cylinder and two compressors; all three being 12 inches in diameter and 24-inch stroke, with an air pressure of 45 lbs. per square inch when all the nine hoists are working. In the second example, there are two steam cylinders 12 in. by 22 in., and two compressors 14 in. by 22 in., with 45 lbs. air pressure for full work. The 18 friction hoists are each worked by two air cylinders coupled direct to the friction-wheel shaft. The annual working expense of this machinery is £133 2s.

The supply of power for hydraulic machines from the public water-mains in Liverpool has been facilitated by the existence throughout the city of special fire-mains, to which it has been practicable to make the connections without appreciably affecting the efficiency of the general distribution of water for trade and domestic purposes. It is obvious that ordinary water-mains can be utilized only to a limited extent for power purposes. With a pressure of 700 lbs. per square inch, which is that usually adopted for hydraulic work, a main 6 inches in diameter will carry about 100-horse power. To obtain the same efficiency from a main conveying water at the pressure ordinarily available, the diameter of pipe required would be about 21 inches.

In an appendix to his paper, Mr. Parry gave the following further examples of the cost of working warehouse hoists by steam and by gas; the results being summarized in Table III.

(A) *Steam*.—Block of five warehouses, with six floors and basement. One warehouse contains two hoists; and four warehouses one hoist each. The six hoists are driven by one horizontal engine fixed in the jigger loft of the middle warehouse, and coupled direct to the line shaft. Maximum load per hoist, 7 cwt.; usual load, 6 cwt. Single-cylinder engine, 9 inches in diameter and 16-inch stroke, running 120 revolutions per minute; allowed to run continuously during business hours, whether doing useful work or not. Vertical boiler, with steam pressure of 40 lbs. per square inch. Machinery erected about 13 years ago. Working expenses for the year 1891, £129 5s. Total number of lifts during the year, 69,925; total estimated foot-tons, 450,155. Example of one day's work, 1000 bales lifted an average height of 35 feet; average weight per bale, 5½ cwt.—making 9625 foot-tons.

(B) *Steam*.—Block of three warehouses, with six floors and basement; one hoist in each warehouse. Maximum load per hoist, 7½ cwt.; average load, 4½ cwt. Speed about 120 feet per minute. Separate doors for receiving and delivering goods. Hand jiggers used for lowering. Horizontal engine, cylinder 8 inches in diameter and 16-inch stroke, running 98 revolutions per minute, said to be started and stopped to suit requirements of work. Vertical boiler, 4 feet in diameter and 8 feet high; ordinary steam pressure, 40 lbs. per square inch. Engine fixed in basement and driving horizontal shafting in jigger loft through bevel-wheels and about 70 feet of vertical shafting. Warehouseman attends to engine and boiler. Working expenses for the year 1891, £57 2s. 9d. Total number of lifts during the year, 20,350; total foot-tons, about 151,110. Example of one day's work, 344 packages lifted an average height of 27 feet; average weight of each, 6½ cwt.—making 3018 foot-tons.

(C) *Steam*.—Two blocks of warehouses of five floors, separated by a space of 20 feet. Two hoists in each block, all driven by one engine fixed on the top floor. Engine drives through bevel-wheels an upright shaft and a line shaft crossing the open space between the two blocks; altogether, 230 feet of 2½-inch shafting. Engine cylinder 11¼ inches in diameter and 24-inch stroke; speed, 90 revolutions per minute when running light. Allowed to run continuously during business hours, unless work is very slack. Vertical boiler, 5½ feet diameter and 10 feet high; steam pressure, 40 to 45 lbs. per square inch. Maximum load on hoists, 50 cwt., double purchase; usual load, 7 to 8 cwt. Speed, 150 to 160 feet per minute. First cost of machinery, £1500; erected 15 years ago. Working expenses for year 1891, £117 1s. 2d. Total number of lifts during the year, 18,524; total foot-tons, about 147,755. Example of one day's work by two of the hoists, 677 bales lifted from 12½ to 47½ feet, equivalent to 5611 foot-tons.

Gas.—Block of four warehouses, with six floors and basement; one hoist in each warehouse. Maximum load with single purchase, 8 cwt.; with double purchase, 13 cwt. Speed about 140 feet per minute. Crossley engine, 8-horse power nominal, attended to by warehouse keeper; fixed on concrete floor in jigger loft, midway in length of block. Fast-and-loose pulley on each end of crank-shaft, driving up to line shafts, which work the hoists. One belt drives shaft for Nos. 1 and 2 hoists, and the other drives shaft for Nos. 3 and 4; so that either two or four hoists can be worked, as desired. Engine in use seven years. Cost of working for the year 1891, £49 6s. Total number of lifts during the year, 36,236; total foot-tons, 218,254. Example of one day's work, 400 lifts, averaging 5½ cwt. and 23 feet high, equivalent to 20,530 foot-tons.

REGISTER OF PATENTS.

Igniting Apparatus for Gas-Engines.—Abel, C. D.; communicated from the Gas Motoren Fabrik Deutz, of Koeln-Deutz, Germany. No. 14,519; Aug. 27, 1891. [8d.]

This invention relates to the gas-engine igniting apparatus described in patent No. 11,444 of 1887, wherein an igniting-tube surrounded by a casing or chimney was heated externally to a red heat by a ring-shaped Bunsen burner surrounding the base of the tube, to which air was admitted through lateral passages at the bottom of the casing.

It has been found by experience that, with this arrangement, the heating flame does not burn regularly if the igniting-tubes are not always of precisely the same diameter, or if the diameter becomes altered by oxidation. According to the present invention, therefore, the heating flame is rendered independent of any such variations in the diameter of the igniting-tube by the employment of a burner-disc having a number of inclined holes or small tubes directed towards the igniting-tube, the flames from which holes or tubes, being each surrounded by the air entering through the lateral passages, unite into one round the igniting-tube, giving off their greatest heat above such point of union. The star-shaped sectional form of the flame thus obtained offers to the air supply a considerable surface; so that complete combustion of the gases will take place at the part to be heated, and no disturbance of the effect of the heating flame will be produced by any alteration in the diameter of the tube. Furthermore, the mode of fixing the igniting-tube by screwing, as indicated in the prior patent, is not very convenient; and this mode of screwing cannot be employed with defective tubes of refractory material such as porcelain, fire-clay, &c.

Valves for Gas-Engines.—Abel, C. D.; communicated from the Gas Motoren Fabrik Deutz, of Koeln-Deutz, Germany. No. 17,724; Oct. 16, 1891. [8d.]

This invention relates to the valve apparatus for gas-engines which controls the communication between the compressed charge and the igniting device, and in which there is either a cylindrical valve having a longitudinal motion or a rotary motion, or else a lift-valve. In either arrangement, solid deposits, resulting from the explosion of the charges, are formed on the working surfaces of the valves, producing sticking or imperfect action.

The present invention has for its object to obviate such defective action; and it consists in imparting to the valve, at each stroke, a compound motion in such a manner that, in the case of a rotary valve, this at the same time has a longitudinal motion imparted to it, while in the case of a sliding or lifting valve, a rotary motion is imparted. It has been found that, by means of this compound motion, the close fit of the valve and its seat is always ensured; while with rotary valves articles of deposit that find their way between the working surfaces are caused to be expelled from between them.

The means for effecting this compound motion can be variously modified. Thus, according to one arrangement, in the case of a cylindrical rotary valve that controls the communication between the explosion chamber of the engine and the igniting device, the valve is so arranged in its casing as to be capable of end motion—such as by forming a space at its inner end, while its outer end has a coned surface so as to seat gas-tight against a correspondingly coned surface of the casing. Beyond this the valve stem passes through a stuffing box, and is connected by a sliding connection to a sleeve to which a reciprocating rotary motion is imparted by a rod and crank, eccentric, or cam on the engine-shaft. From the transverse passage of the valve, a longitudinal passage leads through the inner end of the valve to the space at the end of it. Thus at the charging stroke of the engine piston, when a partial vacuum is formed in the cylinder, the effect of the above arrangement of passages and space will be that there will be an excess of atmospheric pressure acting on the outer end of the valve stem; and this will cause the valve to slide longitudinally to a certain extent inwards while it is being rotated. During the compression and firing strokes, on the other hand, there will be an excess of pressure, tending to drive the valve longitudinally outward; so that it will be thereby made to slide back again into its original position.

Charging and Drawing Gas-Retorts.—Lyon, C. W., of Gildersome, Yorks. No. 3413; Feb. 25, 1891. [1s. 1d.]

This invention of "improvements in machinery or apparatus for charging and discharging gas-retorts, has for its object the performance of these operations with less labour and at less cost than heretofore usual."

It consists, firstly, of mechanism for charging. This comprises a hopper at one end of a tube or spout, fed with coal from other hoppers or shoots kept supplied with coal, and having closed or hinged trap-doors, and being located at a suitable elevation for the hopper of the charging mechanism to pass beneath them, opposite to the several tiers of retorts. Thus, on the charger passing from one retort to another and its hopper coming under one of the shoots, and by such action having released the trap-door thereof immediately over, it thus becomes automatically filled, so as to be able to charge a retort without loss of time. The tube or spout is so mounted upon a carriage that it can be readily placed in front of, and passed into, a retort at whatever height or position it may be. Within this tube or spout is a suitable screw which is caused to rotate and to traverse or push the coal contained in the hopper into the retort, commencing its delivery therein at the rear or back end; and, during such delivery, the tube or spout is caused to gradually retire from the retort by mechanism suitably devised for the purpose. Having charged one retort, it can then be passed to others for a similar purpose.

For actuating the apparatus, the patentee proposes to employ, by preference, a gas motor engine, on a suitably arranged carriage, the whole mounted upon rails passing in front of the retorts. For supplying the gas motor with gas and atmospheric air, so as to suit the various positions of the retorts, and in order to obtain air in as pure a state as possible, it is drawn from outside of the retort-house by means of a suitable vessel about the length of the retort-house, so constructed that, on water or other liquid being supplied thereto to a certain depth, it forms two sealed cavities, one to contain gas and the other

Fig. 1.

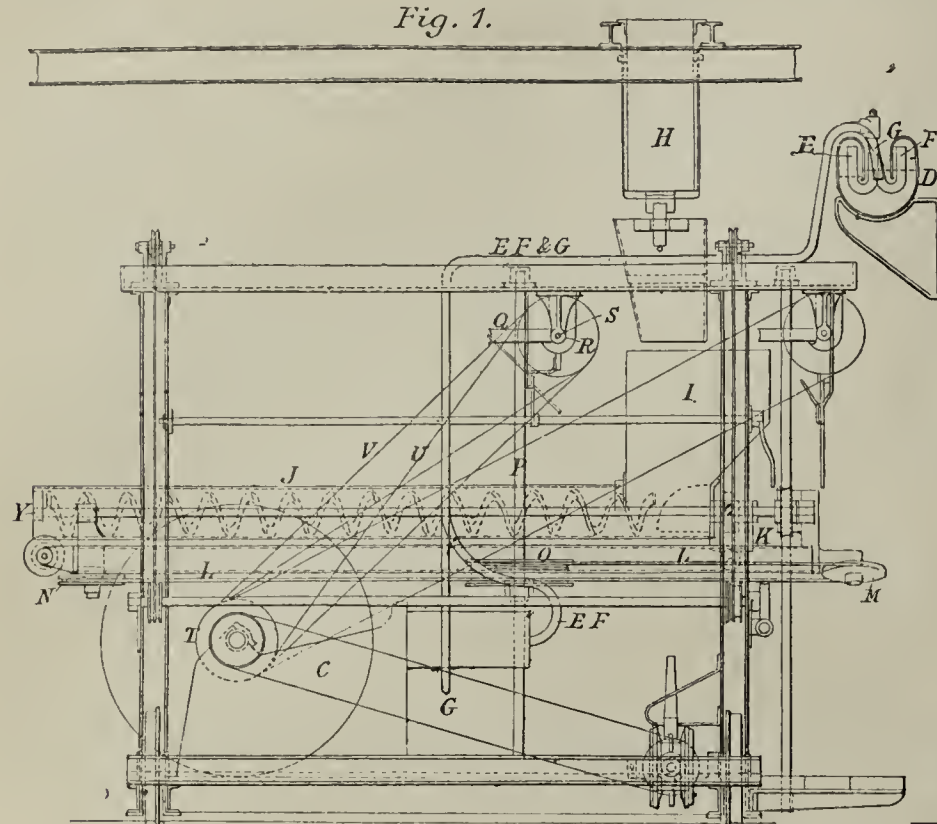


Fig. 2.

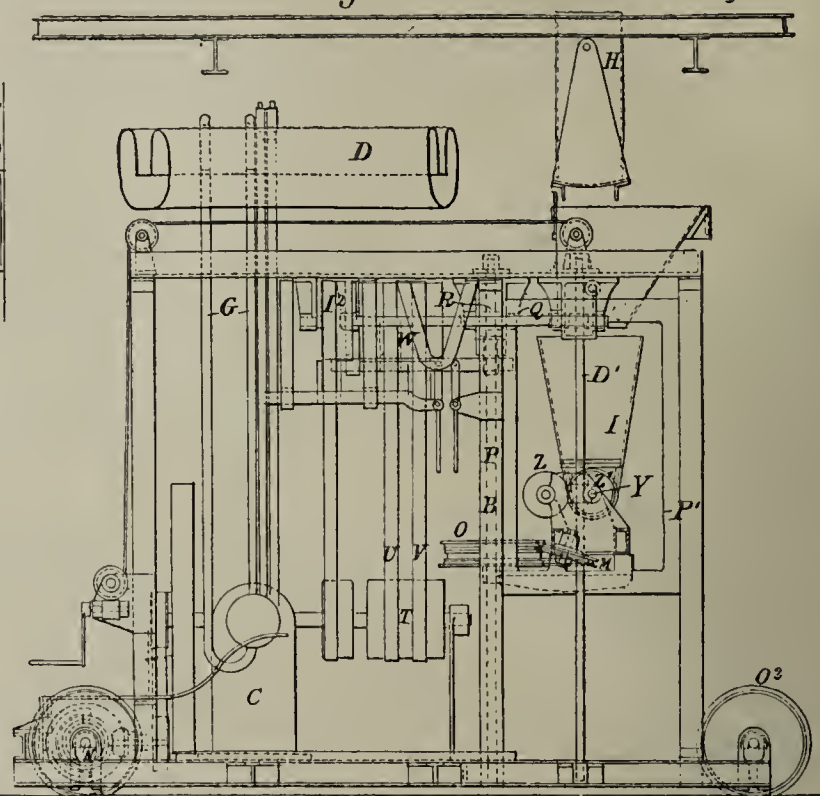
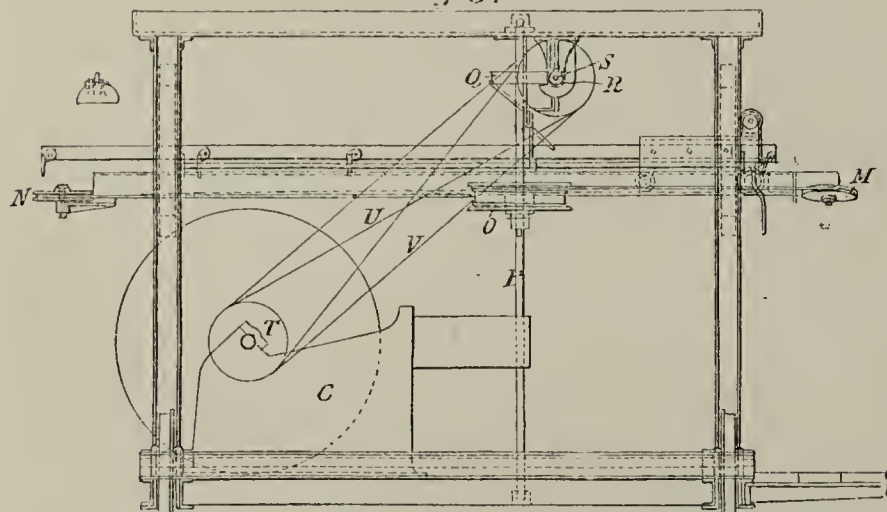


Fig. 3.



air. This vessel is fixed horizontally and parallel with the rails upon which the charging and discharging machines run to and fro. From the gas-engine a pipe passes into each of the sealed cavities; and both are capable of travelling therein as the machine passes to and fro on the rails, and at the same time to receive a continuous supply of gas and air for the engine—means being provided for the removal of any liquid deposited in the bends of the pipes. The water that forms the seal in the above-named vessel can be used for keeping the cylinder of the gas-engine cool, and thereby dispense with the cold-water tank usually required with a gas-engine. The quantity of water in the vessel is regulated by an automatic valve or tap at one end and an overflow at the other; so that a constant supply of cold water is kept up.

Secondly, for discharging the retorts, a specially constructed rake is arranged with a to-and-fro movement in and out of the retort, having one or more heads. It is so arranged by suitable mechanism that, on entering a retort, the heads swing backward and pass as near the crown of the retort as possible; but on the return stroke, the heads drop on to the coke and draw it out. The rake is mounted on a suitably constructed carriage, with mechanism and a gas motor engine for actuating it.

Fig. 1 is a side elevation of the charging apparatus, as seen mounted upon rails in a retort-house. Fig. 2 is a back elevation. Fig. 3 is a side elevation of the discharging apparatus.

C is a gas motor engine, of which there is one to both the charging and discharging apparatus, and combined with their respective framework for actuating the various required movements. These motors are supplied with gas and air for actuating them from a vessel D, fixed to the side of the retort-house, and of the same length as the house. This vessel, when properly equipped (and as previously referred to), forms two sealed cavities—one for gas and the other for air; water being the separating and sealing medium. E and F are pipes for conveying gas and air from the respective sealed cavities to the engine. These pipes are fitted with plugs at their upper bend, which can be removed to allow of the application of a hand-pump to clear the bends of liquid accumulating there. Cold water for cooling the engine cylinders is also supplied from the vessel D, by the circulating-pipes G. The several pipes E, F, and G, are free to pass along the vessel D, as the apparatus moves along the house from one retort to another. H is a hopper or shoot; there being one opposite to each set of retorts. These hoppers are constantly supplied with coal; and are each provided with a swing bottom or trap-door, and are opened by means of tappets, as the apparatus takes its place beneath it ready for charging a retort. From the hopper coal is shot into a magazine I, in sufficient quantity for a charge. This hopper, to which the charging tube or spout J is attached, is fitted at its rear with a carriage K, and mounted upon wheels that run in channel-guides of the framing as the tube or spout enters into and retires from a retort. To the carriage K the ends of a chain or cord L are connected, which then pass over guide-pulleys M and N, and around a drum O of a windlass on the shaft P. On the upper part of this shaft is a worm-wheel Q, actuated by a worm R on the shaft S, which receives a reversible motion from the drum T on the engine-shaft, through the medium of cross and open straps U and V taking alternately on the fast pulley W, governed by a strap shipper commanded by hand. This arrangement

enables the charging tube or spout J to be passed into a retort and withdrawn therefrom while the charging takes place. Within the tube or spout, is mounted a creeper screw X upon the shaft Y gear wheels Z connecting the shaft to a driving-shaft that runs parallel with the tube or spout and is grooved the whole length. The wheel Z upon it has a feather taking therein; and it is thus capable of sliding thereon, as well as being driven thereby, while the tube or spout is moving end-wise.

The tube or spout J must first be filled by placing sufficient coal in the hopper I, then setting the screw X in motion to traverse it into the tube or spout. The apparatus is now ready for charging the retorts one after another. Means for moving the apparatus on the tram-rails from one retort to another at any level and in either direction are provided; also for raising and lowering the charging tube or spout to the various tiers of retorts.

The arrangement of the discharging-machine is practically similar to the charger; and its action will be readily understood from an inspection of fig. 3.

APPLICATIONS FOR LETTERS PATENT.

- 965.—VICKERS, W. E., and EVERETT, G. A., "Effecting the complete mixture of inflammable gas or vapour with air." Jan. 18.
 1117.—BRANSTON, F. R. E., "Stoves for oil or gas." Jan. 20.
 1148.—RUSSELL, T. G., "Engines operated by mixtures of gas and air, or other combustible vapours." Jan. 20.
 1181.—LOMAX, W. J. and C. J., "Combined refuse furnace and gas apparatus." Jan. 21.
 1246.—BROOKS, J. B., and Holt, J., "Gas and vapour engines or motors." Jan. 22.
 1320.—LOVE, J., "Gas regulators or governors." Jan. 22.
 1437.—M'DOUGALL, I. S. and J. T., "Treating oils for rendering them capable of transport or storage, and of use as fuel, or as illuminants, with greater safety and convenience than hitherto." Jan. 25.
 1441.—WESTON, B. S., "Gas-engines." Jan. 25.
 1480.—HOPKINSON, W., and GARSIDE, R. W., "'Peep-light' cocks for gas." Jan. 26.
 1500.—PRIESTLEY, G. V., "Gas and petroleum motors." Jan. 26.
 1575.—KLONNE, A., "Manufacture of illuminating and heating gas, and apparatus therefor." Jan. 26.
 1685.—HORNSBY, J. W., EDWARDS, R., and GIBBON, W. E., "Engines operated by the explosion of mixtures of combustible vapour or gas and air." Jan. 28.
 1768.—RICHARDSON, J., and NORRIS, W., "Gas-engines." Jan. 29.
 1804.—FOX, S., "Manufacture or production of water gas, and apparatus therefor." Jan. 29.
 1805.—LEE, T. W., "Manufacture or production and distribution of a mixture of inflammable gas and air, and apparatus therefor." Jan. 29.
 1814.—SCHWARZ, R. G., "Gas-engines." Jan. 29.
 1874.—BROPHY, M. M., "Atmospheric gas-burners." Jan. 30.

Barnsley and the Water Supply of Darton and Roystone.—A special meeting of the Darton Local Board was held last Tuesday for the purpose of considering the water supply of the township. The Clerk read a letter from the Local Government Board, in which was enclosed a communication from the Barnsley Town Council, opposing the application made by the Darton Board to borrow £7000, for the purpose of securing a supply of water from Penistone. The Barnsley Town Council pointed out that they were willing and prepared to continue the present supply of water to Darton and Roystone, which township Darton propose to supply at 1s. per 1000 gallons. Although the minimum price which Darton agreed to pay Penistone was 6d. per 1000 gallons, it would really cost 10d. delivered at Darton. The cost of supplying water to Darton, they maintained, would be £9400, and not £7000 as represented. A reply to Barnsley's objections had been prepared by the Clerk; and it was decided it should be forwarded to the Local Government Board. It was pointed out that the Barnsley Town Council had frequently called upon Darton to reduce their consumption, and had finally given notice that they should cut off the supply. The terms offered by Barnsley were unsatisfactory; and the Local Board, in the interests of the inhabitants, had been compelled to take steps to secure a supply of water from elsewhere.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

The Suggestion for The Gas Institute.

SIR,—The question your correspondent of last week (p. 195) wishes The Gas Institute to inquire into is a wide, but interesting one. The Research Committee proposed is already in existence; and I may promise you that the matter shall be fully considered at the first meeting of the Council.

WILLIAM A. VALON,
President, Incorporated Gas Institute.

3, Victoria Street, Westminster, Feb. 6, 1892.

Standards of Light.

SIR,—I feel that some short comment is necessary from me in answer to the remarks of Mr. Charles Hunt and Mr. John T. Sheard in your last issue. There is really not much difference of opinion between these gentlemen and myself on the special point raised.

In advocating the gas being consumed to a constant 16-candle standard, I do not ignore the fact that gas of a less value than 16 candles, when burnt in the Sugg "London" Argand, gives its best result consumed at a rate just short of smoking-point; but it is questionable whether such an extreme deviation from the present method would be agreed to by all parties. The abandonment of the rigid 5 feet consumption, and the maintenance of a constant 16-candle light, is at least a step in advance, advocated by Mr. Harcourt, and is so moderate a demand that it is far more likely of adoption than a wider claim. Moreover, once let the light of the gas be a shifting quantity, and you must have a moveable standard, or a moveable disc, and you cannot have equi-distance between the two lights. I had also in my mind while writing that I liked the general working of the Harcourt table photometer; but this, of course, would be useless without the gas to be tested being burned to a constant light.

My only wish over the whole matter of photometry is to see the general question of procedure settled on a fair basis; and although I have made (partly for the sake of elucidating a discussion) certain recommendations, I have no desire or wish to dogmatically insist upon them, but prefer to keep my judgment reasonably open in the face of the fact that we have an important Scientific Commission about to investigate the whole question.

Feb. 5, 1892.

H. LEICESTER GREVILLE, F.I.C., &c.

The Valuation of Gas and Water Works for Assessment.

SIR,—As a reader of the JOURNAL, I have been much struck with the enormous cost incurred in connection with the assessment appeal of The Gaslight and Coke Company, the whole of which must be paid by either the consumers or the ratepayers; and the question that occurs to me is: Cannot a readier method of arriving at the rateable value of gas and water undertakings than the present one be introduced. My experience, as a member of an Assessment Committee ever since the passing of the Assessment Act, enables me to say that such Committees are not qualified to deal with the technical calculations which the present mode requires, or with the mystical "hypothetical tenant." The disturbance in valuation to which I refer more particularly, in the cases that have come before the Committee and the Gas Company I am connected with, is caused by some Guardian being favoured with a circular from a valuer, setting forth the great increase he has made in the lists by his valuation of the property. Thereupon the Guardian directs attention to the enormous profits made by the companies concerned; and the valuer is set to work. He earns his percentage; and either the companies submit to the injustice, or, by resistance, obtain a compromise. In the cases my Committee have taken to Quarter Sessions, we have sustained the valuation; both parties having to pay their own costs. The additional rateable value has, however, not yet recouped the cost; and it appears to me to be a loss all round.

The course I would suggest is to take as a basis the actual profit made. No reasonable man would have any difficulty in fairly fixing the rateable value from the published accounts of either gas or water companies. It should be (say) one-fourth for structural value; and the remaining three-fourths should be divided over the different parishes, either urban or rural, according to the quantity of gas sold therein. With union chargeability, a little inequality would doubtless be felt. In the union from which I am writing there is something analogous to what I mean. There are considerable stone quarries which, previous to the formation of the Assessment Committee, were very irregularly rated. The Committee requested representatives of the various owners to meet them. On doing so, they very straightforwardly gave full information as to the cost of obtaining the saleable stone; and thus the Committee were enabled, from the actual profit realized on the stone sold, to fix an equitable rateable value. A return is made to the Committee every year, and they have means of checking its correctness. I can only add that the system works very smoothly; and it is one which all the members of the Committee understand.

Feb. 3, 1892.

T.

Accident at the Halifax Gas-Works.—Last Friday week, Timothy McGowan was attending to a coke-breaking machine at the Halifax Corporation Gas-Works, when he had his arm drawn into the machinery, and badly lacerated. Some of his ribs were also broken.

Imprisonment for Stealing Gas at Longwood.—Hugh Gunn, a plasterer, of Lindley, was charged last Monday week at Huddersfield, with stealing gas, the property of the Longwood Gas Company. In June the Company removed the meter, and cut off the supply of gas to the prisoner's house, because he owed an account. On the 19th ult., it was discovered that a pipe had been connected with the service, and conveyed gas to a stove, where it was burning. Prisoner declared that he knew nothing about the matter. The Magistrates, however, decided to send him to gaol for a month.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Friday, Jan. 29.

(Before Mr. Justice ROMER.)

Lord Hatherton v. The South Staffordshire Water-Works Company.

In this action, the plaintiff asked for a declaration that he was entitled to be supplied by the defendants with water, free of cost, to certain farms at Huntington, in Staffordshire, for the purpose of irrigation. The defendants denied their liability.

Mr. RIGBY, Q.C., Mr. HALDANE, Q.C., and Mr. WILLIAMS appeared for the plaintiff; Sir H. DAVEY, Q.C., Mr. R. NEVILLE, Q.C., and Mr. A. T. LAWRENCE represented the defendants.

Mr. RIGBY, in opening the case, said the point was a very short one, and turned upon the construction of section 22 of the defendants' Act of 1875, which was put in for the protection of the plaintiff; he having petitioned against the Bill, which gave the defendants power to sink a shaft, make a pumping-station, and drive headings 1000 yards in each direction from the station—thereby depriving a great part of his land of the water it would otherwise receive. Accordingly, a clause was inserted to the effect that, if at any time Lord Hatherton or his successors should be desirous of obtaining a supply of water for domestic or agricultural or other purposes for the use of Teddesley Hall and Hatherton Hall, or for the use of the home farm, the agents' or bailiffs' houses, the workmen's cottages, &c., or his or their farms and cottages at Huntington, or any of them, he or they might lay pipes therefrom to the nearest point of the Company's system, and thereupon, and always thenceforth, the Company were to gratuitously, and at their own expense, deliver into those pipes a supply of water of such quality and at and during such times as they supplied it to their customers at or from the Huntington pumping-station. A map, showing the station, was produced, on which were certain fields coloured green, which plaintiff said had been from time immemorial—at any rate, they had evidence going back 50 years and more—cultivated by irrigation. This was well known. In fact, when the defendants obtained their original Act in 1853, they took power to supply water for the purposes of irrigation; so that it could not be said that this was a new method of cultivation. The learned Counsel therefore contended that the plaintiff was entitled, under the section in question, to have the supply for which he asked. First of all, it came under the heading of "agricultural purposes," for one could not limit the meaning of "agricultural" to the growing of oats or wheat; and he cited the Oxford Dictionary, edited by Dr. Murray, to show that the word included "tillage, husbandry, and farming, in the widest sense." But if it could in any way be made out that water for irrigation was not included in "agricultural purposes," it certainly came within the "other purposes" of the section.

Justice ROMER asked if there was any question about the lands for which the water was required being included in the "farms at Huntington."

Mr. RIGBY replied that there was not.

Justice ROMER remarked that in that case he would hear what Sir Horace Davey had to say.

Sir H. DAVEY submitted that the claim made in the pleadings was extravagant, as he understood it was to be water for irrigating the whole of Lord Hatherton's lands in Staffordshire, amounting to about 12,000 acres.

Mr. RIGBY said this was not so. The statement of claim no doubt said the plaintiff was possessed of lands to this extent; but the whole of the area referred to in the clause on which he relied was something like 2000 acres.

Sir H. DAVEY said there was nothing on the evidence limiting the claim in this way. It was not to have water for irrigating such lands as were usually cultivated by irrigation, which would be a comparatively small matter, but water for the irrigation of the whole of the lands mentioned in the section, which would, in fact, prevent the Company from carrying out the primary object of the undertaking, and of supplying water for the domestic use of the inhabitants of the district. It might easily absorb the whole supply. New methods of agriculture were constantly being introduced; and it was at least conceivable that a person might desire to cultivate rice, which required to be grown in a foot of water. If the plaintiff would limit his claim to such fields as were now, or at the date of the Act, usually irrigated as water meadows, though it might be a question whether he was entitled to it, he thought the Company would probably not raise any difficulty about it.

Justice ROMER asked Mr. Rigby if he was willing to accept this offer.

After some consultation between Counsel and parties, it was stated on both sides that there was a probability of their coming to an agreement on substantially the foregoing basis; and the case was thereupon ordered to stand over for a fortnight, in order that details might be arranged.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Thursday, Jan. 28.

(Before Mr. Justice SMITH and a Common Jury.)

Tiller v. The Southwark and Vauxhall Water Company.

This was an action to recover damages in respect of loss sustained by the plaintiff through the alleged negligence of the defendants. The plaintiff, a licensed victualler, on Dec. 15, 1890, was the proprietor of the King's Arms, High Street, Wandsworth; and he alleged that the defendants, having water at high pressure under their control, allowed it to overflow so as to make its way into his cellar, and spoil the spirits and tobacco stored therein, for which he claimed £113 damages. The defendants denied the negligence.

Mr. CANDY, Q.C., and Mr. H. KISCH appeared for the plaintiff; Mr. BIGHAM, Q.C., and Mr. SHEARMAN, for the defendants.

Plaintiff, in his evidence, stated that, on the evening of Dec. 15, 1890, about six in the evening, his attention was drawn to the fact that the

water-main in front of his premises had burst, and that the water was running into his cellar. He borrowed two pumps, and engaged men to keep the water down. The work was continued for four hours; and at about ten o'clock the Battersea steam fire-engine came, and pumped the cellar dry. The water, however, came in again; and the process of pumping had to be repeated. On the 16th the water had risen to about 18 inches in the cellar; and the Company sent their engine to pump it out. Great damage was caused to the stock. When the ground was opened, it was ascertained that the main was fractured. Witness examined the broken pipe, and found that the casting was "honeycombed"—dirt and slag had accumulated in the metal. The defect was of such a nature that a practical man ought to have detected it at the time the pipe was put down. It was not fit to hold water at high pressure. Witness had had 14 years' experience as an engineer.

Cross-examined: His experience consisted in making valves and brass pumps. He had never made a casting of an iron pipe, but had worked on them. The honeycombing was inside the pipe; but there was a roughness on the outside which led him to suspect that there was something wrong. Witness was cross-examined at some length with the view of showing that he had exaggerated the damage caused to his stock.

Mr. D. F. Worger, Assoc. M. Inst. C. E., the Company's Assistant-Engineer, was called, and stated that the pipe in question was fixed on Feb. 4, 1890. It was a 20-inch pipe; the weight being rather more than a ton, and the thickness a little over an inch. It came from the Company's works at Battersea; and witness thoroughly inspected it before it was laid. There was no roughness on the outside to indicate any imperfection in the iron. It was an ordinary casting, and the cock was properly and skilfully laid. About the date of the accident, the Company had ten or eleven bursts, and upwards of 1000 leakages, attributable to the extreme frost drawing the joints of the pipes.

Mr. Seaton, a civil engineer, who had had 20 years' experience of pipes, said perfectly sound and well-laid pipes would burst on change of temperature. He had known a 16-inch main burst; but he did not recollect a case with a 20-inch.

Mr. Gaster, a clerk in the Meteorological Offices, produced the records taken at Kew on Dec. 14 and 15, 1890, from which it appeared that the temperature varied as much as 10° in the course of 24 hours; but it was all the time below freezing-point.

Counsel on each side having addressed the jury, the case was adjourned.

Friday, Jan. 29.

Justice SMITH summed up the case this morning; telling the jury they had to say, first, whether the accident arose from the negligence of the defendants, because otherwise they would not be responsible; and, secondly, if they should be of opinion that negligence was proved, they would have to say what amount of damage the plaintiff had sustained.

After retiring for a short time, the jury returned a verdict for the plaintiff, with £55 damages.

Wednesday, Feb. 3.

(Before Justices LAWRENCE and WRIGHT.)

Corporation of Southport v. Assessment Committee of the Ormskirk Union and the Overseers of Birkdale.

This was a special case stated for the opinion of the Court by Mr. Justice Charles, on an appeal by the Corporation of Southport against an assessment of gas mains and pipes of which they have the use in the township of Birkdale.

Mr. A. M. CHANNELL, Q.C., and Mr. S. T. EVANS appeared for the appellants; Mr. A. T. LAWRENCE represented the respondents.

Mr. CHANNELL stated that the appellants were owners of the Southport Gas-Works, and were empowered, under their Act of Parliament, to supply gas to the township of Birkdale. By section 43 of the Southport Improvement Act, 1871, the Local Board of Birkdale had the exclusive right of laying gas mains and pipes within the township; affording the Corporation of Southport the use of the mains for the supply of gas for public and private purposes in the township. In consideration of this, the Corporation agreed to pay to the Local Board the sum of 4½d. per 1000 cubic feet on the gas used by private consumers, and a further sum of 3½d. per 1000 cubic feet for the privilege of supplying it. The Local Board of Birkdale accordingly laid the mains and pipes, and kept them in good repair. On the 7th of May, 1891, the Corporation of Southport were assessed as occupiers of the mains and pipes, and were charged 1s. in the pound. The amount at which they were so assessed was £42, based on a rateable value of £840. The respondents' valuer arrived at the £840 by taking as the gross estimated rental the products of the receipts from the 4½d. and the 3½d. agreed to be paid, after making all proper deductions for the cost of maintenance and reproduction. The amount paid by the appellants to the Birkdale Board in respect of the 4½d. per 1000 cubic feet for the year ending March 25, 1890, was £717 16s. 6d.; and that paid in respect of the 3½d. per 1000 cubic feet was £562 1s. 6d. The respondents submitted that the sum £1279 18s., the aggregate of the two amounts above mentioned, was properly taken as the gross estimated rental for the purpose of ascertaining the rateable value, and arriving at an assessment of the pipes and mains. On the other hand, the appellants contended that, whatever such gross estimated rental might be, it was a sum less than the receipts in respect of the said 4½d. per 1000 cubic feet, which for the period mentioned amounted to £717 16s. 6d. They further submitted that the proper amount of such gross estimated rental should be determined by reference to the ratio which the receipts of the appellants for gas supplied in the township of Birkdale for the year ending March 25, 1890 (being the year next preceding the date when the valuation was made), bore to the gross receipts of the whole of the gas-works and undertaking of the Corporation for the same period. An arrangement had been come to between the parties for the purpose of having this question decided; and it had been agreed that if the Court should be of opinion that the respondents were right in taking the sum of £1279 18s. as the gross estimated rental of the mains and pipes, the

assessment should remain as it now stood—viz., at £840. If, however, it was held that the gross estimated rental should be £717 16s. 6d., less the cost of maintenance and reproduction, then the rateable value was to be reduced to £300. If the Court were of opinion that the correct method of arriving at the gross estimated rental was by reference to the ratio between the receipts in Birkdale and the gross receipts of the gas-works and undertaking of the Corporation, then the rateable value was to be reduced to £150. If, however, their Lordships held that none of these methods of ascertaining the gross estimated rental were correct according to law, then they were asked to declare what was the right method by which to arrive at the rateable value. The learned Counsel then quoted various authorities in support of the appellants' contention; among them being the Mile End Old Town case, which, he said, was looked upon as a guiding case in such matters. The general rule had been to arrive at the rateable value of the whole undertaking by finding what the receipts and payments were, and then distributing it among the various parishes; and they ought to treat the whole thing as one system, and not deal with it in separate parishes.

Justice WRIGHT asked if any case had arisen in which the same point had been dealt with.

Mr. CHANNELL said he believed not.

Mr. A. T. LAWRENCE, for the respondents, argued that there was no analogy between the case quoted by his learned friend and the present issue, because facts were found there which could not possibly be found in the present case—viz., that the condition of things in the several parishes in respect of costs was precisely the same.

Justice LAWRENCE said he was of opinion that the sum of £717 16s. 6d. was the gross estimated rental. It was clear that the 4½d. per 1000 cubic feet was the consideration given for the gas, and that the 3½d. had nothing to do with the rent of the gas-pipes, but seemed to be a sum which might possibly, under ordinary circumstances, have been paid in a lump amount. This being so, he thought the annual charge should be reduced from £840 to £300.

Justice WRIGHT concurred, and said he did not think the Court ought to answer the general question of law at all, as the facts excluded the contention that the rateable value ought to be found. The 4½d. was the sum to be paid in respect not only of the cost and maintenance of the pipes, but also with consideration of the use of them; and this was the only sum which properly represented the rental. The 3½d. was compensation for the invasion of the district, and ought not to be taken into consideration. It was difficult to say what principle ought to be adopted; but no doubt the parties would find in that declaration evidence on which they could proceed in estimating the value—viz., that £717 16s. 6d. was the estimated rental.

After some discussion between Counsel,

Mr. CHANNELL stated that they had agreed that the finding of the Court should be as follows: "The Court is of opinion that none of the methods of assessing stated in the case are correct; but that the 4½d., producing £717 16s. 6d., is important evidence of the estimated rental, but is not conclusive."

The Barnoldswick Local Board and the Gas Company.—At the ordinary meeting of the Barnoldswick Local Board last Wednesday, a proposal for acquiring the plant of the Gas Company was considered. It was eventually decided that the Clerk should write to the Company inquiring if they were prepared to meet the Board with respect to the matter.

The Gas Supply of Burley-in-Wharfedale.—Messrs. W. Fison and Co., of the Greenholme Mills, Burley-in-Wharfedale, who have manufactured for the Local Board the gas consumed in the district, have intimated to the Board their intention to discontinue the supply after the lapse of two years. The Board have decided to ascertain from the Otley, Ilkley, and Yeadon Gas Companies whether they will supply Burley, and on what terms.

Suggested Purchase of the Gomersal Water-Works by the Local Board.—At a meeting of the Gomersal Local Board last Wednesday, Mr. J. Brearly suggested for the consideration of the members the advisability of purchasing the Gomersal Water-Works on behalf of the ratepayers. He said that the stock of the Company consisted of 1000 shares of £5 each, and that, according to his reading of the last balance-sheet, they had made a net profit of £545 on the year. If the Board had to pay £10,000 for the interest of the Company, they could borrow this sum at 3½ per cent., which would involve an annual charge of £350; and even then there would remain, on the results of the past year, a profit of £195, besides the expenses incurred by the Company for their offices, &c. If the works were the property of the ratepayers, moreover, there would be an incentive to economy which did not at present exist. Several members remarked upon the importance of the suggestion; and Mr. Scott moved that a Committee be appointed to ascertain whether the Company would be willing to treat with the Board; but, on the suggestion of Mr. Anderton, it was agreed to let the matter stand in abeyance until after the election, next month.

The Kirkleatham Water-Mains Arbitration.—A special meeting of the Kirkleatham Local Board was held at Coatham last Saturday week, to consider what steps should be taken with regard to the question of the water supply of the district. The Committee entrusted with the negotiations in the matter reported that a scheme for effecting a compromise with the Stockton and Middlesbrough Water Board, with a view of continuing the present service, had been fully discussed; but, having taken into consideration all the circumstances of the case, they recommended that the only course open to the Board was to appeal to the Divisional Court to set aside the award of the Arbitrator who conducted the recent proceedings (see *ante*, p.164). The recommendation was adopted. It is reported that Messrs. Downey and Co. and Messrs Walker, Maynard, and Co., the two principal manufacturing firms in the district, have offered, if the Local Board will abandon their scheme and obtain power to spread the repayment of the expenses already incurred over a term of years, that they will voluntarily contribute at the rate of ½d. per 1000 gallons towards their redemption. A similar offer, it is stated, has been made by the North-Eastern Railway, who are also large consumers of water.

MISCELLANEOUS NEWS.

THE GASLIGHT AND COKE COMPANY.

The Half-Yearly General Meeting of this Company was held at the Chief Offices, Horseferry Road, Westminster, last Friday—Colonel W. T. MAKINS, M.P., in the chair.

The SECRETARY and GENERAL MANAGER (Mr. J. Orwell Phillips) having read the notice convening the meeting, the report and accounts, given in the JOURNAL last week, were presented.

The GOVERNOR, in moving the adoption of the report and accounts, said that about £159,000 had been expended on buildings, machinery, and works, in the six months covered by the accounts. At Beckton they had laid out £5000 on a gasholder and tank, £12,000 on a retort-house, £26,000 for oil-gas plant, £6000 for waggons, £4000 for shops, and £11,000 on sundries. At Kensal Green the items were very much the same, except that the oil-gas plant had involved an expenditure of £16,000, and that on gasholders and tanks £20,000 had been spent. With reference to the revenue and expenditure for the half year, he thought the shareholders might consider it, on the whole, a very satisfactory account, apart from the loss on the sale of coke and residuals. Coke had realized less by £45,356; and the other decreases had been £2219 in breeze, £12,748 in tar and tar products, and £1428 in ammoniacal liquor. Altogether they had lost £61,751, out of which gas only stood for £7000. The figures he had given were in comparison with those for the corresponding period of 1890; and the Company were worse off by the amount he had shown. On the other hand, coal had cost £65,000 less; and there had been savings amounting in salaries to £230, in carbonizing wages to £8748, in purification to £3220, and in wear and tear to £18,135. Taking the whole result, they had made about £30,000 more profit in the past six months than in the December half of the previous year. With reference to the question of capital, he had omitted to say that they would probably require some more about the middle of the year. They had not made up their minds to what extent it would be necessary to increase their manufacturing plant. They were severely tried in the few days preceding Christmas, when their resources were taxed to the utmost. This was through the four days' fog. Had the fog lasted eight days, they must have failed; and no expenditure of capital which could be justified would prevent a failure in the supply of gas in the event of a fog of this duration coming upon them. In fact, they must look upon it as a visitation of God—like an earthquake, a tidal wave, a cyclone, or some upsetting of natural events against which they could not provide. It was impossible for them to have so much plant as would make them independent of a fog of the extended duration he had mentioned. It would require such a large amount of capital which would be "dead" all the rest of the year, and upon which interest would have to be paid. If they were to go to such an expense, the price of gas would be higher all through the year, in order to guard against a possible failure at the end. They were also a little more pressed in the direction of the "load factor" than their neighbours north and south of the Thames. The comparisons between the maximum daily deliveries in relation to the total annual deliveries were as follows: In The Gaslight and Coke Company last year, it was 1-150th part of the whole. On the biggest day the delivery was 1-150th of the entire annual output; whereas the figures were 1-184th in the case of the South Metropolitan Company, and 1-171st in that of the Commercial Company. They were rather worse off in the way of dead capital than either of their neighbours; and this accounted to some extent for their capital being heavy. They had, however, looked into the matter carefully (not now, but a year ago), and they had already made provision for an increased make next year of 14,000,000 cubic feet of gas a day; and this ought to put them in a position to meet a fog as serious as, and perhaps a little more serious than that which they had last Christmas. The Company's daily manufacturing power, with the increase he had mentioned, would be increased to 125,450,000 cubic feet. They also had storage capacity, including what would be ready at the end of the year, of 105,685,000 cubic feet; and if they started with their holders full, and their manufacturing plant in full swing, they ought to be able to meet a dense fog of four or five days without breaking down. If the fog extended beyond this period, it was almost impossible—and, financially, quite impossible—to provide for it by further extending the plant. The Directors believed that, with the provision to which he had referred, they had done all they ought to do; and they looked forward without apprehension to being able to meet any demand next winter. The great blot on the revenue account was the loss by coke. This had arisen from three causes. In the first place, the cement trade was in an exceedingly bad condition; and as cement makers were some of the Company's largest customers, they had had to take very much lower prices in the past half year than in the corresponding period of 1890. In the next place, the open weather had adversely affected the household trade for coke; and, in consequence of the depression of the steel and iron trades in the Midland Counties, instead of London sending coke to Birmingham and those parts, Birmingham was sending it to London, and compelling the Company to reduce their prices. He thought he might go so far as to say this—that, if it had not been for the heavy fall in the price of coke and residuals, it would not have been necessary for the Company to increase the price of gas at all, though this was a matter to which he would refer later on. He regretted to say that, as far as they could see, there did not appear to be any immediate prospect of a revival in the coke and residuals market. At any rate, in dealing with the question of price, and making their estimates for the future, they had assumed that there would be no appreciable recovery for some little time to come. A very good feature in the revenue account was the reduction which had been made in the working expenditure. This had been very carefully looked into during the past year, and certain changes, to which he would presently refer, had been made; and the result would probably be a continual reduction in the carbonizing and other manufacturing expenses. Their engineers, like everyone else, wanted to do as much as they could; and the Directors would be only too glad to be in a position to gratify such natural instincts, if it were not that they were contrary to the interests of the shareholders and the consumers. This being so, they did not let those gentlemen have a penny more than was absolutely

necessary either for the proper construction of new works, or for the efficient maintenance of the old ones. A bad feature in the accounts was the question of rates and taxes, which were up again £2280, though a portion of this amount might be recovered. Under the rules, they were obliged to pay on the assessment; and if they obtained a reduction in consequence of their appeal, the money would be refunded. He had just heard that judgment in their appeal case would be given next Monday; and the Board looked with confidence (though not with over-confidence) to getting something substantial in the way of a reduction of the very heavy rates which they had had to pay for many years. It seemed to him that those who had the fixing of the rates and those who looked at the matter from the Vestries' point of view did not see that it was in some respects as broad as it was long. If they imposed such very heavy rates on the Company, they caused the price of gas to increase. Those ratepayers who did not burn gas had a very great temptation to squeeze the Gas Companies as hard as they could, and get the utmost farthing out of them. The shareholders would see by the report that the question of oil gas was mentioned. They had a certain amount of plant in operation; and the result was very gratifying so far as regarded the making of good gas. But the cost of production was not so satisfactory; and unless they obtained oil somewhat cheaper than they appeared to be getting it at present, it would be necessary to move very cautiously in the direction of increasing their oil-gas plant. There seemed to be some disposition to "boom" the oil market. But this would tend to check the use of oil; and the Directors would not think of employing it in competition with coal when the latter was cheaper. At the same time, they thought it necessary to have a certain quantity of oil-gas plant, as they could produce the gas much more quickly than they were able to do by lighting up a bench of retorts. The Deputy-Governor reminded him that there was another feature to be remembered—viz., that the enriching process was a substitute for cannel, which was becoming scarcer and dearer every year. He would now deal with what might be termed the "burning question"—the rise of 4d. per 1000 cubic feet in the price of gas. He did not think the public generally realized the fact that the consumers and the Company were partners in this business—that it was necessary the Company should receive a certain price per 1000 cubic feet of gas in order to pay for the cost of its production, and to provide for the authorized dividend. When they received a larger amount than this, it was carried to the reserve. "Reserve" was, of course, the common term used; but, in the case of their Company, it meant that it was a joint purse belonging to them and the consumers, into which they could dip if they were short on balancing their accounts, and to which they could add if they had a surplus. He ought to explain that there were three funds—a contingency fund, an insurance fund, and a reserve fund; and when these were filled up, the rest was carried forward, and called "undivided profits," which, however, were not divisible beyond the authorized amount of the statutory dividend. In 1888 they required, to pay the cost of production and the dividend, a profit of 14'38d. per 1000 cubic feet; and in that year they had a surplus beyond of 1'03d., which was put to their reserve fund or joint purse. In 1889 they required 14'28d. to pay all expenses and the dividend; and they earned only 12'87d.—the deficiency being taken out of the reserve. In 1890, when the price of coal and the wages of the men went up, they earned a profit of only 9'17d. per 1000 cubic feet; and this necessitated taking from the reserve the difference of 4'46d. required for meeting the cost of production and the dividend. In 1891 they made a profit of 9'66d. per 1000 cubic feet; showing a deficit in their requirements of 3'85d., which was also taken from the reserve. In 1888 they added £74,409 to the reserve; while in 1889, 1890, and 1891 respectively they withdrew from the fund £106,023, £344,376, and £308,572—the total amount withdrawn in the three years being £758,971, bringing the reserve fund down to its present condition. It had been argued by some that they ought to have raised the price of gas sooner, and not to have permitted their reserve to be depleted so much; but it would not only have been wrong, but also useless and unnecessary, to have increased the price. At a former meeting the reserve fund was termed by someone in the room "a bloated balance," which was of no use to the Company or the consumers. They therefore reduced the price of gas; and it was when the reserve was getting nearly exhausted that they felt it necessary again to raise the price. A sliding scale ceased to be one if the sliding was only one way. They heard no abuse when they reduced the price; but the moment the sliding scale went in the opposite direction, they were abused. The rise in price had not been necessitated by mismanagement; and he did not believe that a £5 note could have been saved had they adopted a different system. It had been rendered necessary by the course of trade. The Directors were men of business; they were not conjurors. The manufacture of gas was an ordinary business; and if they did not get a proper price for gas and residuals, they could not supply gas at the low figure they had been doing. He did not think there was any cause for complaint on the part of the consumers at the action of the Company. He had before him a long list of the most important towns in England, every one of which had, within the last year or two, increased their charge, some by 6d., others by 4d.; and in one case—Cambridge—the advance had been 10d. The Gaslight and Coke Company were therefore not at all singular in advancing their price. With reference to their business prospects, apart from the loss on coke, he thought they were good. They might hope for cheaper coal; for he thought everything pointed to their getting a little benefit from a reduction in the price of this material. The augmentation in their business was going on steadily at its usual average for the last twelve years. In 1880 they increased their business by 2'16 per cent.; in 1881, it was 4'37 per cent.; and in 1882, it was 4'25 per cent.—the average increase in the three years being 3'59 per cent. The average for the following three years was 3'60 per cent.; for the next three, 2'89 per cent.; and for the last three, 3'62 per cent. He might say that within the past three years the Company had felt to a much fuller extent than before the competition of the electric light. The average increase in their business over the whole twelve years had been 3'43 per cent. a year; while for the past year the improvement had been 3'76 per cent. There was therefore no apparent decrease in their business. A shareholder had written to him desiring him to refer to the question of the electric light. Hitherto he had always avoided saying much

about this subject; but, looking at what their American friends would call the "slump" in the price of gas stock in the half year, he had felt that there must be some undefined dread on the part of shareholders, and that it would be best to face the question, and give every information possible about it. The Directors had carefully looked into this question as it affected the Company; and he would give the proprietors the result. In the first place, the most important electric lighting district was included in what he would call the Bond Street quadrilateral—Bond Street, Regent Street, Oxford Street, Piccadilly, Pall Mall, and the Strand. Their return of rent for the year 1889 for this district was £77,675, when the electric light was more than beginning to make itself known; in 1890, the amount fell to £74,947; and last year, it decreased to £73,538. These figures were based on the lower price of gas; and he had not taken any credit for the increase which had been made. They had therefore lost in this district—which was more electrically lighted than any place in the world—£4000 of rental in the past three years; whereas the increase in the rental all over their district for only one year (last year) was £92,000. He had had the matter tested in another way. They had had a list made out of 81 consumers in every part of their district—typical consumers, including the Houses of Parliament, Marlborough House, the British Museum, the General Post Office, banks, clubs, and places of amusement, newspaper offices, and large tradespeople—and the total rental they received from these consumers three years ago was £91,363; two years ago it was £88,323; and last year it was £87,847. So that, again, they had lost £4000 by all these great consumers of the electric light—only £4000 in three years; while they made last year £92,000 increase. He had another interesting return—a very short one, but he thought more significant, perhaps, than the others he had given—and that was as to the distribution of electric lighting in the Company's district. They had three districts—the northern, central, and western. They had among their consumers 2600 who used the electric light—178 in the northern district, 286 in the central district, and 2151 in the western district. He thought this proved, as conclusively as any figures could prove, that the electric light was a light of luxury, and was chiefly used by those who did not care much about the cost. He felt that this was one of the most satisfactory pieces of information they had yet had respecting the electric light in their district. They had 2600 consumers who used this light out of 215,000 or 220,000 who did not use it; so that less than 1.25 per cent. of their consumers had at present adopted the electric light. He might add that the increase in meters for one quarter—the September quarter of 1891—over the same period of 1890, was 3940; and as the increase of meters might be called that of customers, they had had more new customers in one quarter than there were consumers of the electric light over the whole of their district. To his mind these figures showed that they need not regard the competition of electric light companies as a matter to be the least afraid of. The fact was that, as the wealth and luxury of the country grew, more light was required, and more would be made; and there was plenty of room for gas and the electric light, as well as for the purveyors of oil and candles. With reference to a matter to which he had already referred—the "load factor," and the varying way in which their output pressed upon them—he had had a little diagram prepared, showing the differences in the output in November and December, 1891, as compared with the same months of the previous year, and also indicating the variations in the temperature. The diagram showed how remarkably the output fluctuated inversely with the lowness of the thermometer. In 1890, December was very cold and foggy, and the Company sold much more gas; in 1891, excepting in the last week, it was warm and genial. This accounted for the decrease of 1.74 per cent. in the half year. The usual certificates by the late Engineer-in-Chief and the Distributing Engineer were not appended to the report; but, in lieu thereof, there was a general certificate from all their Engineers, which the Directors vouched for. The change arose from this cause: In the early part of last summer or the late spring, Mr. Trewby's health showed signs of becoming deteriorated. He had medical advice; and it was seen that he was in an overwrought condition, and had too much anxiety and work. Mr. Beale was ill last year at Beckton; and the large growth of 3½ per cent. in their business every year pressed more upon them. The Directors considered the matter very carefully, and came to the conclusion that they would relieve Mr. Trewby of the daily anxiety and responsibility of the carbonizing and distribution of the gas, and leave upon him the more important duty of designing and superintending the construction of new works, and generally all constructing and engineering questions, as well as certain others which need not be referred to. He was happy to say that the result of this had been that Mr. Trewby had returned to his usual health and activity. The responsibility which that gentleman had had to bear had, however, to be placed elsewhere; and the Directors came to the conclusion that they would put that responsibility upon the shoulders of each Engineer at each station. This entailed a little more work on the Directors; but they did not grudge this. They interviewed every one of the Engineers each Court day; and so were kept more closely in touch with their manufacturing work in every district. The result had not been bad, or they would not have had a saving of £18,000 in wear and tear in the half year; and they proposed to continue the experiment for some time longer. He believed that it would be found to be a better system than that of putting the whole of the weight on the shoulders of one man. He knew there was a strong objection—he felt it himself—to what was termed dual authority; and there ought to be a head over the whole staff of Engineers. Practically the Board were the head; and if they were in any difficulty, they could obtain the advice of their Consulting Engineer. They could also decide, if the "doctors" disagreed. He thought the outlook of the Company was satisfactory, in spite of the increased price of gas. They had made solid and steady progress. The Directors were closely watching expenditure, and carefully supervising the work. They had a firm faith in the continued success of the undertaking; and they trusted that the present little temporary depression in their prosperity, which had been with them so long, would soon pass away. A 12 per cent. dividend was, after all, not a very poor return. He had been going to say that some of their friends in the Press seemed to treat the Directors a little unkindly

and harshly. They did not complain; but he ventured to ask them in future, before they criticized the management so very severely—perhaps he might say incoherently—to wait until the accounts came out, and then, if they could see a blot on them, to attack them. They ought not to give the Company a "slating" before they knew what answer the Directors had to make. They were not thick-skinned, and they did not mind criticism; but, whether through the influenza, the rise in price, or the drop in Stock Exchange values, there had seemed to be an attack of editorial hysteria, which had broken out in the shape of denouncing the Directors of the The Gaslight and Coke Company as a set of incompetent nincompoops, who ought to make room for others. They had, however, been with the Company for nearly a quarter of a century; and, in spite of the view, which was taken by some members of the Press, they hoped they would be able to retain the confidence of the proprietors for a few years longer.

The DEPUTY-GOVERNOR (Mr. H. C. Ward) seconded the motion.

Sir FREDERICK T. MAPPIN, M.P., said he had been much surprised at the Governor's statement that more capital would be required this year. In 1883 they had a capital of £10,732,000. In 1890 they created more "A" stock, and received £671,600; and in the following half year, a further £432,900—making altogether a capital of £11,795,400. For six years they called up no capital; and they only spent on extensions in that period £171,500. In the last two years, however, they had expended £599,000; and now they heard that more was to be spent. He could not think this was a proof of good management—that for some years they did nothing, and then suddenly increased their capital so much. They had been absorbing their surplus balances and reserves, and had been paying dividends of 13¼ per cent. and 13 per cent., and now they proposed 12 per cent. The ordinary stockholders ought to be told that the dividends they had been receiving of 12 and 13 per cent. had not been earned—that only 7½ or 7½ per cent. had been earned; the remainder coming from the surplus and reserve fund. At December, 1888, they had in hand £807,000, of which they had paid out £692,000 since. He thought this was a state of things that was not creditable to the Board or safe for the shareholders. The Directors since 1888 had also lowered and raised the price of gas in every shape and way. Surely the Directors and their advisers should know better how to manage things. They ought to display more foresight. The Governor had told them that there had been a decrease in the consumption of gas in the past half year of 1.74 per cent.; and yet there had been a heavy expenditure on capital account during the year. He thought they ought not to require to spend such sums if there were no increased demand to meet. Twelve months ago the price of their ordinary stock was 246.51; but this January the stock stood at 219.24. He thought that this showed want of confidence, and that the management must be wrong somewhere. They had spent £100,000 on the purchase of stoves, and £127,000 on renewals and repairs to them; but the income from them had only been £42,000 in 6½ years. He did not like to speak in this manner; but, being a considerable holder in the Company, he thought he was right in speaking out. The Directors ought to dwell on these matters before declaring such large dividends. Why could not the Company now pay 10 per cent. only, in which case the reserve fund would be left at £181,000, instead of at £115,000. He hoped that the Directors would not be satisfied with the present state of things; and it ought to be remembered that the action of such a Company as theirs very much affected provincial Companies. He believed that many who were present were in a "fool's paradise."

Mr. GEORGE LIVESSEY said it was with considerable regret that he rose to address the meeting, as he would much rather have remained seated. But he saw no reason why his official connection with another Company should deprive him of his privileges and rights as a shareholder in their Company. He had read the Directors' report, and had listened to the Governor's speech; and he must say that he had failed to see anything in either of them which showed that the Board appreciated the gravity of the position of the Company in raising the price of gas to 3s. 1d. per 1000 cubic feet. This was a very serious matter indeed; and the reduction of the dividend from 13¼ to 12 per cent. was comparatively of very minor account. An increase in price, however, tended to check consumption; and though he agreed with a great deal of what the Governor had said about the electric light, and that gas was able to hold its own against it, there were other means of reducing the consumption than the superseding of gas by the electric light. An increase of price tended to make consumers more dissatisfied. Their Secretary had told the *Daily News* reporter that the Company had no friends. Well, the increase in price would certainly tend to make people more dissatisfied than ever; and he believed it would cause them to economize in the use of gas. The proprietors had been told that there had been an increase in their business of 3.40 per cent. on an average of 12 years; and that, taking this year, the increase was 3.76 per cent. compared with 1890. But this was not quite the proper way to take the matter. The winter last year was very exceptional; and the proper way to take the relative consumptions was to go to a normal half year—say, the half year to December, 1889. If there had been an average increase of 3½ per cent. in their business, they would now be 7 per cent. in advance of the December half of 1889; whereas the improvement was only 3.3 per cent. He attributed this to some extent to the increase of price to 2s. 9d. in 1890. He agreed with what the Governor had said about the withdrawals from the reserve fund; but he wanted to know whether there was a necessity to raise the price to 3s. 1d., or whether there ought to be a necessity. The Governor had stated that not a single £5 had been wasted; but he (the speaker) thought he would be able to show the meeting that, with different management, £500,000 at least might have been saved. The Commercial Gas Company were situated almost in the same position as The Gaslight and Coke Company, only they had a very much poorer district. They required 2d. per 1000 cubic feet less than this Company to pay their full dividend of 13¼ per cent. The Commercial Company had been selling gas since the beginning of the year 1889 at 2s. 4d. per 1000 feet, and were still supplying it at that price. They had withdrawn from their reserve in the past three years about £48,000; while the Directors of the Chartered Company, as Sir Frederick Mappin had pointed out, had taken from their reserves, in the same period, £692,000. They

had also taken from the consumers, in the shape of the increase in price to 2s. 9d., about £330,000; and the reduction of the dividend to 12 per cent. represented another £27,000. This made a total of £1,049,000 absorbed by them in the last three years in order to make up the dividends. If, however, they had worked as economically as the Commercial Company, the amount would have been £456,000—or, say, £500,000, to be within the mark. He contended, therefore, that £500,000 had gone; and that if they had worked as well as the Commercial Company, their reserve fund ought now to amount to £700,000 instead of £115,000. It had been stated that there was an improvement in the revenue account; but if it had been on the same scale as that of another Company, they would have saved 3s. 5½d. on the revenue in the past year, and have made £167,000 more profit, which would have enabled them to pay the full dividend without touching their reserve fund. It had been said that great concerns could be managed more economically than small ones. He believed there was a good deal of truth in this, provided there were competent management. For an important concern like theirs, they wanted for the management men of equal capacity to that of the General Managers of the great Railway Companies; and in that case he thought it would be found that a large concern could be managed better, and more economically, than a small one. It was not for him to apportion the blame in any way; it was for the Directors to find out where the inefficiency was. He thought they did not try to conciliate the large consumers, who complained to him—those whom he had met—that they were being charged too much; and in charging them the same price as the small consumers, they practically charged them more, because the administrative charges in the case of large and small consumers were so much less in the case of the former. There was, however, hope for the shareholders. The coal might be bought more cheaply; and there was no reason why the coal should not be bought as cheaply by The Gaslight and Coke Company as by the smaller Companies. There might then be a saving of 3s. 6d. a ton. There was, therefore, plenty of hope that this magnificent Company would attain the position to which it was entitled.

The GOVERNOR, in reply, said that he always paid the greatest attention to the remarks of Sir Frederick Mappin, who was the Chairman of the Sheffield Gas Company. That gentleman had said he was surprised at the Directors' proposal to increase the plant; but he (the Governor) did not see how they were to increase their manufacturing plant without spending capital. He explained nearly two years ago the reason why they were the long time referred to by Sir Frederick Mappin in not calling up any capital—namely, that at the time in question they used as capital the undivided balances in their business (not the reserve fund), it not being necessary to keep these balances and go to the shareholders for capital upon which a dividend would have had to be earned. But for having these balances, they would have raised the same amount of capital, spread over an average of years, as they now proposed. They would not, however, spend a penny more than was necessary. He thought one of the greatest evidences of good management in a gas company was the reduction in the amount of capital used per ton of coal in producing the gas; and he did not think that Mr. Livesey would contradict this. Since 1876 they had reduced their capital from £8 to £5 12s. 11d.; and during that period, Mr. Livesey's Company (the South Metropolitan) had reduced their capital per ton of coal carbonized from £4 15s. 9d. to £4 12s.

Mr. LIVESEY pointed out that in the meantime the South Metropolitan Company had amalgamated with another Company.

The GOVERNOR, continuing, said that this might account for some of it; but making the comparison from the date of the amalgamation, the capital per ton of coal carbonized had been reduced by The Gaslight and Coke Company from £7 os. 1d. to £5 16s. 3d.; while in the case of the South Metropolitan Company the reduction had been from £5 os. 2d. to £4 12s. 6d. In 1883 the capital per ton of the Sheffield Gas Company was £4 12s.; and in 1891 it was £3 13s. 1d. He had only mentioned these facts to show that a rule which could be applied impartially to all gas companies did not turn out so badly for this Company as might be imagined. Mr. Livesey had given them the case of the Commercial Company; but that Company was very peculiarly situated—it was small and self-contained. There was another fact, which had been admitted in the rating inquiry before Sir Peter Edlin. Mr. Jones acknowledged that in the Commercial Company they were holding over to a period of less pressure repairs which they would like to do. In their own Company they had maintained everything; and he thought they would have been guilty of a gross breach of trust had they let the property go down for the purpose of showing better accounts in comparison with other companies. Mr. Livesey had said that their Company ought to be able to buy coal on as good terms as he could; but the South Metropolitan Company was in a much better situation in this respect. It must be remembered that there was a recognized difference of 3d. per 1000 feet—which had been admitted twice by the Legislature and the Board of Trade—between the price at which gas should be sold north and south of the Thames. This was because theirs was a much older Company, and they had a good deal of old and expensive stock which the newer Companies had not. Moreover, in the public interest, they had been required to remove their works from Westminster, Blackfriars, Curtain Road, and Brick Lane, down to Beckton. This had involved a large amount of capital outlay, and the sacrifice of money; and on account of that dead capital, it was considered that they were entitled to charge 3d. more per 1000 feet for gas than the new Companies. Sir Frederick Mappin had referred to the price of the Company's stock in the market; but the drop in the market would not very much affect that gentleman, for he held the preference stock, which had not fallen to anything like the same extent as the ordinary stock. But it was out of the power of the Directors of any company to regulate the price of its stock. There were certain Stock Exchange gentlemen who were ready to start any scare; and then weak holders were frightened, and rushed and sold their stocks. The scare went off, the price went up, and then these gentlemen made their harvest. He advised the shareholders to buy instead of to sell. At the present price they could get a return of nearly 6 per cent.; and he wanted to see any investment on the Stock Exchange, with a regulated monopoly—guarded as it was by the existence of the sliding scale—which would return to the investor anything like this rate of interest. They would pay the

greatest attention to what Sir Frederick Mappin and Mr. Livesey had just said; and if they could see the £500,000 which Mr. Livesey had referred to, they would get hold of it. But he thought it existed more or less in the southern imagination of Mr. Livesey. The Directors had a large stake in the concern; and every means of reducing expenditure and increasing efficiency was being taken. He challenged the strictest investigation into the way their business was conducted; but it was not fair to compare them with the South Metropolitan or the Commercial Gas Company, because of the difference of situation and capital to which he had referred. Up to December last, however, the South Metropolitan Company had raised their price 3d., as had been done in their Company; and the South Metropolitan had taken more in proportion out of their reserves to make up deficiencies than had been done by The Gaslight and Coke Company. The same policy which had been adopted by them had been adopted by the South Metropolitan Company, only in a more aggravated form. What that Company would do next half year he could not say. The Board held that the price they ought to charge to both large and small customers should be the same. They treated every one alike; and they would continue to do so. In his remarks about the stoves, Sir Frederick Mappin had omitted to refer to the enormous quantity of gas which had been consumed in them, and the benefit of which the Company had had. The £42,000 was rental of the stoves only; and it seemed to him that this was very good business.

The motion was then put, and carried unanimously.

Mr. ROKEBY PRICE afterwards proposed, and Mr. SNOWDEN seconded, the re-election of the retiring Directors—Mr. Ulick John Burke and Mr. John Birch Paddon.

Sir ROBERT RAWLINSON said he desired to thank Mr. Livesey for the advice he had given to the Directors and the shareholders. Theirs was the largest Gas Company in the world, with the most compact area, and the richest; and they were charging the highest price he knew of. If the Directors did not manage affairs differently from what they had done in the last three years, the Company would get into greater difficulties. The rise in price was against the increase in the consumption; and they had electricity staring them in the face. He hoped that the Directors would take to heart the disinterested advice which that great gas authority, Mr. Livesey, had given them.

The GOVERNOR said he could answer these remarks, but they were out of order. They had already discussed the general policy of the Company, and they could not re-open it. He then put the resolution, which was adopted.

The Auditors were afterwards re-elected; and a vote of thanks to the Governor and Directors brought the meeting to a close.

BORDEAUX GAS COMPANY.

The following statistics relating to the above Company are taken from the Directors' report on the working of the undertaking during the year ending June 30, 1891: The quantity of gas sent out for consumption in the twelve months amounted to 24,843,389 cubic metres, or about 882 million cubic feet, which produced a sum of 4,011,750 frs. Compared with the preceding year, these figures show an increase of 869,952 cubic metres of gas, and additional receipts to the amount of 154,020 frs. The number of meters in use on June 30, 1890, was 13,991, corresponding to 170,323 burners; at the close of the past financial year there were 14,353 in operation, corresponding to 172,757 burners. There was consequently an increase of 362 meters. Of the total number, 689 were the property of the consumers. In the suburbs, there were 452 meters in service, of which 42 were private property. In the public lighting of the city, 5067 burners were employed, as compared with 5002—a rise of 65; in the suburbs, there were 511 burners. Very little alteration took place in the productive power of the works during the year. As in nearly all other gas undertakings, the greatest tax upon the manufacturing plant was on the 24th of December, 1890, when 117,296 cubic metres, or about 4 million cubic feet, of gas were sent out. New mains were put down in the city to the extent of 2531 yards; and 5845 yards were taken up and replaced by larger. In the suburbs, 2565 yards of new mains were laid. Upon works of first establishment, 10,287 frs. were spent; bringing up the total to 8,474,575 frs. The amount expended in connection with suburban concessions was 17,000 frs.; making the total 374,643 frs. The Company have an electric lighting undertaking; and in the past year they applied the receipts arising from their Treaty with the Municipality, together with a sum equal to about 40 per cent. of the cost of the installation, in reducing the capital to the extent of 60,000 frs. The working of the concern for the year produced a gross profit of 1,337,908 frs., of which the bonds, interest, and redemption fund absorbed 405,788 frs.; leaving 932,120 frs. From this sum 46,606 frs. were taken for the reserve, 60,000 frs. for the share redemption fund, and 150,000 frs. for interest at the rate of 5 per cent.; making a total of 256,606 frs., and leaving 675,514 frs. Deducting 67,551 frs. for the remuneration of the Directors, there was left 607,963 frs., which were thus disposed of: To the ordinary shareholders, 390,000 frs.; to the original shareholders, 130,000 frs.; carried forward, 87,963 frs. The reserve was brought up to 544,654 frs., or 244,654 frs. more than the one-tenth of the capital; and the statutory dividend for the year was 90 frs. per share (500 frs.), or at the rate of 18 per cent.

The Price of Gas at Liverpool.—On a motion for the laying of a lighting rate of 4½d. in the pound for 1892 being proposed at the meeting of the Liverpool City Council last Wednesday, Mr. Smith urged that something should be done to reduce the present price of gas to the Corporation; for the lighting rate had increased 1½d. within the last few years. Alderman T. Hughes thought the promotion of a Bill by the Gas Company in the coming session of Parliament would afford the Council an opportunity of getting some concessions from them. He understood, however, that the high cost was due to the very unusual illuminating power which the Company were required to maintain; and he suggested that the lessening of this might enable them to reduce the price. The motion was agreed to.

SOUTH METROPOLITAN GAS COMPANY.**Directors' Half-Yearly Report.**

The following is the report of the Directors of the above Company, which, with the accounts for the six months ending Dec. 31 last (given on the opposite page), will be presented to the proprietors at the half-yearly general meeting on the 17th inst. :—

The great reduction in the amount received for coke—viz., from £116,708 in the last half year of 1890 to £84,145 in the December half year of 1891 (a falling off of £32,563)—is evidence that the price has returned to the low rates that prevailed a few years ago, when coal was at its cheapest; whereas the price of coal is still 50 per cent. higher, free on board, than at that time, which indicates that the price of coal is artificially maintained. Coke being now a far cheaper fuel than coal, the sale, at low prices, of the large quantities for disposal all over the country may be expected to benefit gas undertakings, by helping to bring down the price of coal.

Excepting the above-named adverse circumstances, the Directors have the pleasure to state that in all other particulars the working is satisfactory. Notwithstanding the unprecedented increase in the consumption of gas, due to the severe winter of 1890, and the mild weather that prevailed generally last half year, there has been a small addition to the quantity of gas sold. The Company's officers and foremen are, as they always have been, devoted to its interests; and of the workmen of all classes it can truly be said of the great majority, that never has the work been done better, or in a more cheerful spirit, particularly by the stokers during the week of fog at Christmas. More gas has been made with less coal (which has been of good quality); and, as a result of the large amount spent on mains last summer, the Company has been able to give to the district generally an ample supply of gas at a low initial pressure.

In order to comply with the constantly increasing demand for gas, additional manufacturing power must be provided year by year; necessitating the periodical raising of further capital, which is all spent in productive works. At present another complete gas plant for the manufacture of 5 million cubic feet a day is in course of construction at East Greenwich, where is also being erected a large gas-holder to contain 12 million cubic feet. This is, of course, considerably in excess of the requirements of the near future; but the cost per 1000 cubic feet capacity will not exceed £5, whereas before the introduction of very large gasholders the cost per 1000 feet was from £15 to £20.

On the subject of capital, it is necessary to be constantly correcting the statement that gas shareholders are receiving excessive dividends. It is true that the original capital, which bore all the risks and losses of the earlier struggles of the Company, is receiving the actual dividends declared; but those who now hold this stock have, to a very large extent, purchased it at market rates, which only yield them a little over 5 per cent. on their investment. Since 1876, however, Parliament has required all new capital to be issued under the auction clauses, with the result that, although the nominal dividend may be 13 per cent., the Company only pays in actual interest a trifle over 5 per cent. for this capital. During the last two years, £88,500 of "C" stock has been thus placed, producing £213,570 of capital for the extension of the works of the Company; and nearly the whole of this amount has been taken by the consumers. A very considerable proportion of the shareholders have now purchased their stock under the auction clauses.

But this is not all. In order to obtain capital at the lowest possible rate, for the mutual benefit of the consumers and the Company, the works at East Greenwich, together with the land, and large additions to works and mains elsewhere, have been paid for almost entirely by money raised by the sale by auction of 5 per cent. debenture stock; the capital so obtained costing the Company but little more than 3½ per cent. In the last ten years, over £900,000 has been obtained by the sale of ordinary "C" and debenture stock, on which the average charge for interest is a fraction over 4 per cent. It is mainly by providing for extensions with this cheap capital that the Company has been able to reduce the price 6d. per 1000 feet, and to pay 1½ per cent. additional dividend. The 6d. per 1000 feet gives £160,000 a year to the consumers; and the 1½ per cent. gives £30,000 a year to the shareholders. This is the practical effect of the sliding scale.

But for the reduction in the value of coke, there would have been more than sufficient to pay the full dividend of 13 per cent., to which, with gas at 2s. 6d. per 1000 feet, under the sliding scale, the shareholders are entitled. There is, however, a deficiency of £25,189. To the extent of £8168, this is met by the interest on the reserve fund and the profit realized on the sale of stock; leaving a net deficiency of £17,021 to be taken from the reserve fund.

The Directors recommend the payment of a dividend of 13 per cent., to be apportioned in the usual way in accordance with the Scheme of Amalgamation, excepting a fraction due to "A" undivided as usual.

Two Directors (Captain T. B. Heathorn and Mr. R. O. White) and one Auditor (Mr. W. Westcott) go out of office by rotation. They are all eligible for re-election, and offer themselves accordingly.

Following the report is the statement of accounts. As on previous occasions, we epitomize those portions in which there is little or no change; giving the remainder in full.

Statements Nos. 1 and 2 show the amount of share and loan capital raised at the end of the past year. The former stood as on June 30 last—viz., £2,050,000; the latter, at £725,000, or an increase of £25,000.

Statements Nos. 3, 4, and 5—the capital, revenue, and profit and loss accounts—are given in full on the opposite page.

Statements Nos. 6, 7, and 8 show the positions of the reserve, renewal, and insurance funds. The reserve fund has been further reduced to £54,808 12s. 6d., by the transfer of £59,640 7s. 8d. to the profit and loss account. The renewal fund stands at £9661 15s. 10d.; and the insurance fund, at £12,851 15s. 9d.

Statements Nos. 9 to 11—furnishing particulars as to the manufacturing operations of the Company—are given in full; as is also No. 12, the general balance-sheet.

YORK UNITED GASLIGHT COMPANY.

The Half-Yearly Meeting of this Company was held last Thursday—Mr. J. F. TAYLOR in the chair.

The report which was submitted stated that the revenue account showed a balance of £5935 to the credit of profit and loss account. This amount, after being charged with £358, the half-year's interest upon money borrowed on mortgage, left £5576 available for the dividend, amounting to £6800, and showing a deficiency of £1223, in contrast with £2310 for the corresponding period of 1890. But as in 1890 the deficiency was charged to the reserved surplus profits of previous years, available for the purpose, so now the Directors proposed to charge the present deficiency to the same fund; and they recommended that the usual dividend be declared of 5s. per share upon the old shares, and 4s. 6d. per share, or 5 per cent. per annum, upon the new shares, payable free of income-tax. The general condition of the works and plant of the Company was satisfactory; but the Directors felt that the time was approaching when they would have to consider the question of important additions to meet the growing demands of their business, which year by year were pressing upon them. As a first step, they announced their intention at an early date to make the final call of £1 per share upon the new £10 shares.

The CHAIRMAN, in moving the adoption of the report, said the half-year's working had been fairly satisfactory, not only to the shareholders but also to the general public; and the Company had so far met the difficulty caused by the increase in the price of coal without advancing the price of gas. Notwithstanding the talk about electric lighting, it was his opinion that gas property was as safe as ever it was.

Mr. W. W. WILBERFORCE seconded the motion, which was agreed to.

On the motion of the CHAIRMAN, a resolution was passed declaring the dividends recommended by the Directors; and a vote of thanks to the Chairman and Directors for their services concluded the business.

CAMBRIDGE UNIVERSITY AND TOWN GASLIGHT COMPANY.

The Half-Yearly Meeting of this Company was held on Thursday, the 28th ult.—Mr. Alderman C. BALLS (who has been a Director of the Company for the last 44 years) in the chair.

The SECRETARY (Mr. W. Peed) read the notice convening the meeting; and it was agreed to take as read the report and statement of accounts. In the former, the Directors recommended that a dividend be paid at the rate of 10 per cent. per annum on the original consolidated stock, and 7 per cent. on the consolidated stocks of 1880, 1882, and 1885, and on the new £10 shares. The Manager (Mr. W. Duesbury) reported that the whole of the works and distributing plant had been maintained in good working condition and efficiency; and the increase in the consumption of gas had been satisfactory.

The CHAIRMAN said he ventured to hope that the shareholders would agree with the Directors that the work of the Company during the past half year had been very satisfactory. They would observe that on this occasion they had to take somewhat more from the reserve fund to pay the dividend. In the previous half year they took £158; but now it reached nearly £500. Perhaps it was only right he should say a word or two on this question. As the shareholders were aware, the condition of the coal market told upon the profits of the Company. The coal regulated every manufactured article—such as retorts, firebricks, and various other articles and materials which they used. With regard to the labour question, he was glad to say they stood very well with their workmen. The men were satisfied with their wages; they had not complained; and he did not think they had cause to complain. While he was speaking of workmen, he might remind the shareholders that on Sundays the work was reduced to a minimum. The Company suffered a little loss on this account; but the Directors thought it was well worth the loss to relieve the men on Sunday, and they now worked as closely as they safely could on that day to reduce the amount of labour. He was pleased to say that the production of gas during the half year had increased something over 4 per cent. Very many companies had had to take large amounts from their reserves to enable the maximum dividend to be paid; and others had had to raise the price of gas on account of the increased cost of coal and labour. In their own case, they had no need to increase the charge for gas, and he might say they did not anticipate they would have to do so. He found that both The Gaslight and Coke Company and the South Metropolitan Company last Midsummer had to take more than one-third of the amount required for their dividends from their reserve funds. The former took £159,845; and the latter, £59,640. If the Cambridge Company had to dip into their coffers in the same ratio, he thought the shareholders would have some cause for grumbling. He had a list of some of the Companies who had raised the price of gas. He found the South Metropolitan Company had increased theirs by 3d. per 1000 cubic feet; the Edinburgh and Leith Commissioners, by 3d.; the Alliance and Dublin Company, by 3d.; the Barnsley Company, by 4d.; The Gaslight and Coke Company, by 4d.; the Bristol Company, by 5d.; and the Liverpool Company, he believed, by 4d. He did not say that in their own case they had anything to boast of; but it was a matter of congratulation on the part of the Directors and shareholders that they stood in the position they did. There was one new feature in the accounts—viz., the cooking stoves; and he considered they had been fairly successful with them. He then moved that the reports of the Directors and Manager be adopted.

Mr. ATKIN seconded the motion, which was unanimously agreed to.

The dividends recommended by the Directors were declared.

Mr. VINTER then proposed a vote of thanks to the Chairman and the Directors for their skilful management of the affairs of the Company. He thought it very satisfactory indeed that the sum extracted from the reserve fund only represented 9d. per ton on the price of coal.

The motion having been carried,

The CHAIRMAN, in responding, said he would not venture to say they would get a reduction in the price of coal in their next contract; but they hoped to. He thought they were very much indebted to Mr. Duesbury for his zeal and ability in conducting the affairs of the Company, and bringing them to such a satisfactory termination.

ACCOUNTS OF THE SOUTH METROPOLITAN GAS COMPANY FOR THE HALF YEAR ENDED DEC. 31, 1891.														
Dr.					No. 3.—CAPITAL ACCOUNT.					Cr.				
To Expenditure to June 30, 1891					£ s. d.					£ s. d.				
Expenditure during half year to Dec. 31, 1891, viz.—					..					2,871,016 15 1				
New buildings and machinery in extension of works					44,182 6 6									
New and additional mains and services					14,931 9 10									
Do. meters					4,831 9 3									
Do. stoves					7,673 19 6									
										71,619 5 1				
Total expenditure					2,942,636 0 2				
Balance					153,217 19 10				
										3,095,854 0 0				
										Description of Capital.				
										Certified to June 30, 1891.				
										Received since that Date.				
										Total to Dec. 31, 1891.				
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PROVINCIAL GAS AND WATER COMPANIES.

Under this heading, during the next few weeks, we shall be giving, from the half-yearly annual reports and financial statements which reach us, some particulars as to working of Gas and Water Companies carrying on their operations in the provinces.

Gas Companies.

The half-yearly balance-sheet of the Calverley and Horsforth District Gas Company shows that the revenue for the six months from the sale of gas has been £3055; from the sale of residual products, £1041; and from rents, &c., £43—making the total receipts, £4150. The expenditure amounted to £2701. Of the balance of £1449, the sum of £1336 has been carried to profit and loss account; being the amount required to meet the usual dividend, and the difference (£113) has been transferred to the renewal account. A sum of £1558 has been spent during the half year in the extension of the works.

The report of the Directors of the Clayton, Allerton, and Thornton Gas Company, which is to be presented at the annual meeting of the shareholders to-day, states that, on the working of the past year, there is a balance of £2101 available for appropriation. The Directors have decided to recommend the declaration of a dividend at the rate of 7½ per cent. for the second half of the year, which, with the interim dividend of 5 per cent. paid in August, will make 6½ per cent. for the year.

Notwithstanding the mildness of the season as compared with 1890, the Directors of the Dorchester Gas Company will have the pleasure of reporting, at the meeting of the shareholders to-day, that the returns of gas-rental for the past half year are satisfactory. But, owing to the fact that the cost of coal has further advanced, the profit, compared with the corresponding six months of 1890, shows a diminution. The revenue from all sources amounted to £3239, and the expenditure to £2197—leaving a profit of £1042. At the net revenue account, there is a balance of £1022 in hand to pay the dividends. The Directors recommend a dividend of 10½ per cent. on the ordinary, and 6 per cent. on the preference shares, less income-tax.

The shareholders of the Grantham Gas Company held their half-yearly meeting last Tuesday. The report submitted by the Chairman (Dr. J. W. Jeans) stated that the consumption of gas was satisfactory; but the balance-sheet showed a diminution of revenue from the sale of the bye-products. The price of coal continuing high, it was impossible to say what, if any, reduction might be looked for in the coming contracts. The Directors recommended the payment of the dividends of 5 per cent. on the old shares, and 3½ per cent. on the new shares, for the six months ending Dec. 31 last. It was stated by the Chairman that the Directors would have to consider seriously the question of raising the price of gas if in the next contracts they had to pay the same high price as in the last. The report was adopted.

The Directors of the Newcastle and Gateshead Gas Company have decided to recommend the payment of the usual yearly dividend of 9½ per cent. Of this one half was paid as interim dividend in August last. A greatly enhanced price has been paid for coal during the past year; but much more favourable contracts have been entered into for the future. The annual meeting of the shareholders will be held on the 17th inst.

The report and accounts of the Westhoughton Gas Company for the half year ending the 31st ult. show that the total expenditure on capital account up to June 30, 1891, was £23,256; and during the past six months there has been spent on new structures, manufacturing plant, storage works, &c. (including the new holder, with a capacity of more than 200,000 cubic feet, and which was recently put in operation), an additional sum of £1479; making a total outlay of £24,715 upon the works since their establishment. The amount which has been received on capital account, including payments on shares and mortgage bonds, is £24,975; leaving a balance of £259. As regards the revenue account, the receipts, during the past half year for gas, residual products, &c., were £1599—an increase of £165. The total expenditure amounted to £1006; leaving a balance of £592 to be carried to profit and loss account. The Directors recommend a dividend of 5 per cent. per annum—a similar rate to that paid during the three preceding half years.

The Directors of the Weymouth Consumers' Gas Company are able in their report to congratulate the proprietors upon the successful outcome of their operations during the past half year. Evidence of that success is shown in the balance of profit on the revenue account (£2107), which is more than sufficient to pay the debenture interest and the maximum dividend upon both classes of capital. The Directors therefore recommend the declaration of a dividend at the rate of 10 per cent. per annum on the ordinary "A" stock, and 7 per cent. per annum on the ordinary shares (less income-tax). It is also mentioned in the report that, in consequence of several delays, the new trunk main which is being laid for the supply of the Melcombe Regis district is not yet completed. The greater portion of the pipes are in position; and the Directors hope that in a short time gas may be turned into them. A payment of £500 has been made to the contractors on account of the work. The revenue account exhibits a total income of £6241, of which gas produced £4862, and residual products £1087. The expenditure came to £4133, leaving the above-named balance of £2107.

Reporting upon the operations of the Whitworth Vale Gas Company during the past half year, the Directors state that, their old contract for coal and cannel having run out, they have had to pay very much more for these materials; while to clear their production of coke a reduction has had to be made, with little or no improvement in the price of sulphate. Taking these things into consideration, it is a great satisfaction to them that they have been able to maintain the dividend without having to raise the price of gas. There is a balance of profit on the six months' working of £930, which, added to the amount brought forward, enables the Directors to recommend the full dividend of 10 per cent. on the original shares, and 7½ per cent. on the amount called up on the "B" shares. The Directors record the death, last October, of their colleague Mr. John Buckley, who had been connected with the Board since 1873.

Water Companies.

The half-yearly accounts of the Calverley District Water Company show that they commenced the six months with a balance in hand of £644; and the water-rental amounted to £2967, which, with other items,

made the total receipts £3793. Of this sum £1807 had been paid to the Bradford Corporation; £600 was disposed of in the payment of a dividend of 3s. per share in June; and the Directors now propose to utilize the rest in paying a dividend for the half year of 2s. per share, free of income-tax, and carrying forward £61 to the next account.

At the recent meeting of the shareholders of the Cambridge Water Company, the Directors recommended a dividend on the consolidated stock at the rate of 10 per cent. per annum, and upon the amount paid up on the new shares at the rate of 7 per cent. After paying these dividends, they stated that there would be £3358 to be carried forward. The report of the Manager (Mr. W. W. Gray) indicated that the business was making satisfactory progress. The reports were unanimously adopted.

In the report of the Directors of the Colne Valley Water Company, to be presented at the half-yearly general meeting of shareholders to-day, they state that an additional £1834 was expended on new plant and extensions in the six months ending Dec. 31 last, and £5000 has been placed to a suspense account in respect of the loss on the old engines. It is intended that this amount shall be paid off out of revenue at the rate of £500 a year; and the first instalment of £250 has been credited. The net profit on the past half-year's working was £3821; being nearly £700 more than in the last six months of 1890. The balance to the credit of the dividend and interest account, after paying the usual 4 per cent. interest on the preference shares and debenture stock, is £2234. This will allow of the payment of a dividend at the rate of 3 per cent. per annum, and leave £357 to be dealt with.

At the recent half-yearly meeting of the Grantham Water Company, the report submitted by the Directors showed a balance upon revenue account of £4370 in favour of the Company; and it was proposed that £1750 of this should be applied in the payment of a dividend of 5 per cent. for the past half year, and that the balance of £2620 should be carried forward. The Chairman (Mr. J. G. Thompson), in moving the adoption of the report, said the loan on mortgage had been increased on account of the extra expense incurred in regard to the new filter-beds which had been constructed. The past winter had been a trying one, on account of a large number of pipes bursting. He was very pleased, however, to state that the Company could furnish the town with double the quantity of water now supplied if it were necessary; and in this statement the Manager (Mr. H. Preston) could bear him out. The report was unanimously carried.

The report of the Weardale and Shildon Water Company shows increasing receipts and a better dividend. For 1888 the dividend was 3½ per cent.; for 1889, it rose to 4 per cent.; for 1890, it was 4½ per cent.; and that now recommended for 1891 is 4½ per cent. The Company supply water to a large part of South Durham.

The half-yearly meeting of the York New Water Company was held last Thursday. The accounts which were presented showed that the water-rental for the half year amounted to £8201, and that there was a sum of £6109 remaining on the revenue account balance-sheet. The report of the Directors stated that the revenue from water-rents had satisfactorily increased. Owing to the severe frosts in the closing weeks of the half year, the quantity of water used and wasted was exceptionally great; and consequently the pressure in the mains was considerably reduced. But the Board were glad to be able to report that none of the Company's mains were affected by the frost. The Directors recommended a dividend of 5s. on the preference shares, being at the rate of 5 per cent. per annum; a dividend of 9s. on the ordinary shares, being at the rate of 9 per cent. per annum; and a dividend of 6s. 4d. on the new shares 1878 and 1879, making, with the dividend of 6s. 3d. paid in August last, a dividend of £6 6s. per cent. per annum, for the past half year. The Chairman (Mr. J. F. Taylor), in moving the adoption of the report, said the year's working showed an increase in rentals of £383, which the Directors considered a very good result. The surplus on the year, added to the previous surplus, amounted to £577. As all the shareholders knew, the funds of the Company suffered very disastrously through their opposition to the scheme of water supply of the Bradford Corporation; but the latter body had now altered their plans altogether. The severe frost in the closing weeks of the past half year involved an exceptional waste of water; in one week alone, 4 million gallons of water were sent into York in excess of the ordinary supply. They were still doing their best to maintain the high quality of the water, and to promote the general efficiency of the supply. The report was adopted, and the dividends were declared.

Dorchester Gas-Fitting Company, Limited.—We have received from the Secretary of this Company (Mr. Frank Osmond) the accounts for the year ending Dec. 31 last; and they show that the balance of revenue will admit of the payment of a dividend of 6d. per share (being equal to about 7½ per cent.), and leave £38 12s. 4d. in hand.

The Institute of Secretaries.—The first general meeting of this Institute, the initial proceedings of which were noticed in the JOURNAL a short time ago, took place at Winchester House, Old Broad Street, on the 30th ult. Mr. E. C. Wickes presided, and explained the objects of the Institute. He said no doubt many present had, in the course of their experience, met with difficulty on points of detail or practice respecting which they would have been glad to apply to some central body, so as to get uniformity as far as possible. The present was the first attempt he had heard of to form an Institute of Secretaries, though many other professions had institutes, from which great benefit had resulted. One of the objects of the Council was to collect all the information they could obtain with reference to the position, duties, and responsibilities of secretaries. They also provided for making suggestions as to legislation with respect to the Companies' Acts. It was advisable that those who undertook the duties of secretaries should be qualified to perform them; and the Institute would form a means, to a certain extent, of training secretaries, and certainly of enlightening gentlemen who already held such positions on points of difficulty, in order that they might be enabled to perform their duties more satisfactorily. Advantage was also likely to result from having such a centre as the Institute to those who desired to obtain engagements; and the Council would, no doubt, satisfy themselves, as far as they could, that the gentlemen recommended by them were properly qualified.

THE LIGHTING OF COURTS AT BIRMINGHAM.

Mr. James Smith, the new Chairman of the Public Works Committee, made a statement, at the meeting of the Birmingham City Council last Tuesday, as to the progress which had been effected in the matter of lighting the courts—a subject which has been referred to from time to time in these columns. The Committee, he said, were proceeding with the work as rapidly as possible; and 431 lamps had been erected and paid for by landlords, but only 192 of these were at present lighted. They were now taking special measures to have the other 239 lighted; and as the total cost for a year's lighting and maintenance of a lamp was only 22s., he thought there would not be very much difficulty in inducing the landlords (who had already spent £4 in erecting each lamp) to undertake the much smaller cost of lighting, especially as it would be of even more benefit to them than to the tenants. The Committee hoped to make more rapid progress now; and if the measures to which he had referred did not prove efficacious, they would resort to another power which they possessed, but did not wish to exercise. The Mayor (Mr. Lawley Parker) also made a few remarks on the subject. He said that it was within the power of the Council to light the courts and to pay for the lighting; but it was necessary to do a great deal before this could be done. They would have to call upon the owners of the courts to perform all the necessary work in order that the Council might take over the courts as public thoroughfares. When this had been done, the public could pay for the lighting of the courts. Whether it was wise for the owners to do all the necessary work, in order that the Council might bear the cost of the lighting, was a matter for the owners themselves to consider; because it involved first of all an enormous expense as far as they were concerned in paving, guttering, and so forth, so as to make them fit for the Corporation to take over. Secondly, this would deprive the owners of the courts of the whole of the freehold, except that part occupied by the dwellings themselves. The alternative was that the owners should pay for the gas, which would cost them at the rate of 1d. per week per house. In the discussion which followed, the Committee were severely reprovved by some of the members for not pushing forward the work with greater speed. Mr. Stevens ventured to say that the Council had been altogether tinkering with the question. People who lived in courts had as much right to see that their houses were lighted as those who resided in the front of the street. It was a narrow, meagre, and unwise policy for the Council not to lay out the necessary money for the lighting of the courts. At the rate at which the work had already proceeded, it would be thirty years before the last court in the city would be lighted. Mr. Wilders believed, in the interests of morality, good order, and the public peace, that the courts ought to be lighted; but he could not help stigmatising what had so far been done in the space of two years as a miserable failure. Mr. Granger, Mr. Jarvis, Mr. Price, and Mr. Dixon also spoke in favour of the lighting being carried out more expeditiously. Mr. Smith, in reply, admitted that not much had been done with respect to the lighting of the courts up to the present time; but he thought, from steps they were taking, the Committee would soon be able to report greater progress.

THE BIDEFORD TOWN COUNCIL AND THE GAS COMPANY.

The Opposition to the Company's Provisional Order—The Suggested Purchase of the Works.

The Directors of the Bideford Gas Company have forwarded to the Town Council their replies to the objections which the latter have raised against their Provisional Order (see *ante*, p. 119). In the first place, the Company deny that any serious complaint have ever been made, except such as have lately arisen from the town outstripping the plant and power of the works. Abundant evidence, they say, would be forthcoming of the efficient and progressive management of the works, and of the efforts of the Company to keep faith with their customers. They have loyally performed their agreements with the Council for the lighting of the town, and all expiring contracts have been invariably renewed. The Company contend that the prices charged by them are fair and reasonable, and bear favourable comparison with the average charge made in towns similarly circumstanced. It is pointed out that in 1871 the Council were successful in opposing an application for a Provisional Order; yet they have never made the faintest attempt to redeem their pledge to light the town themselves, either by providing works of their own or by attempting to acquire the undertaking of the Company. The Company complain that, although the local authority knew in August last of their intention to revive their application for an Order, it was not until Nov. 27 that the least effort was made to approach the Company. They submit that there is no serious intention to purchase the works, and that the allegations of the Council must be placed side by side with their allegations of twenty years ago. The Company state that the granting of the Provisional Order will not militate against the acquirement by the Council of any powers they may desire for electric lighting; but it is submitted for inquiry by the Board of Trade that the Council is already heavily burdened. The Company admit that recently some of their mains have been injured by the extraordinary traffic of the steam-roller, but that, according to the Borough Surveyor, equal damage has been done to the water-mains of the Council. The Company are in a position to satisfy the Board of Trade as to the sufficiency and condition of their mains and service-pipes, and that the alleged disturbance of the roads has frequently arisen from the action of the Town Council in fixing new lamps, and altering the position of old ones. Finally, the Company aver that the whole objections have been grounded and built up on the false basis that a Provisional Order would give them absolute power over the streets and sewers; and they submit that the opposition of the Council will lose all weight when it is understood that the powers of the Company would be carefully regulated by the Gas-Works Clauses Act, 1847, which provides that streets and roads shall not be opened or broken up, except under the superintendence of the persons having control of them, and which regulates the mode of reinstatement and repair.

The above replies came before the Town Council at their meeting yesterday week; and after they had been read, Mr. T. Pollard asked why the meeting of ratepayers, who were to be consulted on the question of the purchase of the gas-works, had not been held. The time which the Company had allowed for accepting their offer to sell had now lapsed. Mr. Squire thought the Council gave the Gas Company some justification for their allegation that they did not seriously contemplate purchase. They had neither consulted the ratepayers nor issued the advertisement offering a premium of £25 for plans to light the town by electricity. Mr. Ascott urged that the Council should at once approach the Company with a view to buying them out. The Mayor promised that there should be no more delay, and that the ratepayers' meeting should be called. The Gas Company's answer was then referred to a Committee of the whole Council. At a subsequent stage in the proceedings, when discussing the question of obtaining plans for lighting the borough by electricity, the Mayor suggested that, if a small Committee of the Council met the Directors of the Gas Company, and arrived at a fair price, they might agree to purchase the property without further expense. Mr. Pollard said he believed that, if the Council deferred approaching the Company until after the inquiry, they would secure their Provisional Order; and this would increase the value of the works by at least 20 per cent. The conclusion arrived at was that the meeting of ratepayers on the question should be convened immediately.

WATER CONSUMERS AND THEIR LIABILITIES.

Injudicious Remarks by a Magistrate.

At the Wandsworth Police Court, on the 28th ult., a gentleman complained to Mr. Hannay, the sitting Magistrate, of the Lambeth Water Company cutting off his supply. He stated that the service-pipe became injured by the pressure of another pipe upon it; and a leakage was the result. This was no fault of his; the damage being occasioned by men engaged in laying fresh water-pipes. The Company's employees severed the connection; and he was without water. Mr. Hannay said he could not understand why the Company should have adopted this strong measure. He advised the applicant to apply to the regular Magistrate of the Court. The applicant urged that he was without water. Mr. Hannay: "The Company, unfortunately, have you at every point. If a neighbour supplies you with water, he is liable to be prosecuted. It is a disgrace to the nineteenth century for any Company to have the power of cutting off a man's supply of water. The Company have many Acts of Parliament favourable to themselves." The applicant said he would repeat his application; and this he did on Monday last week. It then transpired that his name was Mr. H. Wooderson; and his residence—the house in question—Trinity Road, Wandsworth Common. He repeated his complaint to Mr. Denman; adding that he had received a notification from the Company, stating that they would be prepared to renew the supply if he remedied the defects and paid a sum of 10s. He said he was of opinion that his liability ended at the stopcock, which the Company required him to put outside his gate. Mr. Denman said *prima facie* the Company had a right to cut off the supply of water if the fittings were imperfect. Mr. Wooderson said the question was whether he was required to repair fittings in the main road. Mr. Denman observed that if the leakage continued, the whole neighbourhood might be flooded. The Water Companies Acts were somewhat complicated; and he suggested that the applicant should consult a solicitor, to ascertain what his liability really was, before taking out a summons. Mr. Wooderson thereupon thanked the Magistrate and withdrew.

On the following day, the Secretary and General Manager of the Company (Mr. S. H. Louttit) sent to the papers the following explanation of the circumstances: "The Gas Company have recently laid some new pipes in Trinity Road; and either their men or the parish steam-roller, which has lately been at work in the road, may have damaged the lead communication-pipe between this Company's main and the premises of the owner and occupier, which pipe is his property, and he is responsible for its being maintained in good condition. (See Water-Works Clauses Act, 1847, sec. 43 to 55, and Metropolis Water Act, 1871, sec. 32.) On Monday evening [the 25th ult.] the turncock observed a leak in the road. He obtained some ballast, and, to prevent an accident, put about a barrowful in the hole it had caused. He then reported the leak to the district foreman, who on Tuesday sent a workman to the house. This man saw the wife of the occupier, whom he asked to send for a plumber to repair the pipe, in accordance with a printed notice which he filled up and handed to her. The lady having declined to send for a plumber, the Company's servant, in the discharge of his duty, cut off the supply, as there was considerable waste, and the leak was dangerous, especially as the supply to the house was constant under high pressure. Notice was then served on the Medical Officer of Health for the parish, in accordance with section 49 of the Public Health (London) Act, 1891. Had the supply not been cut off, the consequences might have been most serious."

The Proposed Acquisition of the Pontypridd Gas-Works by the Local Board.—At the fortnightly meeting of the Pontypridd Local Board last Friday week, the Clerk (Mr. H. L. Grover) reported that the Directors of the Gas Company had instructed him, as their Secretary, to inform the Board that they were quite prepared to sell the works to them if terms could be arrived at. Should no agreement of the kind be come to, then the Company would at once promote a Bill in Parliament for powers to extend their district. The Company were about to expend from £3000 to £4000 in erecting additional manufacturing plant. He (the Clerk) would suggest that a qualified expert be engaged by the Board, as had already been done by the Company. In the event of the Company and the Board being unable to negotiate without friction, then he (Mr. Grover), as Secretary to the Gas Company, would not act for the Board, and he would ask them to engage some independent person to advise them in the matter. It was resolved to hold a private meeting last Wednesday to consider the question. This was done; and the Board determined to take steps to purchase, if possible, both the gas and water works.

LONDON WATER SUPPLY FROM THE THAMES AND LEA.

Mr. Binnie's Report to the County Council.

(Concluded from p. 211.)

Mr. Binnie next deals with the drainage area, geology, rainfall, &c., of the Lea Valley. On these matters he says: Above the intake of the East London Water Company, the area draining to the River Lea may be said to comprise about 497 square miles, or 318,000 acres, embracing parts of the counties of Hertfordshire, Bedfordshire, Middlesex, and Essex. From the point of its junction with the Thames near Blackwall to the source of the New River Company's intake below Hertford, the river flows over the London clay formation, with certain associated post-tertiary beds. Above that point to Dunstable, Luton, Stevenage, Buntingford, and above Bishop Stortford, the flow is from the chalk formation. East of a line drawn roughly from Tottenham northwards by Ware to Barkway in Hertfordshire, the rainfall may be said to be about 24 inches; while westward of the same line, it may be said to average 25 to 26 inches. For reasons presently to be described, it is almost impossible to estimate what the actual flow of the river would be, so that I am not in a position to state what proportion the quantity abstracted by the Water Companies bears to the total flow of the stream. In the report of the Local Government Board for 1888-9 (Appendix B), the Water Examiner reports that "each summer the whole of the volume of the Lea is practically used up by the New River and East London Companies for the supply of their districts; and, in addition, they derive about 15 million gallons daily from wells, and the East London Company 10 million gallons from the Thames." This fully bears out the opinion and evidence of the late Mr. Greaves, the Engineer of the East London Company. The total population of the Lea Valley in 1851 was 131,535. It was estimated to have increased to 172,721 in the present year; showing a growth equal to $31\frac{1}{3}$ per cent. in the 40 years up to date. But of this total it appears that 94,618 persons resided in 33 towns and villages exceeding 1000 in population in the year 1851; and it is estimated that the population of these 33 towns and villages has increased to 139,770, or by 47.7 per cent., in the year 1891. Of these towns, 13 are situated on the main stream of the Lea, and seven of the more principal ones on its tributaries. Besides this human population, I find, from the report of the Board of Agriculture for 1890, that there are in the Lea Valley above the intake of the East London Company 11,810 horses, 27,410 cattle, 111,217 sheep, and 28,122 pigs; making a total animal population of 178,559.

As to the water abstracted from the Lea by the New River and East London Water Companies, Mr. Binnie says these Companies claim the right to draw an unlimited quantity of water from this river. In 1858 they took 40½ million gallons a day; and in 1890, about 72,800,000 gallons daily. Of this latter quantity, probably 13½ million gallons are drawn from deep-seated springs by means of wells and pumping. He tells us that considerable obscurity surrounds the legal powers of the Companies to take water from the river; and, like the Companies on the Thames, they have entered into certain agreements with the Conservators of the River Lea. Whether these agreements are strictly lawful or not, he will not attempt to question; but from what he has been able to gather from the various Acts of Parliament governing the matter, he has formed the opinion that the whole subject requires careful and detailed inquiry before the public are in any way committed to the purchase of the undertakings of these two Companies.

The Royal Commissioners of 1869 made a very full and careful inquiry into the possibility of obtaining further supplies from the Lea; and they sum up their conclusions in the following words: "We believe that we ought not to calculate on any material increase from this source, and that we may consider the quantity which the Lea can contribute to the supply to London is not more than 50 millions of gallons daily." Mr. Binnie says the two Companies are drawing from the Lea nearly 73 million gallons a day; and that they cannot obtain the full quantity they require from this source is proved by the fact that the East London Company have established works on the Thames at Sunbury, from which river they are authorized to abstract 10 million gallons of water a day, and actually do abstract a large quantity. One mode in which the Companies upon the River Lea have increased their supply is by sinking deep wells in the chalk, from which they pump water which they cannot otherwise obtain from the river itself. Undoubtedly the source whence this chalk water is derived is that portion of the valley in the county of Hertfordshire above the intake of the New River Company. In the report of the Local Government Board already quoted, the Water Examiner remarks: "Assuming that a sufficient supply can be drawn from underground sources, it is doubtful whether there will not result a depletion of the springs which feed the Lea, and a corresponding reduction of the volume of discharge of that stream." This statement is fully borne out by the evidence collected by the Hertfordshire County Council, which would have been laid before the Parliamentary Committee recently presided over by Sir Matthew White Ridley had time permitted the Committee to go into the questions of quantity and quality. It is sufficient, Mr. Binnie thinks, to note that almost all the authorities in the upper valley of the Lea have declared their intention, should the works of these Companies be handed over to a public body, to ask that some restriction should be placed upon the quantity of water drawn from this source. He fully shares the opinions of these bodies. He considers that the Companies should never have been permitted to exceed the 50 million gallons per diem mentioned by the Duke of Richmond's Commission in 1869; and he is also of opinion that no public body should be compelled to purchase the works of these two Companies on the basis of the unlimited supply which they claim to derive from the River Lea.

As to the pollution of the Lea, Mr. Binnie can only express his perfect concurrence in the opinion arrived at by the Royal Commission on Domestic Water Supply in 1874. In their report the Commissioners state: "We therefore recommend that the Lea should also be abandoned as a source of potable water. This measure is less urgent than the relinquishment of Thames water; but the sanction of your Majesty's Government ought not, in our opinion, to be accorded to any further expenditure of capital upon the supply of Lea water to the Metropolis."

With regard to the possibility of constructing reservoirs in the valley

of the Lea, Mr. Binnie says that, as the upper part of the valley of the river and its tributaries above Hertford is entirely composed of chalk, he feels certain, from his experience in the construction of storage reservoirs, that they would be impossible in such a situation. Nor does he find that they have ever been proposed by any engineer sufficiently acquainted with the subject to speak with authority.

The next subject dealt with is the pollution of the valleys of the Thames and Lea; and on this Mr. Binnie makes the following remarks: It is inevitable that a population, as noted above, of about 1,200,000 human beings, and more than 1,800,000 animals, must pour into the Thames and Lea a large amount of more or less clarified sewage, although the analysis of London water after filtration shows but a small trace of this pollution, and although the death-rate of the Metropolis does not apparently indicate any large mortality due to this cause. This, however, only emphasizes the well-known fact that a large population can for a time drink with impunity the sewage, more or less diluted, of healthy persons and animals. The really important question is: What would be the effect on the health of the Metropolis were the clarified sewage, which is continuously poured into both rivers, to flow from districts where epidemics prevail? This question cannot at present be authoritatively answered, as chemical analysis is powerless to detect the presence of the germs of such diseases in water. It should be borne in mind that, under the pressure of public opinion, and through the agency of the Thames and Lea Conservancy Boards, efforts have been made to cause many of the towns to clarify their sewage before passing it into the river. But this clarification, even when carried out in the most perfect manner, abstracts from the sewage only the more solid particles of organic matter in suspension, which amounts to about one-fifth to one-sixth of the total. Consequently, there passes into these rivers, in a state of solution, from four-fifths to five-sixths of the dissolved organic matter—in fact, the great bulk of it, and exactly that portion of it which would, in the case of epidemic disease, probably prove the most dangerous to human life.

It is well to note here, Mr. Binnie continues, that the powers of the Thames Conservancy Board to compel persons and public bodies to clarify their sewage does not extend over the whole area drained by the Thames; in fact, it only covers the Thames itself as far as Cricklade, and its tributary streams a distance of 10 miles up from the river. It must be remembered that the Thames Conservancy receive annually from the various Water Companies the sum of about £18,000 for performing the duties above spoken of; and there can be little doubt that a large proportion of this amount has been expended by the Conservators in improving the navigation of the upper river, and increasing the traffic on it. Year by year the River Thames is becoming more and more what may be called the "aquatic playground" of the Metropolis. This means the increase of all kinds of craft, among which house-boats form no insignificant feature; and although strict rules are made by the Conservators to prevent the fouling of the river, yet from my observation I fear that such rules are honoured more in the breach than in the observance. I can hardly, in any circumstances, consider a navigable river a satisfactory source of water supply; but the special conditions affecting both the Thames and the Lea are such as to render both rivers objectionable as the source of supply for the largest and richest city in the world. Additional sewage contamination takes place where systems of sewage irrigation are adopted which merely have the effect of depositing the solid matters in the sewage on the areas of the sewage farms. The solid matter is inevitably washed into the streams in times of heavy rainfall; besides which, the fluid part of the sewage tends to pollute the subsoil through which it passes. And this is fully acknowledged by the Water Companies who supply London; for it is found impossible (so foul and discoloured is the stream during periods of rainfall) to supply flood water for consumption in the Metropolis.

It is not, however, the author points out, merely by sewage discharge and cesspools that the river, and the subsoil draining into it, receive pollution. Not only is there in the case of the Thames Valley a large population—the great bulk of it, as we have seen, resident in towns and villages on the immediate banks of the river and its tributaries—but as, in the course of nature, this population dies and is buried, the decaying bodies add another source of possible pollution to the district. If we assume that the total population above the intakes in the valleys of the Thames and Lea is 1,200,000, and the death-rate is 15 or 16 per 1000 per annum, there must be annually from 18,000 to 19,000 corpses buried within the watershed. It has been seen that the great bulk of the population is massed along the river banks; and it follows that these bodies will mainly be deposited in graveyards adjacent to the river.

It is often stated that the water of a flowing river which has become polluted by sewage has the power of self-purification; and no doubt, in a certain limited sense, this may be the case. But, quite apart from any such theory in regard to the flow of the Thames through its thickly populated valley, it would be very interesting to know if the river does or does not increase in impurity as it flows downwards. The answer to this inquiry is given in a paper "On the Present State of our Knowledge concerning the Self-Purification of Rivers," recently read before the International Congress on Hygiene and Demography by Dr. Percy Frankland, F.R.S.*

To avoid complications as to the suspended organic matter, Dr. Frankland had caused all his specimens of water to be taken on the same day, from 25 points in the Thames between Oxford and Hampton. These samples were filtered through filter-paper, so that the results, expressed in parts per 100,000, show only the dissolved organic matter. Notwithstanding the large increase in the volume of the river due to the tributary streams—the Cherwell, Kennet, Colne, Wey, &c.—Dr. Frankland's analyses show, as between Oxford and Hampton, the following increases in amount of impurity in the river—

Organic carbon from	0.136 to 0.451
Organic nitrogen from	0.039 „ 0.082
Ammonia from	0.000 „ 0.024
Nitrates and nitrites from	0.178 „ 0.222
Combined nitrogen from	0.217 „ 0.324
Chlorine from	1.060 „ 1.700

These figures show a total percentage of impurity of 1.630 at Oxford and 2.803 at Hampton; being an increase of 1.173, or (say) 72 per

* See JOURNAL, Vol. LVIII., p. 367.

cent. The only substance which had apparently decreased was the harmless salts of lime. This decrease is shown by the total hardness, which had fallen from 21·80 to 18·9, and is practically due to the greater dilution of the water owing to increased flow from the tributaries. Alluding to his table of analyses above quoted, and speaking of the theory of self-purification of rivers, Dr. Percy Frankland said: "It will be seen that the idea of any striking destruction of organic matter during the river's flow receives no sort of support from my experiments; the evidence is, in fact, wholly opposed to any such supposition." And speaking also of a similar set of experiments on the flow of the Ure and Ouse, above York, he said: "There is not the slightest support to the theory of self-purification." But be the theory correct or not, there is clear evidence in Dr. Percy Frankland's experiments that the River Thames becomes more polluted as it flows downward from Oxford to the points of the Water Companies' intakes at Sunbury, Molesey, and Hampton.

Mr. Binnie then proceeds to give particulars of cases in which illness has been proved to result from drinking contaminated water; and he says the instances cited prove, if proof is required, that water is a most potent element in the dissemination of disease. He points out that the removal from time to time of the London Water Companies' intakes higher up the Thames have been with the view of obtaining a purer supply. But he questions if these removals can be continued much longer with advantage, seeing that it would only bring them into closer contiguity with many of the larger towns, such as Oxford, Reading, and Windsor, which are necessarily the greatest sources of pollution. He thinks the subject of the danger arising from the use in the future, as the population increases in the valleys of the Thames and Lea, of water drawn from these rivers, deserves most careful attention, inasmuch as the London Water Supply involves the first necessary of life for 5½ million persons, or nearly one-fifth of the total population of England and Wales. In dealing with the vital interests of so vast a population, it should, he says, be constantly borne in mind that there can be no justification in adopting permanently any source of supply which is liable to serious contamination, and which may, in given circumstances, be the certain means of spreading epidemics disastrous to the whole community.

In concluding his report, Mr. Binnie says that to his mind the whole question is not one requiring to be elucidated by chemical analysis. He considers that the facts given by him, supported as they are by the evidence of high authorities, are sufficient to throw deep suspicion on the London Water Supply, derived as it is from such questionable sources as the Thames and Lea. He admits that, as far as analysis is concerned, the water supplied to London appears to be wholesome. But it has been shown, he says, that analysis, unless the previous history of the water is taken into account, is no guarantee of purity; and it is evident that the inhabitants of London are living under conditions as to their water supply which might lead to an outbreak of epidemic disease which, for extent and severity, would be almost unparalleled in the history of the world. There are also, he thinks, serious reasons, on other grounds entirely, for limiting the supply derivable from the Thames and Lea, even were these waters considered to be perfectly pure and wholesome.

LIVERPOOL CORPORATION WATER SUPPLY.

At the Meeting of the Liverpool City Council last Wednesday, Alderman J. Hughes submitted the report and estimates of receipts and expenditure for the current year, and called attention to an increase of £6800 in the revenue. They had, he said, received for water-rate in respect of Bootle £3200. In addition to this, there was the sum of £3500 produced by the increased sale of water, chiefly for trade purposes. This showed that for shipping and trade purposes water was now more freely used than in previous years; and it was the desire of the Committee, by reducing the charge, to encourage that use. Indeed, they hoped before long to ask the Council to sanction a scheme by which the scale of charges for water used in manufactures and business would be reduced, and manufacturers tempted thereby to come to Liverpool, and not only take its water but take part in its administration. Although in 1888 the Committee reduced the charge for filling ships' boilers from 5s. 9d. to 2s. 6d. per 1000 gallons, there had been a large increase of receipts from that source; and the consumption of water for trade purposes had been considerably increased. On the other side, the expenditure on maintenance for 1891 was £79,121, including £1500 for the maintenance of the Vyrnwy works; but that total was £16,304 less than the expenditure on maintenance ten years ago, which was in itself evidence that they had had regard to economy as well as efficiency. The Committee were now supplying 134 million gallons per week; but they hoped that this would be increased in future. As to the aqueduct tunnel under the Mersey, it was now completed for 500 feet of its length; and there was only a distance of 350 feet to be finished. The rate of progress had averaged 51 feet per week; and he hoped that by June or July Liverpool would have not only an ample supply of water for their own purposes, but would largely contribute to the supply of many other places along the pipe-line. The estimates were then passed; and the Council also fixed the domestic water-rate for the year 1892 at 7½d. in the pound upon the net annual value of premises within the city and the borough of Bootle, and at 10½d. in the pound in respect of premises beyond the limits of the city and the borough of Bootle.

The Assessment of the Bristol Water Company's Works.—At the meeting of the Bedminster Board of Guardians last Tuesday, the Chairman (Mr. F. Weatherly) stated that the Assessment Committee had applied to the Board for power to appoint a valuer to re-assess the property of the Bristol Water Company. The question had recently come before the Assessment Committee; and it was considered by several of the members that the time had arrived when the works should be re-assessed, as a number of additions had been made. The extensions were hardly completed; but as it would take two or three months to re-assess the property, he thought the matter ought not to be delayed. The last valuation, it was mentioned, took place about ten years ago. The application was unanimously agreed to.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

This week the Edinburgh and Leith Gas Commission is in the enviable position of being like that other and more illustrious body against whom an eminent person was brought to curse them, but who did the opposite. The Edinburgh Merchants' Association, after sundry fulminations as to the quality of the gas supplied in the city, remitted "the whole question" to a Committee of their number, which Committee contained the men who had been most vigorous in complaining, selected probably with the intention that they should "roast" the Gas Commissioners more deliberately in private than would have been prudent in a meeting which was open to the Press. That Committee, casting about for the stick wherewith to administer the castigation they considered the Gas Commissioners deserved, and presumably failing to find a prophet, appointed a man of science to guide them. This line of procedure was not only commendable in itself, but in their choice of Dr. Ivison Macadam they are to be congratulated; for probably no scientist in Edinburgh is more capable of giving an intelligent and reliable opinion upon coal gas than is Dr. Macadam. His report was read at a meeting of the Association on Wednesday night. It is too long a document to be given in this column; and I can therefore only refer to it. Dr. Macadam tested the gas for illuminating power in the laboratories at Surgeons' Hall in Nicolson Street, and at 56, Hanover Street, and by that means, if my memory serves me right, he tested the gas from both the Edinburgh and the Leith works. The former he found to be of 27·08, and the latter of 25·14 candle power. Regarding this result, two remarks are competent. In the first place, there are likely to be properly fitted-up appliances for testing gas in the laboratories at Surgeons' Hall, where for long the Leith gas was tested for the Edinburgh and Leith Gas Company; while at 56, Hanover Street, the apparatus would probably be of a temporary kind. In the second place, Surgeons' Hall is only about three-quarters of a mile from the Edinburgh works; whereas Hanover Street is about three miles from the Leith works. The two gases were thus not tested on an equality. If they were both Edinburgh gas, the only conclusion permissible is that the apparatus was faulty. But as no argument has been attempted to be founded upon the difference in illuminating power, it is sufficient here to merely point the above circumstances out. Of more consequence is Dr. Macadam's conclusion that "the gases were of good quality and purity; and when burned under low pressure and with proper burners, gave fair results." He thought, however, that the price charged was above the value of the gases as illuminating agents; and that a very considerable saving could be effected by the use of paraffin oil. If Dr. Macadam simply meant that paraffin oil is a cheaper illuminant than gas, he was probably right so far as Edinburgh is concerned; because paraffin oil is produced in abundance within four miles of the city boundary, and it is a cheap commodity in the city. But if it be actually cheaper, which I doubt, it is strange that the community—who are quick to discover a monetary advantage—have not found it out. I know that paraffin can be had for about one penny a bottle; but at that price it is a distinctly inferior illuminating agent. When a decent article is obtained, it is doubtful whether the cost of the oil would not, light for light, be more than that of gas in Edinburgh. If Dr. Macadam meant to lay down an abstract rule that 4s. 6d. per 1000 cubic feet for 26-candle gas is more than gas is worth as a lighting agent, he will land himself in difficulties with commercial problems from which he will find it hard to extricate himself. One illustration will show this. If paraffin oil were to be as universally used as gas, its value would be so enhanced that it would then be a dearer illuminant than gas at the price named; and the remark would then be open that its cost was above its value as an illuminating agent. The conclusion to which Dr. Macadam arrived—that the illuminating power of the gas should be reduced by four candles, so as to allow a lower price to be charged—is a sensible one. The Gas Commissioners have every reason to be satisfied with Dr. Macadam's report. It proves that they are doing all they can in the circumstances; and that the best course for them to pursue is what they attempted in 1890, but were prevented by popular clamour from continuing. Dr. Macadam was able to convince the Merchants' Association that what he proposed was right. The men who had been querulous before became mild, and satisfaction was expressed at the proposal to reduce the illuminating power of the gas. If this action of the Merchants' Association—begun in hostility, but ending in acquiescence—should be the means of educating the public on the single subject of the most profitable quality of gas, it will have done a service to the gas industry which cannot be over-estimated; because there is no doubt that the most effective way of breaking the cannell ring is by getting the public to accept a lower quality gas.

When the Glasgow Corporation Gas and Electric Lighting Committee's minutes were under consideration at the monthly meeting of the Town Council on Thursday, there was something approaching to a little storm in regard to the gas supply of some of the suburban districts of the city. Bailie Primrose inquired if any steps were being taken to increase the quantity and improve the quality of the gas supplied to the south-western portions of the extended city, including Pollokshields, Dumbreck, and Paisley Road district. He said he had made enquiry on the same subject months ago; and was assured that the Stiggian darkness would be improved. There were good grounds for complaint, as almost every house was using oil-lamps, so as to modify the darkness. In the absence of Mr. Ure, the Convener of the Works Sub-Committee, Mr. Mitchell attempted to give a reply. He remarked that he was glad they had been favoured with one of Bailie Primrose's eloquent and sparkling addresses; and then he went on to say that he had never heard of such complaints from any quarter before, but he was able to state that they were laying a new main from the Tradeston Gas-Works to Pollokshaws—a remark which had nothing whatever to do with the subject of complaint. There was, however, room for excuse, as he is neither Convener nor Sub-Convener of the Committee. Mr. Mitchell was asked to promise that he would bring the matter before the Works Committee and have the gas supply put into a more satisfactory position. There was widespread discontent in the districts

of West Pollokshields, Dumbreck, and Ibrox, both as to the quality and quantity of the gas at certain hours. Complaints had been repeatedly made in the Council Chamber and in the office of Mr. Foulis, who had admitted that they were well founded, and had undertaken to have a new main put down. Bailie Paton said that he had again and again called the attention of the Gas Committee to the want of pressure. The condition of the gas in Pollokshields was absolutely unbearable. Mr. Dickson stated that he was in that district on the preceding Saturday; and saw a gentleman who had gone to the expense of setting up two gas-fires, when he discovered that he could not get gas to feed them. Bailie Pettigrew gave it as his opinion that if the consumers would look after the state of their piping, they would get good gas; but how the piping could affect the quality of the gas, it is rather difficult to understand. Bailie J. H. Martin said it was simply a want of pressure; and he had the same complaint from the East-end. Then Mr. Battersby, one of the South-Side members of Council, remarked that his district was quite as bad. The Chairman, on behalf of Mr. Mitchell, promised that the matter would be brought up at the first meeting of the Gas Committee, and the discussion closed. As an "outsider," I can say, without any hesitation, that the pressure has many times been very low during the past winter in my part of the extended city. I am told that Mr. Foulis sent two of his experts to Pollokshields yesterday (or possibly Thursday night), to the house of one of the complainants, when it was satisfactorily demonstrated that the condition of things prevailing was not what it ought to have been.

At the same sitting of the Town Council, it was formally agreed to purchase the two central lighting stations of Messrs. Muir, Mavor, and Coulson, electric lighting engineers, together with their machinery, plant, goodwill, &c., at the cost of £15,000; so that at the end of the present month the Corporation will become purveyors of electric light as well as gas. All the necessary arrangements have been made for taking over this concern, which has now been in existence something like seven or eight years. Already a new order for electric light has been booked by the Committee—it is for the supply of about 160 lamps for a great billiard-room about to be established in the centre of the city; and it has been resolved to give the required amount of current from the station where high-tension electricity is generated. It is confidently expected that all the present customers will continue to take a supply of electric light from the Corporation; and the opinion is entertained by some members of the Electric Lighting Committee that the demand will amount to a "boom" when they are in a position to supply current from the new station which is forthwith to be built and equipped from Professor A. B. W. Kennedy's plans.

The Dundee Gas Commissioners had before them at their monthly meeting on Wednesday a claim from the owner of the property in Balgay Street, Lochee, in which the explosion of gas took place on the morning of the 15th ult., for £160 as compensation for damage to his property. The Clerk said he had made inquiries, and he had also a report from Mr. McCrae, the Manager, on the subject, from which it appeared that the explosion was not due to any fault or negligence on the part of the officials of the Gas Commission. The feeling of the Commissioners was that they should deny liability, and defend any action which might be brought against them. Bailie Perrie, however, called their attention to the loss which was sustained by the tenants of the building through damage to their furniture, upon which ex-Provost Brownlee, Convener of the Works Committee, said he was sure the Gas Commission would not see the poor people injured in any way, and, while denying liability, they would, *ex gratia*, compensate them. The subject was left in the hands of the Conveners of the two Committees of the Commission and Bailie Perrie, with powers to settle.

At Thursday's meeting of the Hamilton Town Council, the Gas Committee stated that the Manager's report showed the cost of gas for the preceding month to have been 1s. 4½d. per 1000 cubic feet; and that the average illuminating power was equal to 28.2 standard candles. The Committee reported that they had again had under consideration the proposed extension of the works or the introduction of the electric light into the burgh; and the Town Clerk submitted a report as to the probable cost of the latter. Further consideration of the matter was delayed in order that more inquiry might be made on the subject. The motion for the adoption of the minutes having been moved, Mr. Sanders remarked that there was much dissatisfaction in the minds of some of the ratepayers as to the proposal to spend £12,000 on the extension of the gas-works; but Provost Archibald thought that Mr. Sanders might safely take it that no expenditure in that direction had yet been sanctioned. Ex-Bailie Tainsh (a former Convener of the Gas Committee) remarked that they had improved the illuminating power of the gas somewhere about three-tenths of a candle, but unfortunately the gas itself had not been improved. He thought that the matter should be looked into; and if it was 28 candles let it be so, but if only 20 candles call it so. He moved that the report be not received as it stood. On being asked if he could verify his statement as to the illuminating power of the gas, Mr. Tainsh said that he had made the test at the works. Mr. Brown stated that, along with Mr. Miller, he had that day tested the gas, and found it to be 26 (and some odd points) candles. Their intention to visit the works was altogether unknown to the officials. But Mr. Miller put in a qualifying statement to the effect that if the room (photometer room, I suppose) had been up to the proper temperature, the results would have been better for the gas. In reference to Mr. Tainsh's remarks, the Provost said that he did not think it right that a person in the position of the Manager should be the subject of statements which he had not an opportunity of meeting.

Following upon what was stated in these "Notes" last week, regarding the request by the Glasgow Alum and Ammonia Company, for a reduction of the contract price at which they purchase residuals from the Dundee Commissioners, it will not be matter of surprise to learn that the Gas Commissioners have instituted legal proceedings before Lord Stormonth-Darling in the Court of Session, to recover their account against the Company. The action has only just been brought into Court; and the nature of the defence cannot yet be stated.

Reduction in Price.—The Directors of the New Mills Gaslight Company, Limited, have decided to reduce the price of gas from 5s. to 4s. 7d. per 1000 cubic feet.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, Feb. 6.

Sulphate of Ammonia.—There is barely any change in the market, although seemingly from outward appearances depressed; but there is a steady undertone, and prices are quotably unchanged as far as transactions from first-hands are concerned. The present position lies in a nutshell. Speculators anxious to secure parcels for present delivery, to cover previous sales, are quietly paying full rates, while quoting on the open market prices considerably below the figures of their own transactions. Thus while £10 10s. is quoted f.o.b. Hull, makers are realizing about £10 12s. 6d.; and second-hand parcels at Leith are offering at £10 10s., while good makes are being sold at £10 11s. 3d. At Liverpool business has been reported at £10 7s. 6d.; but makers have not sold below £10 10s. This will a great deal explain the recent contradictory reports; and as the shipments continue on a fairly large scale, and there is not much offering, while apparently still a fair quantity is required by the dealers, a firmer tone of the market may presently be expected, even if the Continental demand does not come up to anticipations. Nitrate is slightly easier; and there are sellers at 9s. 6d.

LONDON, Feb. 6.

Tar Products.—There is a slightly better tone in this market. Benzole buyers have at last thought the price low enough to make some purchases. The business, however, is not much; and very few will purchase beyond the next two or three months. Solvent naphtha continues in fairly good request, and maintains its price surprisingly, having regard to the value of benzol and toluol. Creosote and common oils are difficult of sale; and makers still hold very large stocks. Anthracene remains unsaleable; and its market value is very weak—the prices quoted below being nominal only. Pitch buyers seem to have filled their requirements. For spot delivery there is weakness; and for forward business, buyers speak of much lower prices. Prices are: Tar, 19s. Pitch, 33s. 6d. Benzol, 90 per cent., 2s. 4d.; 50 per cent., 1s. 9d. Toluol, 1s. 4½d. Solvent naphtha, 1s. 3d. Crude benzol naphtha, 30 per cent., 11d. Creosote, 1d. Crude naphthalene, 35s. Crude carbolic, 60's, 1s. 1½d.; crystals, 5½d. Cresol, 8½d. Anthracene (nominal), 30 per cent., "A" quality, 1s.; "B" quality, 8½d.

Sulphate of Ammonia.—The market is flat; and business for prompt delivery of no use. There is some inquiry for forward delivery; but makers will not look at the prices offered. A little business has been done at from £10 to £10 10s., less 3½ per cent., according to position, conditions, and delivery. Gas liquor (10-oz.) is quoted at 6s. 6d. to 8s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The demand for all descriptions of fuel is steadily quietening down; and except in some special sorts, supplies are becoming more plentiful in the market. Best house-fire coals continue in generally active demand, but medium and common sorts are not moving off so freely. Prices remain steady at about late rates. Best Wigan Arley coal is still firm at 12s. 6d.; Pemberton four-feet and second qualities of Arley average 10s. 6d. to 11s.; and common house-fire coals, 9s. to 9s. 6d. per ton. The lower qualities of round coal continue in but indifferent request for iron-making, steam, and general manufacturing purposes; and the demand for these tends rather to lessen than to increase. Inland requirements are necessarily affected by the lessened activity in most of the coal-using industries; whilst for shipment there has not been so much enquiry, and prices are rather easier. At the pit mouth, quotations remain at 8s. to 8s. 6d. per ton for good qualities of steam coal; and they are scarcely firm at these figures. For shipment, ordinary steam coal is now readily obtainable at 10s. per ton delivered at the ports on the Mersey. The best qualities of engine fuel move off without difficulty, and are maintaining late rates; but common sorts are again hanging upon the market, and there is some easing down on recent quotations. At the pit mouth, ordinary burgy averages 6s. to 6s. 6d.; best slack, 5s. to 5s. 6d.; medium 4s. 3d. to 4s. 9d.; and common sorts, 3s. to 3s. 6d. per ton.

Northern Coal Trade.—The coal trade has been very dull until the last day or two, with a fall in prices. Best Northumbrian steam coals fell to 10s. per ton f.o.b.; and it is believed that slightly lower prices have been accepted. Second-class steam coal is about 1s. per ton less; and small steam has been sold as low as 3s. 3d. per ton. Gas coal is still in very large demand; but the consumption is decreasing weekly, and will do so for four months yet—though in a little time we may have a larger export from the northern ports. The price of gas coal varies a good deal; but about 9s. 3d. per ton f.o.b. may be looked on as a medium price for best Durham gas coal—some collieries asking 9s. 6d. per ton for prompt delivery. For forward contracts for export, it is well known that lower prices prevail. Bunker coal is dull, and the price is weaker. Manufacturing coal is very flat. Household coal is very quiet also. Coke is steady at 16s. per ton f.o.b. for best blast furnace qualities. The project of a "stoppage of collieries" for a fortnight is not seriously regarded in this district, for the settlement of the sliding scale in South Wales means the continued working of that great district; while in the Midlands, though there may be some slight desire to get in stocks of fuel, little else is expected to result.

West of Scotland.—The coal trade in the West of Scotland is rather quiet, owing principally to the restricted output all over the country. For prompt shipment, late rates are still freely obtained; but a few sales have been made forward on rather easier terms. It is reported that some houses are discounting the fall; but as yet quotations have not been finally decided. Cannel coal is firm; and it is stated that a Fife house has fixed a year's contract for Paris at 45s. per ton. Shipping is still rather quiet, on account of the slow despatch. For prompt supplies, quotations remain as follows: Main, 8s.; ell, 8s. 9d. to 9s.; splint, 9s. 3d.; and steam, 10s. 6d. to 10s. 9d.—all f.o.b. Glasgow. The exports of Scotch coal during the past week amounted to 100,705 tons—an increase of 24,899 tons over the same week of last year. The shipments for the month of January totalled 392,609 tons; being an advance of 138,081 tons, as compared with the corresponding month of 1891. Last year the trade was disorganized by the railway strike.

The Cape Town District Water-Works Company, Limited, have received a cable advising them that judgment has been given in their favour by the Supreme Court of Cape Town in the lawsuit brought by certain riparian owners on the Liesbeck River contesting some of their water rights.

Gas, Water, and General Investment Trust, Limited.—The Directors recommended the usual dividends at the rate of $4\frac{1}{2}$ per cent. per annum on the preferred stock, and 10 per cent. per annum on the deferred stocks, for the half year ended the 28th ult., carrying forward £1221, and placing £13,699 to the reserve fund, which now stands at £64,341.

Additional Storage at the West Bromwich Gas-Works.—At the monthly meeting of the West Bromwich Town Council last Wednesday, the Gas Committee reported that they had considered the various tenders sent in for the erection of a gasholder in accordance with drawings and specifications submitted, and recommended the Council to accept that of Mr. Daniel Howard, subject to the sanction of the Local Government Board being given to the proposed extension of the works. Alderman R. Farley, in bringing up the report, stated that a large number of tenders had been received for the holder, and the estimates were very close. The Committee, however, had unanimously decided to accept that of Mr. Howard, a local manufacturer, the amount of whose tender was £5335. The report was adopted. The Committee are now soliciting tenders for the construction of a brick tank for the holder; and the work will be proceeded with as soon as the necessary authority is obtained.

Cutting Off Water Supplies.—At the meeting of the Fulham Vestry on Monday last week, Mr. Proudman moved that the Clerk be instructed to prepare a petition to the House of Commons, embodying the following: "That, as your Honourable House has in its wisdom seen fit, by provision of the Public Health Act, 1891, to require the Sanitary Authorities of parishes to declare uninhabitable any dwelling-house of which they have had notice of the disconnection of water, by the water company supplying the district in which such dwelling is situate, we, the Vestry of Fulham, as a body directly affected by such provision of the Public Health Act, earnestly urge upon your Honourable House the desirability of depriving Water Companies, by early enactment, of the power of thus creating insanitary conditions by disconnecting the water from dwelling-houses; leaving to such Companies the ordinary process of law to recover their claims upon consumers, inasmuch as they monopolize the supply of this prime necessity of existence to the public." The matter was referred to the Law and Parliamentary Committee.

Electric Lighting for Liverpool.—A memorial was read, at last Wednesday's meeting of the Liverpool City Council, from 450 consumers of electricity, requesting the Council to give their consent to the application by the Liverpool Electric Supply Company, Limited, for a Provisional Order, whereby (the variation of the statutory purchase clause in the Liverpool Electric Lighting Order, 1889, being repealed) the Company would be bound to reduce their present maximum charge for electricity to 8d. per unit. Mr. Hornby, in moving the adoption of the general proceedings of the Watch Committee, said they were determined to oppose the application of the Company. Under the Order of 1889, the Corporation had the power in nineteen years to buy the first and most important part of the undertaking; and the Committee considered they ought not to give up that right without some considerable concession—such as the Company had not as yet proposed—for the reduction of the maximum rate was more imaginary than real. The Company's last step was to go to the Board of Trade, and try to ignore the Council altogether. The motion was seconded by Mr. Rathbone. Several members spoke in support of the action of the Committee; and subsequently their proceedings were confirmed.

The Management of the Rotherham Gas and Water Undertakings.—At the quarterly meeting of the Rotherham Town Council last Wednesday, Mr. Cox moved that the following resolution, passed by the Council on Jan. 6, be rescinded: "That a gas engineer be appointed to manage the gas and water works undertakings at a salary of £300 per annum." He argued that the resolution was against the wishes of the majority of the members of the Council. In Rotherham they were serving the public with gas at a less price than the towns of three counties which stood similarly to Rotherham in regard to the coal-fields. The gas-works were being fairly and economically managed; and the appointment of an engineer would not result in greater profits or an improved quality of gas, and would not save the Council the expense of consulting high authorities. Mr. Walker seconded the motion. A good deal of small talk followed, until the Mayor (Mr. Hirst) expressed the opinion that the discussion was an absolute waste of time; and he was very much surprised the matter had been again brought forward. He added that he would not be a party to altering the financial position of the present Manager (Mr. J. Goodwin); but he would vote against Mr. Cox's proposal. The motion was defeated by 12 votes to 10.

Alleged Murder of the Former Proprietor of the Cheshunt Gas-Works.—According to a report circulated by the Press Association, information has been received at Waltham Abbey of the alleged murder of Mr. J. Brown, formerly the owner of the gas-works supplying that district. When the undertaking was acquired by the present Company in 1869, Mr. Brown went to America, and, after doing a successful business in various parts of the country, settled in British Columbia, where he became possessed of large estates. His connection, however, with certain businesses in England did not cease; and only a month or two ago he visited Waltham Abbey, in connection, it is said, with the affairs of the Gas Company. Upon his return home, he found, according to the advices received, that within the domestic circle matters were not as they should have been, and he forthwith proceeded to take steps to sell his estates, with a view to returning to England. Before these negotiations were completed, however, Mr. Brown suddenly disappeared, and a diligent search resulted in his body being found on his own homestead—death being due to strangulation. This discovery resulted in the arrest of several inmates of his household, who, according to report, are now awaiting their trial on a charge of wilful murder.

Worcester Water Supply.—In a paragraph dealing with the water supply of Bridgnorth in the last number of the JOURNAL, it was stated that Worcester and Bewdley had applied to the Corporation of Birmingham with regard to the probable cost of taking a supply of water from their proposed new aqueduct to convey water to the city from Wales. We learn that, since the Worcester Corporation made the application, they have decided to treat their water supply from the Severn by means of Anderson's revolving purifiers; and that the Company who hold the patent for this appliance are now constructing the necessary plant for dealing with the whole of the supply to Worcester.

Electric v. Gas Light for the London School Board Offices.—At a recent meeting of the London School Board, a recommendation of the Works Committee, that the Board should authorize a further estimated expenditure of £3600 (exclusive of the cost of the fittings), for providing electric lighting for the enlargement of the offices of the Board now being carried out, and also for the existing offices, was adopted. According to the Committee, the whole of the offices of the Board can be lighted by the new method at an annual expenditure of something like £550, while at present the gas bill amounts to as much as £600. But it has been pointed out by a London evening paper that the initial outlay of £3600 will take the annual savings of quite a generation to replace.

The Fatality at the Jarrow Gas-Works.—In reference to the fatal accident which occurred on the 30th ult. to a labourer at the Jarrow works of the South Shields Gas Company, briefly noticed in the JOURNAL last week, it appears to have been caused by the man's jacket being caught in the shaft of a crane which he was putting into gear without orders, and without having the machinery stopped, in accordance with the rules of the works, prior to doing so. To their verdict of "Accidental death" the jury added a rider "that the foreman and manager give notice that, when anything is being done to the machinery, it be stopped; and the jury believe that the Company's officials and foreman have shown a certain amount of neglect in not having such notices carried out."

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 243.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon invest. ment.
£			p. c.					£ s. d.
GAS COMPANIES.								
590,000	10	15 Oct.	10½	Alliance & Duhlln 10 p. c.	10	16-17	..	6 3 6
100,000	10	"	7½	Do. 7 p. c.	10	11½-12½	..	6 0 0
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105-107	..	4 13 5
100,000	20	27 Nov.	8	Bahia, Limited	20	12-14	..	11 8 6
200,000	5	12 Nov.	7½	Bombay, Limited	5	6½-7	..	5 7 1
40,000	5	"	7½	Do. New	4	4½-5½	..	5 14 1
380,000	Stock	13 Aug.	12½	Brentford Consolidated	100	210-220	..	5 11 4
125,000	"	"	9½	Do. New	100	157-162	..	5 14 2
220,000	20	16 Sept.	11½	Brighton & Hove Original	20	40-42	..	5 9 6
888,500	Stock	16 Sept.	5	Bristol	100	98-103	..	4 17 1
320,000	20	15 Oct.	11½	British	20	43-45	..	5 0 0
50,000	10	28 Aug.	11½	Bromley, Ordinary 10 p. c.	10	18-20	..	5 15 0
50,380	10	"	8½	Do. 7 p. c.	10	13-15	..	5 13 4
328,750	10	"	—	Buenos Ayres (New) Limited	10	5½-6½	..	—
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	93-96	..	6 5 0
150,000	20	13 Aug.	8	Cagliari, Limited	20	25-27	..	5 18 6
550,000	Stock	15 Oct.	13½	Commercial, Old Stock	100	240-250	..	5 10 0
165,000	"	"	10½	Do. New do.	100	190-195	..	5 10 3
130,000	"	30 Dec.	4½	Do. 4½ p. c. Deb. do.	100	118-123	+	3 13 2
800,000	Stock	30 Dec.	13	Continental Union, Limited	100	225-230	..	5 13 0
200,000	"	"	10	Do. 7 p. c. Pref.	100	185-195	..	5 2 7
75,000	Stock	16 Sept.	10	Crystal Palace District	100	190-200	..	5 0 0
486,090	10	29 Jan.	10	European, Limited	10	19-20*	..	5 0 0
354,060	10	"	10	Do. Partly paid	7½	14-15*	..	5 0 0
5,470,820	Stock	13 Aug.	12½	Gaslight & Coke, A, Ordinary	100	219-224	..	5 7 1
100,000	"	"	4	Do. B, 4 p. c. max.	100	95-98	..	4 1 7
665,000	"	"	10	Do. C, D, & E, 10 p. c. Pf.	100	248-253	..	3 19 1
30,000	"	"	5	Do. F, 5 p. c. Prt.	100	118-123	..	4 1 4
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	172-177	..	4 4 9
1,300,000	"	"	7	Do. H, 7 p. c. max.	100	152-157	..	4 9 2
463,000	"	"	10	Do. J, 10 p. c. Prt.	100	245-250	..	4 0 0
476,000	"	"	—	Do. K, 6 p. c. Prt.	100	147-152	..	3 18 1
1,061,150	"	11 Dec.	4	Do. 4 p. c. Deb. Stk.	100	110-114	..	3 10 2
294,850	"	"	4½	Do. 4½ p. c. do.	100	118-123	..	3 13 2
908,000	"	"	6	Do. 6 p. c. do	100	160-165	..	3 12 9
3,800,000	Stock	12 Nov.	12	Imperial Continental	100	223-228	..	5 5 3
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4-4½	..	6 13 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p. c. Deb.	100	109-111	..	4 10 1
541,920	20	27 Nov.	6½	Monte Video, Limited	20	15-16	..	8 2 6
150,000	5	27 Nov.	10	Oriental, Limited	5	8½-9	..	5 11 1
60,000	5	30 Sept.	7	Ottoman, Limited	5	4-5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited	10	2½-3½	..	—
People's Gas of Chicago—								
420,000	100	3 Nov.	6	1st Mtg. Bds.	100	100-105	+2½	5 14 3
500,000	100	1 Dec.	6	2nd Do.	100	100-105	+2½	5 14 3
150,000	10	15 Oct.	10	San Paulo, Limited	10	10-11	..	9 1 10
500,000	Stock	28 Aug.	15½	South Metropolitan, A Stock	100	270-275	..	5 12 9
1,350,000	"	"	12	Do. B do.	100	225-230	+3	5 4 4
200,000	"	"	13	Do. C do.	100	230-240	..	5 8 4
700,000	"	30 Dec.	5	Do. 5 p. c. Deb. Stk.	100	138-143	..	3 10 0
600,000	Stock	16 Sept.	11½	Tottenham & Edm'nton, Orig.	100	—	..	—
WATER COMPANIES.								
729,331	Stock	30 Dec.	10	Chelsea, Ordinary	100	256-261	..	3 16 7
1,720,560	Stock	15 Oct.	8	East London, Ordinary	100	204-209	..	3 16 7
544,440	"	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	136-140	..	3 4 3
700,000	50	11 Dec.	8	Grand Junction	50	101-106	..	3 15 6
708,000	Stock	13 Aug.	10½	Kent	100	268-273	..	3 10 11
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max.	100	225-235	..	4 0 10
406,200	100	"	7½	Do. 7½ p. c. max.	100	189-194	..	3 17 4
260,000	Stock	30 Sept.	4	Do. 4 p. c. Deb. Stk.	100	120-123	..	3 5 0
500,000	100	13 Aug.	12½	New River, New Shares	100	335-345	..	3 10 4
1,000,000	Stock	29 Jan.	4	Do. 4 p. c. Deb. Stk.	100	123-126*	..	3 3 6
902,300	Stock	30 Dec.	6½	S'thwk & V'xhall, 10 p. c. max.	100	147-152	..	4 5 6
126,500	100	"	6½	Do. D 7½ p. c. do.	100	140-145	..	4 9 8
1,155,066	Stock	11 Dec.	10	West Middlesex	100	245-255	..	3 18 5

† Next dividend will be at this rate.

The Extensions at the Halifax Gas-Works.—At a meeting in committee of the Halifax Town Council last Thursday week, Mr. Brook took occasion to mention that that afternoon the Gas Committee had decided to go forward with the proposed extension of the gas-works; but they found it necessary to make application for leave to borrow a further sum of £40,000—£10,000 for land at present leased from the Railway Company, and £30,000 for mains and general distribution, the latter sum covering the cost (£1000) of laying down mains to Dean Clough Mills. Answering Alderman Pollard, he said they would not purchase the land referred to until they had received the sanction of the Local Government Board; and, in reply to Alderman Bairstow, he stated that the total amount now proposed to be borrowed would be £100,000. Alderman Booth remarked that of the £60,000 applied for, they found £30,000 was already pledged; and in order to carry out the scheme, they would require, in the next five years, at least £80,000 altogether. Although they might not need the whole of the £100,000, it was better to apply for that sum. The consumption of gas, it was found, had doubled every eleven years; and therefore it was wise for the Committee to go forward with their project.

The Widnes Local Board and the Power to fix a Minimum Charge for Water.—At the St. Helens County Court last Wednesday, his Honour Judge Shand should have delivered judgment in a case which was heard before him a short time ago at Widnes, in which a number of builders there contested the right of the Local Board to fix a minimum charge for water-rate. The Local Board fixed a minimum charge for water delivered through meters of 5s per quarter, whether or not the person consumed that quantity; and the defendants contested it on the ground that it was *ultra vires*, as the Local Board had no power to fix a minimum charge, but must only charge for the water consumed. Mr. Oppenheim, Clerk to the Widnes Local Board, appeared for the plaintiffs; Mr. Lewin represented the defendants. His Honour said it did not occur to him that the judgment was to be delivered there that day; and, as a matter of fact, he had not got it with him. But if it was any convenience to the Solicitors to know, he could tell them the general result now; and he would read his judgment at Widnes at the next Court day. The judgment was in favour of the Local Board on all points; and, as far as his memory served him, he had given judgment for the plaintiffs, with costs in each case.

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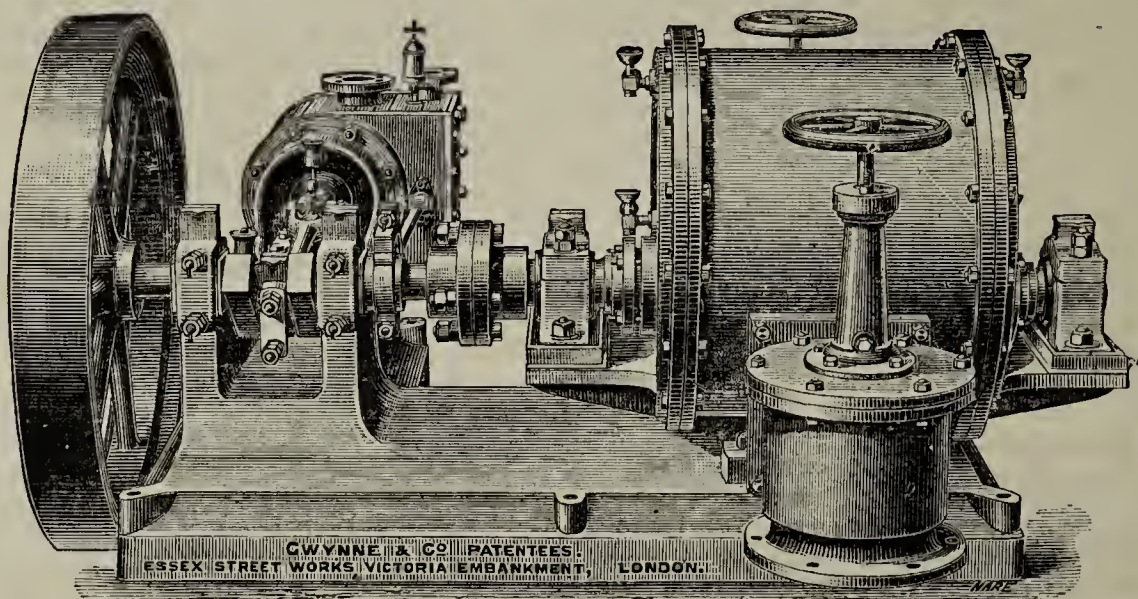
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TO CORRESPONDENTS.

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THE
JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, FEBRUARY 16, 1892.

A Strike of Coal Porters.

LIKE the traditional thunderbolt from a clear sky came the announcement in last Thursday's newspapers that a strike of coal porters had begun in London the previous morning, which, it was fully expected, would affect some 10,000 men. There was the usual uncertainty as to the real reason for the men coming out; but it was at least clear that the strike was a trial of strength between the men's Union and the employers. It appears that there

has been friction of the usual kind for some time past between the Union men and the masters; several "Branch Executives" having ordered their members not to work with non-unionists, and also to refuse to load vans for carmen in arrears with their subscriptions. It hardly needed an inspired article in the *Daily Chronicle*—a newspaper that always favours the Union side—to assure the general public that members of the Union who have fallen in arrear with their subscriptions constitute a class that Union wire-pullers are "particularly incensed against." Of course they are, for such cases are the dry-rot of all such organizations. This same newspaper informs us that "the Union had laid it down in their last notice to "their members that, whilst they would not refuse to "work with non-unionist men, *should their members refuse at any time to work with men* who, having joined the Union, "refused to comply with the rules concerning keeping "their subscriptions paid up, *the Council of the Union would sustain and defend the men* in any such action." The italics are ours. After a considerable amount of practice in construing Trade Union proclamations, we do not hesitate to aver that this was meant to be a provocative notice. It placed the initiative with the men, but left them no choice in the matter. An opportunity soon arose for proving that the permissive turn of this memorandum would be read as an imperative. A certain firm of coal merchants, trading under the name of F. B. Cameron and Co., dared to employ a backsliding unionist foreman who had not cleared his card; and upon the men (who had communicated with their leaders respecting the matter) refusing to work under him, in obedience to instructions, they were forthwith discharged. At the same time, in accordance with well-known Union tactics, another quarrel was picked with the firm over a petty question of taring empty sacks; and thereupon the President and Secretary of the Union opened up negotiations with the firm—of course, claiming to be solicitous to do all in their power "to bring about a settlement of the dispute." What amount of good faith there may be in this claim will appear by reference to their responsibility for the issue of the provocative notice that caused all the trouble. Just at this juncture, the Secretary of the Coal Merchants' Society issued a warning to the members of what was going on at Cameron's yard; and this, it is pretended, gave such mighty offence to the Union leaders, that, after a "special delegate meeting," which sat, with dramatic effect, all night, the order went forth for a general strike of Union hands. We are assured that "long and anxious "were the deliberations" of these gentry "as to how far "they would be justified in virtually stopping the coal "supply of London, and as to how far they would be "supported by public opinion if that course were "taken." Just so. It would never do to appear to precipitate with a light heart the strife between Union tyranny and free labour. But the whole thing had evidently been cut and dried; and at six o'clock in the morning it was announced by the Secretary "that those who had not gone "into work should not do so, and those who had gone in "should be fetched out." The order, we are informed, was received with a "mighty cheer." This is as usual; the unreflecting majority are always in favour of violent measures. Before another day had passed, a unionist carman had been sent to prison for seven days for assaulting a freeman; the Magistrate remarking, for the general instruction, that for the present, at any rate, and while the law of the land remains unreformed upon Trade Union principles, every "man has a right to work when "he likes, for whom he likes, and how he likes," and he is not to be interfered with in exercising this liberty. So the strike opened, and appeared to be going on in the usual way. Whatever the issues ostensibly raised for the sake of attracting the support of the public, the true point was nothing more than the old one of who is to order how work is to be done—the employer or the Union. The Coal Porters had been pretty quiet for the last three years; and they imagined themselves strong enough to fight the question once more. They succeeded in disorganizing the retail coal trade of London for a few days; and while the poor people found coal unattainably dear, gas and electric light companies had their supplies stopped for a time. The men, of course, professed to be "hopeful and determined;" and, just as in the disastrous South Metropolitan gas stokers' strike, their stump-orators tickled them with assurances that "the

"blacklegs cannot do the work." It was evident, however, if the employers stood firm, and the Union did not give up the struggle, that history would repeat itself. The already congested labouring population of London would be increased by importations of men from the country, who in a few weeks would make as efficient coalies as those who were being converted into street-corner bullies and mendicants to satisfy the demands of Messrs. Brill and O'Connor. The Union funds would soon be exhausted; and then the strike would collapse. As *The Times* put it, this time the men who had come out by the orders of the Union Executive had "no quarrel with their masters, and no grievance to redress." It was a strike "not got up in the interest of the men, nor by the wish of the men, who were never consulted, and knew nothing at all about the matter." How long this species of oppression is to be permitted it is for working men themselves to say. When a clear majority of the men of any trade agree by ballot to strike for some definite object, having seen their way and counted the cost, there is nothing to be said. But while ignorant men place absolute power over their own livelihood in the hands of men entirely irresponsible and utterly unfit to use it, we must expect to see a continuance of such scandals as we now witness.

As was expected would be the case, the strike has practically collapsed. The manner of its cessation is as instructive as that of its initiation. Although hysterically applauded by the London newspapers which follow the cue of flattering the Labour Party, whether right or wrong, such as the *Daily Chronicle*, the *Star*, and the *Trade Unionist*, forty-eight hours' experience of the realities of an arbitrarily-ordered strike was enough to convince the wire-pullers that they had made a mistake. The Union was "well organized," as Tom Mann gleefully testifies, to the extent that the men came out when summoned by their delegates; but no sooner had they stopped work than the futility of the whole proceedings became manifest. Not only did the idleness of all the unionist coalies of London fail to overawe the single firm of dealers who had originally offended the Union, but, to the disgust of the latter, the other employers elected to make common cause with this firm; evidently perceiving that, if the Union chose to raise the question of freedom to labour, the issue might as well be fought out now as at any future time. Moreover, lawlessness was most sternly suppressed. The first rioter had seven days' imprisonment for an assault upon a free carman; the next was sent up for three weeks. Meanwhile, free labour was merrily pouring in; and the police insisted on keeping the peace. So even the hare-brained instigators of the strike and their too-willing dupes saw that the "game was up;" and, after a vain attempt to induce the employers to withdraw the notice proclaiming their intention to maintain the freedom of labour, the leaders unconditionally gave in, and the great strike "upon principle," which began on Tuesday, and was to have been persevered in until the cause of the New Unionism triumphed all over London, collapsed on the following Friday. By some mysterious process, the *Daily Chronicle* sees in this termination a "victory for the men;" but it is pretty clear to the men themselves that a few more days of such "victory" would have left them starving. As it is, the determination of the masters to employ whom they please, without reference to the Union, has made some of the unionists regret the strike; for when the men wanted to go in on Saturday morning, they found in many instances their places taken. Altogether, and although this ridiculous strike only lasted so short a time, it is clear that it has inflicted a blow upon the cause of the New Unionism from which the latter—already discredited by many failures—will with great difficulty recover. Bluster as they may, the leaders cannot deny that their followers have had to return to work on exactly the same terms as prevailed before the strike; and that the attempt to bar the employment of free labourers has not only failed, but that, if any men have lost their berths, it has been through the action of the Union. Their friends in the Press have agreed to make the fall soft for the Union officials; but the fall is undeniable.

It is proverbially difficult to see the end of strife, and the last thing before going to press we learn that Friday's so-called "settlement" has been rejected by a considerable section of the men who are employed in what is known as the "seaborne branch." Possibly this mutiny in the ranks of what has been held forth for general admiration

as a "splendidly organized" Union, means little more than a determination on the part of some of the men to keep "Saint Monday" before returning to work. Some observers, however, regard the split in the ranks of the unionists as so serious, that the Union can hardly recover. It is reported that, in staying out yesterday, the "seaborne" men openly broke with the Union Executive, and that most of them tore up their cards. Moreover, among the men who stay out and those who have returned to work great dissatisfaction is felt because no strike pay was forthcoming at St. Pancras on Saturday. The whole affair shows how perniciously the New Unionism works for all concerned, and how little reliance is to be placed upon the organization of these societies for rough "trades" for effecting anything but mischief. The London coalies seem to have been particularly unfortunate, for their first leader was the notorious Michael Henry, who found it expedient to vanish after his historic interview with the heads of The Gaslight and Coke Company; and now they have been "left in a hole" by Henry's successors. It is worthy of mention that, although the block upon coal at St. Pancras only lasted three days, the St. Pancras electric lighting station was placed in great difficulties; and if it had endured for a week at all the depôts of coal, more than one of the London electric lighting companies would probably have had to shut down, unless they could have fired up their boilers with gas coke. Since it is an ill wind indeed that blows nobody good, it is satisfactory to learn that the coal block gave a much-needed impetus to the coke trade in all parts of London.

The Disposal of Chartered Residuals.

INQUIRIES have been addressed to us, by correspondents whose connection with the trade in gas-works residuals is too close to admit of their raising the question in their own names, with respect to an incident of The Gaslight and Coke Company's meeting to which passing reference was made in our editorial notice of the proceedings, but which is not mentioned at all in our condensed report of the speeches delivered on this occasion. The reference was to the remarks of the Governor (Colonel Makins), in reply to an inquiry of Sir F. Mappin's, which we characterized as "twitting Sir F. Mappin with the alleged 'unfavourable returns for sulphate of the Sheffield Company.'" Naturally enough, it may be asked what these words mean, seeing that there is not a word in our report of the proceedings on the subject of the dealings in sulphate of either The Gaslight and Coke or the Sheffield Company. It is necessary to explain, therefore, that the observations of the Governor and Sir F. Mappin on this subject were not suppressed by our reporter for any other reason than that of his general instruction to condense the abstract which he prepares for our columns. We do not profess to give verbatim reports of company meetings; and it must occasionally happen that, in the process of condensation, some of the remarks that are bandied across the table on these occasions escape recording. In view of the undoubted importance of Sir F. Mappin's point, however, and also in order to explain the editorial reference, we now return to the subject, and give the incident all the prominence in our power. What occurred was this: In the course of his speech, Sir F. Mappin asked the Governor if it is true, as rumoured, that the Chartered Company's make of sulphate is sold through one broker, who also buys on his own account. If so, Sir F. Mappin opined that this would explain the depreciation in the market value of this commodity. In reply, the Governor stated that the Company do not sell sulphate through any broker, but only through the agent of the Company, who never buys an ounce or a ton for himself. With his usual smartness in defence, Colonel Makins carried the war into the enemy's country by asserting that the results of the Chartered practice in this regard will compare favourably with those of any other Gas Company, "and most favourably with those of the Sheffield Company." With this the incident closed; Sir F. Mappin being disastrously routed, from the point of view of the debater, and Colonel Makins and the Chartered residuals agent remaining masters of the situation. It is not for us to offer any opinion upon the subject. The suggestion conveyed by Sir F. Mappin's question is unmistakeable. No such inquiry ought to be made in public without good foundation for raising the point; and it is to be hoped that the

reasons which induced Sir F. Mappin to take the action he did in the matter will be further explained at the first opportunity.

Fog in the House of Lords.

THE inevitable fog debate, which has become one of the "hardy annuals" of the House of Lords, came earlier than usual this year, on the motion raised by Lord Midleton last Friday for a Royal Commission to inquire into the subject. The matter will be found briefly chronicled in our "Parliamentary Intelligence to-day." The Marquis of Salisbury, who seems to have succeeded Lord Derby in the professorship of the art of pouring cold water upon "burning questions," declined to sanction the expense and trouble of a Royal Commission, whose labours, as everybody can see, would be practically fruitless, but was ready to consent to the appointment of a Select Committee to inquire into the subject, provided Lord Midleton is willing to be the Chairman, and can get a sufficient number of other noble Lords to sit with him for such a purpose. Of course, the sovereign efficacy of anthracite as a smokeless, and therefore innocuous, fuel was postulated by Lord Midleton; and although Lord Salisbury effectively dealt with this point, which the smoke abatement enthusiast is never weary of bringing forward, it is impossible to read Lord Midleton's suggestions for rendering the general use of anthracite obligatory, without thinking of those "golden days" regretfully apostrophized by the Peers in "Iolanthe," when it could be said of the House of Lords that these "noble statesmen did not itch to interfere with matters which they did not understand." The subject was briefly discussed once more in *The Times* in a sensible leading article, which regretfully, but unreservedly, endorsed Lord Salisbury's view of the matter. Lord Midleton's suggestions for dealing with the evil are neither new nor good. He prattled of anthracite and its qualities, and of various ways of making house chimneys less smoky than they are at present; but, as Lord Salisbury said, people will not adopt these things without coercion, and that of adrastric kind. Dealing with the same subject a short time since, our contemporary the *Engineer* confessed that anthracite would not be used for a single month in London. Writing from an experience extending over four consecutive years, with anthracite burnt in the most suitable grates, and attended by servants who perfectly understood its properties, our contemporary sums up its qualities by quoting with entire approval "the sentiment of an American engineer who pronounces anthracite 'an invention of the Evil One.'" Another contemporary, *Industries*, in discussing the foregoing statements, offers the truly original suggestion that the best way to lighten the Gas Companies' burdens, which prevent them from selling cheap gas, and so render gas-fires expensive, would be "to permit the Companies, by means of a sliding scale, to lower the illuminating power of their gas, and to gradually introduce to their consumers a cheaper gas which would commend itself for heating purposes to a large class of the community." The idea is not altogether a bad one; at least, it suggests an undiscussed view of the true nature of the conditions under which the statutory illuminating power of London gas was fixed at 16 candles. We suppose that 14-candle gas, tested in a reasonable way, could be sold by the London Companies for about 4d. per 1000 cubic feet less than they are obliged to charge for the present mixture, which has to be sent out as 17-candle gas. Whether such a difference of cost would be sufficient to meet the views of the possible users of gas-fires appears to us to be doubtful. In connection with the fog question, it may be mentioned that Lord Stratheden and Campbell has once more brought forward his Smoke Abatement Bill.

The Governor of The Gaslight and Coke Company and the Price of Gas in Cambridge.—We are asked to correct a misstatement by Colonel Makins, at the recent meeting of The Gaslight and Coke Company, that the price of gas in Cambridge has been advanced 10d. per 1000 cubic feet. In June, 1871, the price was reduced to 3s. 9d.; but in the following year, owing to the coal famine, it had to be raised to 4s., at which figure it remained till the end of 1878, when the 3d. was again taken off. In June, 1879, it was made 3s. 6d. Since then it has been gradually lowered to the present figure of 2s. 10d.; and, as stated by the Chairman at the last half-yearly meeting of the Company (see *ante*, p. 256), the Directors have had "no need to increase the charge for gas," and "they did not anticipate they would have to do so."

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 307.)

So far as the general business of the Stock Exchange last week may be regarded, there was only one market—the American; but the sensational and somewhat mysterious phases of that field of surprises are not our particular concern. Everything else was tame and flat; and, owing to the recent great restriction in the scope of operations, the settlement was a mild affair. The Money Market has developed nothing new; and it remains about *in statu quo ante*. Gas has not been an active market on the whole, though towards the end of the week it was a little more animated. Movements in value were few and irregular. The Metropolitan Gas Companies showed great firmness; but some of the Foreign undertakings evinced less stability. Gaslight and Coke issues were only moderately dealt in. With the single exception of the "H" 7 per cent. limited, all issues come out higher upon *ex div.* quotations. The "A" opened in pretty good favour, and steadily improved, till it was done more than once at 224½; thus recovering the position from which it fell a month ago. The debenture stocks were firm; the 4 per cent. making an advance of 1½, and the preferences, though little dealt in, were better all round. It may be noted of them that the highest and the lowest in rank—viz., the "C" and the "K"—are priced equally; while all the rest are put at lower figures. South Metropolitans were very lightly dealt in—only two or three bargains in the "B" being marked; but some of it changed hands at top price. The "A" rose 2; and the "C" made the substantial advance of 5½. This improvement was largely the result of the issue of the accounts for the past half year. Taking into consideration all the adverse circumstances which have affected the gas industry during that period, the accounts must be regarded as highly satisfactory. Commercials were quiet, but firm; the debenture stock especially being done at top price, and nothing lower. The Suburban and Provincial Companies were almost neglected; British alone attracting attention and business at good figures. The Bromley Consumers' Company show by their accounts a good increase in business—earning their old rate of dividend within a trifle. The Continental undertakings were generally not buoyant; and Imperial fell 1½. The Indian and South American divisions made no sign. Melbourne bonds fell 1, in sympathy with the financial cloud resting over the colony. The Water Companies generally were weaker; and several quotations fell. New River, however, improved 1; the dividend coming out about a penny per share higher.

The daily operations were: Gas opened firm on Monday; and prices were good throughout the day. Gaslight 4 per cent. debentures rose 1½; and South Metropolitan "C," 2½. But Imperial Continental fell 1½. Tuesday was extremely quiet, but firm; Gaslight "A" advancing 2. The tendency continued favourable on Wednesday. South Metropolitan "A" rose 2; and ditto "C," 3; but Melbourne receded 1. Water was flat—Lambeth and West Middlesex going back 2½ each; and Grand Junction and Southwark, 1½ each. Thursday presented no special feature. Friday's business was mostly in Imperial Continental; prices being only moderate. For *ex div.* changes, see list on p. 307. On Saturday there was a little more activity in Gaslight issues; but all quotations remained unchanged.

ELECTRIC LIGHTING MEMORANDA.

Mr. W. H. Preece advertizes the Electrical Exhibition—Prof. G. Forbes's Cantor Lectures—The Lesson of Tesla's Experiments.

PASSING reference is made elsewhere to a communication on "Electricity at the Crystal Palace," to which Mr. W. H. Preece, the versatile Electrician to the Post Office, treated the readers of last Wednesday's *Daily Graphic*. The main purpose of the letter was probably to arouse a little more popular interest in the Electrical Exhibition, which would be all the better for more attention on the part of the shilling-paying public. Mr. Preece admits that "there is nothing really new to the electrical engineer" at this show; but he claims that it "brings home the practical and domestic applications of science to the masses." He says a good word for the "illustrative completeness" of the rooms fitted up to show the household uses of electric lamps; and probably he remembered with regret, while writing these lines, the more booming times when he travelled about the country showing a doll's house electrically lighted. Alas! it takes a bigger bait to get a rise out of the investing public now than it did in those days. Mr. Preece is uneasily conscious that the lighting at the Palace is overdone; and he puts into the mouth of an imaginary "poor gasman"—whose dividends, by the way, the electricians would dearly like to emulate—a plea against desertion, on the score that, although "dirty and dangerous, he is cheap." Mr. Preece remarks that "this poor gasman has not yet realized the fact that the electric light can be cheaper than gas." No; nor has anybody else that we know of. It was only the week before last that the *Electrical Review* almost went out of its way to insist that the price of electricity in pence per Board of Trade unit is equivalent to that of gas in shillings per 1000 cubic feet, and to protest warmly against the bad faith of those electricians who should attract custom upon any lower statement of the matter. But Mr. Preece is superior to criticism,

like the Brush Company and their French measurement. It might be an interesting investigation, albeit a difficult one, to ascertain in how many instances the possible adoption of electric lighting has been hindered by the notorious untrustworthiness of its most conspicuous partisans. As though a single misrepresentation was not enough, moreover, Mr. Preece jeers in the same letter at the idea that high-pressure electricity can be dangerous. But can he have already forgotten that Brighton case?

Professor George Forbes has been selected by the Council of the Society of Arts to deliver a series of Cantor Lectures on the "Developments of Electrical Distribution." Quaint and curious as are some of Professor Forbes's ideas on the subject of electric lighting—he is one of the few men who have ever professed to see beauty in overhead wires—most of his observations respecting matters electrical are generally worth reading. In his opening lecture, he plainly told his audience that, when he treated of the same subject before the Society in 1885, the low-tension system was the only one available, and when they came to look into the cost of laying mains, "it seemed as if they were to sink copper mines in the streets in order to solve the problem;" and he went on to emphasize the fact that, "since the period mentioned, not one single invention of importance had been added to facilitate low-tension distribution." It is worthy of mention, as bearing upon this statement, that the Chairman of the St. James's Company told the shareholders at the last general meeting that the two generating stations of this undertaking were to be connected with a trunk main having a sectional area of 8 square inches of solid copper. This looks bad for those municipalities and others who have adopted the low-pressure system for covering large areas. Professor Forbes also made some pertinent remarks upon the comparative working of central stations and isolated plants; showing how it happens that the former are more costly than the latter, owing to the heavy outlay for mains and the smallness of the daylight consumption. Then, in order to provide for growth of business, the engines of a central station must be larger than is necessitated by the actual work to be done, which means wasting a great deal of steam by working the engines under their full economical load. *Engineering* had an interesting and instructive article upon this head in a recent issue; illustrating the point that the very class of engines which are most economical of steam at full load, are most wasteful when running light, which is the normal condition of machinery in an electric supply station. The net result of these considerations, said Professor Forbes, is that "electricity in London costs twice as much as gas." He warned his hearers not to be led away by the too optimistic statements of those who were interested in trying to make out that electricity is cheaper than it really is. (See Preece *passim*.) Professor Forbes gallantly declared that the electrical industry has nothing to fear from competition; but that "the best way to gain the confidence of the public, and make progress, is to openly state the cost, and apply all skill to overcome the difficulties." This is manly and candid; and if all electricians would follow the Professor's example in this regard, we should be able to discuss technical matters with them much more freely than is now the case, when nearly every statement emanating from their side has to be appraised like the sworn testimony of a professional expert in a patent case.

It was only to be expected that the striking experiments of Mr. Tesla with electricity of exaggerated voltage and frequency of alternation, would vastly impress the town. Nobody who has not seen Mr. Tesla's performance, we are assured, can realize the beauty of his effects, or appreciate the degree in which they appear to upset all preconceived notions of the nature of electrical "currents." One critic declares it to be his belief that Mr. Tesla has succeeded in converting dynamic into static electricity; but, as nobody knows what either form is, the explanation does not greatly advance matters. It is only natural also that the lighting phenomena produced by Mr. Tesla should inspire some people with the idea that not only gas and oil, but all the existing electric lighting systems, are shortly to be superseded by some means of exciting light-radiations without spending energy upon the simultaneous creation of dark heat-rays. It is true that at present, if we compare light and heat radiations to the higher and lower notes of an organ, we know no other way of obtaining the former than by previously exciting the latter; so that it is as if, in order to sound an upper C, we have also to open every lower pipe and blow "like mad." Yet there is another way of looking at the same problem, which is to say that whoever would radiate light without heat, is like a man who wants to travel at a high rate of speed without including slower rates of progression. He wants, that is, to travel over a given route at a rate of 100 miles an hour; whereas he has no means of doing so at a rate of four miles an hour. Which illustration is the truer?

Dr. Ballard, F.R.S., has resigned his position as one of the Medical Inspectors of the Local Government Board; and Dr. W. Fletcher, the Medical Officer of Health for the Ormskirk District, has been appointed to fill the vacancy.

Illuminating Flames.—Professor Vivian B. Lewes, F.I.C., F.C.S., of the Royal Naval College, Greenwich, will deal with this subject in a lecture to be delivered at the London Institution, Finsbury Circus, next Thursday evening at six o'clock.

THE CRYSTAL PALACE ELECTRICAL EXHIBITION.

SECOND NOTICE.

THE Electrical Exhibition at the Crystal Palace is now, to all intents and purposes, complete; and intending visitors to London who may be proposing to include an inspection of this show among their Metropolitan engagements, need not therefore postpone their journey. Whatever lessons the exhibition may have to offer are to be appreciated now or never; and it will be as well to take stock of the various stall-holders' displays before the novelty of the thing has worn off. We are supported in this view of the completeness of the exhibition by the circumstances that the Lord Mayor of London, who was made President of the "Honorary Council of Advice" (presumably in the interests of the City of London Electric Lighting Company), was taken to see it last Saturday week; and that Mr. W. H. Preece was permitted to puff the show in his usual airy style in last Wednesday's *Daily Graphic*. The exhibition being therefore finished, ready for inspection and criticism not more than a month after the formal opening, it is necessary to state here what it amounts to, as a piece of marshalled evidence of the condition of the electrical industries.

We have already explained (*ante*, p. 105) what the exhibition is designed to be; and we now propose to describe it generally. For the sake of clearness, we shall take the exhibits as broadly divisible into three orders: Lighting, Power Machinery, and Electrical Apparatus. If any additions to, or interesting modifications of, the exhibits are made during the progress of the show, it may be necessary to return upon our tracks, and go over part of the same ground again. For the time being, however, we shall endeavour to adhere as closely as practicable to these divisions. Lighting takes the first place, of course; for it is the net result of the arrangements made in such of the other classes of exhibits as our readers are most interested in. The lighting is admittedly the *raison d'être* of the exhibition. The lamps and their ancillary plant are, it is true, eked out by exhibits connected with telegraphy, telephony, and other applications of electricity; but the latter would never have been shown at Sydenham if it had not been for the supposed desirability of exhibiting the former. This is, in short, an exhibition of electric lighting and lighting plant, or it is nothing. The credit of the enterprise must stand or fall upon the lamps. This being so, what is the lighting like? Well, in the first place, it must be admitted that there is plenty of it. From the mast-headed clusters of arc lamps of Siemens Bros. and Co., Limited, and the Brush Company, down to the modest little glow-worm sparks to be found in humble stalls devoted to the advertisement of primary batteries, there must be collected in the Palace some thousands of arc and incandescent lamps of every sort and size known to commerce. There is so much light, indeed, that there is no sensation of glare. The spectator's eye is tuned up to bear such a high standard of illumination, that it is enabled to contemplate arc lamps without distress; and the observer consequently receives a good impression of electric lighting. This is probably what the promoters and the organizers of the exhibition aimed at; and we are prepared for arguments from them tending to make capital out of this effect. But let us stay for an instant, and wonder what the aggregate candle power of all these lamps may be. They are so numerous that it is futile to attempt to count them. The Brush Company claim, of course, that their cluster of six mast-head lights, which pass almost unnoticed in the dome about half-way down the South Nave, are of 2000-candle power each. The Siemens lights are not even shaded by opal glass; but one would be puzzled to find a spot on the floor where they throw a shadow. There are no shadows in this nave, for what with tower lights, arc lamps hung at various heights, and stalls blazing with incandescent lamps, it is a striking illustration of the capacity for adaptation of the human eye that the spectators can see at all. The infinite number of incandescent lamps at low levels, moreover, serve another useful purpose, besides that of mere lighting—they correct the pallid light of the arc lamps, and prevent the spectators from exhibiting to one another that corpse-like appearance which the arcs alone would inevitably have produced. After seeing the South Nave of the Crystal Palace as now lighted, it will be understood that, if electric lighting could always be done upon this scale, it would certainly be effective. Even an occasional extinction here and there would pass unnoticed; and this is a most important consideration.

For, be it understood, this exhibition of lighting differs more in quantity than in quality from that of ten years ago. There are perhaps a thousand lamps on view now to one shown then; but when the lamps are examined individually, they do not appear better or worse than their predecessors of 1882. And this is the chief consideration for an intending user of electric light. It is all very well for the members of a town council deputation, or the resident in a district blessed with a central station electric light company, to go to the Crystal Palace and be dazzled with a collective display in which one lamp helps another, and the general effect is produced at a cost of goodness only knows how much per square foot of floor area lighted. And not only will their eyes be impressed by this splendid effect, but their minds also will be turned away from the real meaning of it all if they listen to gentlemen like Mr. W. H. Preece. The point is, what will these lamps

look like, and what will they do, when they are taken home and posted far apart in dingy streets, or when a householder tries to read and work by the one or two incandescent lamps that he can afford? Well, we do not say that arc-lamp carbons are not better made than they used to be—we are not concerned now with the question of expense, except in so far as it entails the necessity of depending upon every lamp to do its proper work—and doubtless the conditions of steady lighting are better understood and more fully satisfied that they were in 1882. But, after all said and done, the fact remains that the arc lamps at the Palace do occasionally sputter and go out; and the incandescent lamps do in many instances vary and throb, just as did the early ones of their kind. It is a positive fact that wherever a good lighting effect is produced at the Palace, either in the naves (which is tantamount to outdoor lighting) or in the specimen furnished rooms—and we are far from denying that such effects are produced—it will be found that the scale of lighting is greatly in excess of the ordinary domestic standards. We do not urge this observation as a reproach to the exhibitors whose proceedings have suggested it. They must obtain their effect, without heeding the quantitative question. But it is a commonplace to say that “science is measurement;” and this is precisely the point to be remembered by visitors to this brilliant show.

The next question which we had in mind in going through the lighting part of the exhibition, was as to whether any new practice in the application of light-sources to the purposes of interior or outdoor illumination has come out of this new resource of the modern school of illuminators of our streets and dwellings. We all know what the electric arc can do; and the lightness and handiness of the incandescent bulb, with its freedom from flame, would seem to offer a wide range of novel application to the ingenious technician. Our investigation resulted in disappointment. There is a terrible want of originality, and a deplorable absence of taste, observable in most of the exhibits of lighting and lamp-fittings. Electrical science has its Edison, its Swan, and its Brush; but the brilliant stroke of genius that gave the world “French measurement” in electric lighting, exhausted the invention of electricians in this field. The curse of the commonplace lies heavy on the makers of electric light fittings; and it is an object-lesson in the character of the culture of the age to compare the beauty of fitness, as displayed in a modern steam-engine, with the poverty, emptiness, and downright vulgarity of the great bulk of electric light fittings. It is hardly credible, but it is nevertheless too true, that, in the utter debasement of their “art,” the fittings makers have taken infinite pains to make imitations of wax-candles—flames and all—out of incandescent lamps! These wretched impositions are to be seen at the Palace by hundreds; and they inspire the thoughtful observer with inexpressible disgust. When the poor ignorant gas-fitters of the early Victorian period put up their glassy imitation candles, surmounted with batwing flames, they knew no better; and the artist in decoration was not then evolved. These fittings would now be regarded as curiosities, wherever found; and we take a little credit to ourselves for having pointed out the absurdity of such imitations many years ago. What might have been pardonable in the uninstructed gas-fitters of the middle of the century, moreover, is abominable in their “advanced” rivals of to-day. These sinners against artistic veracity and consistency are, however, shameless in their turpitude. Take one of the most “bumptious” of them all—the firm of Rashleigh Phipps and Dawson, who have spread themselves very much over the official catalogue. This firm tell purchasers of this publication that their “showcase is after the model of a Mosque at Cairo, and has been specially designed and manufactured by the firm. The Lily is introduced in the screen work, after the manner of the Ancient Assyrians, who held it as an object of veneration. The Dome is covered in with Glass and Amber Cloth, and is in the form of the Breast—a suggestion that Peace nourishes the Arts and Sciences.” There is much more of the same style, intended to impress readers with a deep sense of the high-toned work shown in this wonderful stall. Yet here also we find imitation candles “after the manner of the ancient”—gas-fitters! But this firm are not alone. It is the same with Messrs. Benham and Froud, Messrs. Allen and Mannoch, and many others. Sometimes the sham candle-flame is a cylindrical bulb of clear glass with elongated incandescent fibre; sometimes it is in the form of a spiral, frosted or plain, with irregular section, to still more closely copy a flickering candle flame. But, in one or another of these shapes, the scientific decorators of the Palace Exhibition propose this patent lie as the proper thing for their patrons to keep under their eyes daily and nightly! Imagine sitting at a dinner-table so lighted, as may be seen in Messrs. Allen and Mannoch’s room in the South Gallery! One would expect to be served with logwood-port, fuchsine-claret, and cider-champagne at such a table; and who could confidently partake of jugged hare, *vol-au-vent*, or other mysterious dish under such a prevaricating light? One firm of exhibitors—Messrs. Frank Giles and Co.—actually go so far as to place imitation wax candles of huge proportions, such as are never seen outside Catholic churches, in one of their specimen-rooms, and top these off with ordinary incandescent bulbs. It is difficult to tell the tale patiently. The example just named is perhaps the worst in the list; but an imitation candle, whether large or small, is an outrage hard to be borne.

The sight of it is enough to make anybody rush home and light up the real article, with the feeling of relief that here, at least, there is no deception.

We hope to return next week to the Lighting at the Crystal Palace Exhibition; but we shall leave it for the present with this grave complaint against the fittings’ manufacturers and decorators. In order that the subject of these so-called “flame lamps”—this is, we are informed, their trade name—may be understood, it may be stated that they are a product of the last year or two. They can, of course, be employed quite unobjectionably as “fairy lamps” for decorative purposes. They take 33 volts, and are connected in series of three, when the group becomes equivalent to one 100-volt lamp. It requires, however, more taste in lighting than most decorators seem able to command, to employ these or any other description of incandescent lamps in such a manner as to be truly ornamental as well as useful.

Southern District Association of Gas Engineers and Managers.—The annual meeting of this Association, which, in the ordinary course, would have been held last Thursday, has been postponed until Wednesday, the 9th prox., when the President (Mr. Andrew Dougall, of Tunbridge Wells) will deliver his Inaugural Address, and the annual dinner will take place. The reason which prompted the Committee to make this change in the arrangements, of which members have been apprised by circular by the Honorary Secretary (Mr. J. W. Helps, of Croydon), was the large amount of sickness prevalent at the time.

The “Electrical Trades’ Directory and Handbook for 1892,” a copy of which we have received from *The Electrician* Printing and Publishing Company, Limited, has reached its tenth year; and the present edition may be confidently said to fully sustain the reputation of its predecessors. The Directory consists of three main divisions—the Handbook, the Directorial, and the Biographical; and in each the information given is brought well up to date. The issue under notice is larger, by nearly 100 pages, than that for the past year; while the general contents have been improved by the omission of matter bearing only slightly upon the electrical industry. As a work of reference, the book will be useful beyond the sphere indicated by its title.

The Petroleum Production of the United States in the Past Year.—The production of petroleum in the United States last year was the largest in the history of the country. In 1889 it was 35,163,513 barrels, of which Pennsylvania and New York produced 21,487,435 barrels; Ohio, 12,471,466 barrels; West Virginia, 544,113 barrels; Colorado, 316,476 barrels; and California, 303,220 barrels. The remainder was produced in Indiana, Kentucky, Kansas, Texas, and Missouri. No detailed figures have been published for 1890; but the production was somewhere about 46,000,000 barrels, of which 29,000,000 were produced in New York, Pennsylvania, and northern West Virginia, a little more than 1,000,000 in the Macksburg district, upwards of 15,000,000 in Lima, and 1,000,000 in other districts—making a total of 46,000,000. The production in 1891 was approximately 50,150,000 barrels, of which Pennsylvania, New York, and West Virginia produced about 34,500,000 barrels; Macksburg, less than 400,000 barrels; Lima, about 14,500,000 barrels; California, 350,000 barrels; Colorado, 325,000 barrels; and the rest of the country, 50,000 barrels.

Is Electricity a Manufactured Product?—One important question brought out by the rapid development of electricity is now causing, says the *American Manufacturer*, no little trouble in the Courts throughout America. This question comes in the way of the authorities empowered to levy taxes; and they are called upon to decide as to whether or not electricity is a manufactured article. In the State of Pennsylvania there is a law of some years’ standing which exempts from taxation the capital stock of manufacturing companies. The existence of this law brought an early test of the question as to whether electrical companies could be classed as manufacturers. Judge Simonton, of Dauphin County (Pa.), in a decision which was subsequently affirmed by the Supreme Court, held that a company producing electricity was not a manufacturing company within the meaning of the law. He ruled that, whatever electricity may be, it is manifestly and admittedly not a material substance; and whatever electric light companies do, they do not, in generating or evolving electricity, make changes or modifications, by art or industry, in the form or substance of material articles. They do not make wares of any kind, nor reduce raw materials to a form fit for use. Judge Williams, in a decision on the same question, declared that nothing has been said to lead to the belief that electricity is a material substance, therefore its production or generation or evolution does not come within the authoritative lexicographic, scientific, or local definition of the terms “manufacture” or “manufacturing.” Those connected with electrical interests claim that electric light or power stations should in law stand on the same footing with gas-works. It is claimed that the production of something by the consumption of coal, whether it be gas or electricity, must be classed as manufacturing. So far, however, all decisions have been against the electrical companies; and taxes must be paid upon the capital of these companies until they can show that electricity is a manufactured article, unless in the meantime new laws are made to meet the development of a new force.

COMMUNICATED ARTICLE.

LIGHTING.

By W. H. Y. Webber.

PART III.—A CRITICAL EXAMINATION OF MODERN PRACTICE.

(Continued from p. 198.)

THE LIGHTING OF INTERIORS.

In the illumination of interiors, we are brought face to face with an altogether different set of conditions to those which govern street lighting. In the first place, the idea of beacon lights is quite foreign to interior lighting, and can hardly even be said to enter into the problem of illuminating those open-air spaces, such as works, yards, &c., which practically resemble interiors in their requirements in the matter of light. So marked, indeed, is the difference in this particular between street and indoor lighting, that whereas in the former the visibility of the lamps themselves is an important element of their usefulness, in the latter it is rarely desirable that the means of lighting should be obtruded upon the notice of the spectator.

Another prime consideration in regard to interior lighting is that it is always required to be carried out upon a higher scale of brilliancy than is necessary or desirable for streets. The permissible minimum of illumination must therefore be raised in proportion; and this again means that, if low power sources are employed, there ought to be many of them, or they should be brought very close to their work, or we must use sources of comparatively high power. The choice between these methods of obtaining the bright lighting required is affected by various considerations. Thus, if we desire to light a public hall, a railway station, or a church (taking account only of the light required on the floor area), the end may be attained by suspending a number of equally-spaced small lights close under the ceiling, or at any lower level where they will allow sufficient head-room; or similar lights may be clustered at equally-spaced centres; or, again, a number of concentrated high-power lamps may be adopted.

At first sight it might be thought that the first plan would prove suitable; but experience shows that it is not so in practice. At the South Kensington Inventions Exhibition of 1886, some of the main buildings were lighted in this way, by means of a great number of incandescent electric lamps sown very thickly over the under side of the roof. The effect was not at all pleasing, although the illumination of the floor was very brilliant, and absolutely uniform and shadowless. The multiplicity of bright points high overhead was dazzling, and their regularity was bewildering to the eye. It was an aggravation of the well-known irritation produced by geometrically-spotted wall papers, which suggest distracting attempts at counting and spelling along the too-pronounced lines of figures of the pattern. Lines of small lights marking in the colour of fire the main architectural features of a majestic interior, are not open to this objection, nor are large circular hoops of flames, which, when of sufficiently large diameter, assume, so to speak, the character of architectural features in themselves. Good examples of the former style of lighting are, or were, to be seen at the Crystal Palace, and in the dome lights of St. Paul's Cathedral, London. The effectiveness of the latter style in a thoroughly commonplace interior is well shown at the Agricultural Hall, Islington. It is one of the very best ways of lighting a temporary, bare hall or shed of large area for a special occasion; and it has the additional recommendation of requiring only the cheapest and most universally available materials.

The plan of lighting a hall with clustered lights may be carried out by means of so-called sun-burners in the ceiling; by one or more large pendants of the "chandelier" type; or by smaller pendant clusters suspended in mid-air. The first displays the decorations of the ceiling, where there are any, and can be made to help the ventilation; the second is decorative in itself; the third is also decorative, but in a lesser degree, and is effective under certain conditions, one of which is that the interior is not too wide. When this is the case, so that three or more longitudinal lines of clusters are required to properly light the central parts of the hall, the irritating "pattern" effect is apt to occur, and the plane of the clusters obtrudes itself on the eye as a division of the height of the hall which is objectionable. Sometimes a combination of two of these plans, with the addition of wall lights at a low level, is found effective.

The remaining plan of lighting large interiors, with a number of high-power lamps, demands care in execution, because, if the arrangement should be unfortunate, the very brilliancy of the elements in the design aggravates the mischief. At the Reading Town Hall, a bold experiment was tried of placing the light-centres out of sight, behind a depolished glass false ceiling. The House of Commons was lit in the same way. The effect is highly pleasing, and the arrangement is helpful to the ventilation. When high-power lamps are not used in this way, they are best as substitutes of the more extravagant sun-lights.

It may be remarked here that in these articles the question of ventilation, so important in connection with the artificial lighting of interiors, whether large or small, is not intended to be dealt with except incidentally.

Having all these arrangements of possible lights for a public hall, church, or factory to choose from, we may return to the

one datum to which all must be referred—that of the amount of light required on the floor-area. Mr. Richards has stated as his view of the matter* that the average illumination of the floor-area in such cases should be the equivalent of the light afforded by one standard candle at the distance of 4 feet. This datum is as good as another to show the working of the rules already given.

The provision of this minimum effect at the floor-level is to be arranged for by means of lights whose collective power must be determined in the first place by their distance. Let the case of a hall 80 feet long, 30 feet wide, and 25 feet high, be considered by way of example. The floor-area in this case is $80 \times 30 = 2400$ square feet. According to the conditions proposed, there must be, at the height of 4 feet above the plane of the floor, an imaginary plane of light of the intensity of one candle. Supposing the lamps to be used for the purpose are recuperative ventilating gas-lamps, with their flames in a horizontal plane 1 foot below the ceiling, it follows that the luminous intensity at this distance, 24 feet above the floor, must be in accordance with the ratio

$Q = I \times \left(\frac{d_1}{d}\right)^2$. In this case, $I = 1$ candle; $d_1 = 24$ feet; $d = 4$ feet. Whence, $I = 24 \div 4 = 6$. Wherefore, $Q = 1 \times 6^2 = 36$. That is to say, at six times the distance of the datum intensity from the floor, there must be 36 times this intensity in the means of lighting employed.

The next step is to determine the quantity of light required. One candle at a height of 4 feet above a horizontal plane will effectually light an area of such plane, having the radius $= h \times \sqrt{2}$. Here $h = 4$; wherefore the formula reads $4 \times 1.414 = 5.656$; and the area of a circle drawn from this radius is 100.29 feet, nearly. Consequently, the nominal number of candle-units required for lighting the floor of the hall will be $2400 \div 100.29 = 24$ nearly. The lamps used must therefore be of $24 \times 36 = 864$ -candle power in the aggregate, which would be supplied by eight lamps of the kind named, each developing 108-candle power, and consequently burning about 12 cubic feet of common gas, according to the average efficiency of this type of lamp. If clustered gas-burners are preferred, the necessary correction is easily made. If, instead of a whitened ceiling, the hall has an open wooden roof, the nominal power of the lamps must be increased to compensate for the absence of reflection.

It will be perceived that there are two ways of rating. This method of expressing the facts also lends itself to the direct measurement of lighting by the aid of a standard candle, as will be described later.

When the most unscientific person is told that, for comfort in reading, he needs light equivalent to that of a standard candle the flame of which is at a distance of 6 inches from the printed page, he understands what is meant, and can be convinced that such an effect is only to be obtained by proper means. It may be remarked that the Law of the Cosinus does not enter into explanations of this nature, because it is experimentally proved, albeit unconsciously, by the tendency of readers to hold their books at such an angle that the rays of light fall upon the page as nearly vertically as can be conveniently managed.

All the problems of domestic lighting that arise in common practice can be dealt with by an intelligent application of the rules already given; the data of lighting intensity being settled, of course, with reference to the requirements of every case. The table given in Vol. LVIII., p. 754, may be safely followed in the ordinary way; due regard being had to the necessities of distribution. Take, for example, the case of a dining-table, which requires lighting according to the 1-foot standard—that is to say, up to the lighting effect of 1 candle at 1 foot distance. A recuperative lamp at a height of 7 feet above the table must have an illuminating power of $\frac{7^2}{1^2} = 49$ candles to

produce this effect; and such a lamp will be effective over a circle with a diameter of 2 (7×1.414) = 19 feet, before which, however, the shadows would become objectionable if there were no end or side lights. These are matters which cannot be dealt with by any hard-and-fast rule, for interior lighting must always be more or less decorative.

With regard to the lighting of dining-tables, for instance, there is much difference of taste. The only point upon which connoisseurs are agreed is that the light upon the table itself should be brilliant. Beyond this there is chaos; for whereas some prefer a central overhead lamp of high power, to be out of everybody's way, others give the preference to candelabra, which need to stand upon lofty pedestals if there is to be uninterrupted view from end to end of the table. There should be as few sharp shadows as possible on the table-cloth; and therefore, when a table lit from a central point overhead is so long as to approach the effective limit already laid down, some means of neutralizing the shadows would be called for.

Drawing-rooms can be satisfactorily lit from the side walls when the width of the room is not too great to permit of the radii of effective lighting from each side meeting in the middle of the floor. Since, in order to provide head-room, the side lights must be at least 6 ft. 6 in. from the floor, this means that such a means of lighting would fail for rooms of greater width than $2 (6.5 \times 1.42) = 18$ ft. 6 in. nearly. In this case central pendants must be provided for occasions when the apartment is fully occupied.

* See JOURNAL, Vol. LVIII., p. 753.

An effect of lighting which might in some circumstances be called "spotty" is seldom an objection, if properly managed, in a drawing-room. Cozy nooks and corners left in *chiar'oscuro* are much more to the modern taste, for rooms principally devoted to conversation, than one uniform glare of light, such, for example as that imperatively called for in a ball-room. Where a drawing-room may be used for both purposes, the arrangements for lighting should be adapted accordingly, so that no makeshift lights may be needed to bring up the standard of brilliancy. On the other hand, when the room is required merely for conversation, the extra lights that are not needed cost nothing.

It should be borne in mind that a good deal of reading and fancy needlework is done in drawing-rooms; so that the wall lamps must be powerful enough to throw a good light upon a low chair at a comfortable distance, especially beside the fireplace. Units of 20-candle rather than 16-candle power should, therefore, be chosen for such points; but certainly not less than the latter, as, in all probability, semi-obscure globes and shades will be employed in conjunction with them. The now general use of ornamental standard oil-lamps, for placing about drawing-rooms as occasion requires, testifies to the popular taste for localized lighting in apartments of this order. There could not be a greater error than to confound the general liking for "soft light" with toleration of dimness or bad lighting. Some electricians have lately maintained that, so long as there is nothing brighter in a house to throw them into the shade, 8-candle lamps will give as much satisfaction as lamps of 16 or 20 candle power. Those who make this assertion, however, can hardly realize the requirements of reading or fine work, which cannot be met with ease, except by using a contiguous table or other stand for the lamp, by any light-source possessing much less than 16-candle power.

In the lighting of studies, libraries, &c., which are used both by day and night, it is important that the artificial illuminant should come from the same direction, and at as nearly as possible the same angle, upon reading-desk or writing table, as the window light. Apartments of this kind require a fairly good general light as well as the powerful light upon the desk. For the former, one recuperative burner or more, according to the size of the apartment, will be the best form of ceiling light; and nothing beats a good Argand for the table. It is undesirable to burn more gas than is absolutely necessary in rooms of this description. Generally speaking, no light of combustion should be closer to the head of the person using it than a distance of 4 feet, and the light should come from the left hand and above.

Wall lights are customary for bed-rooms, and, whenever possible, these should be so placed as to command the bed, with a view to the requirements of sickness. For good bed-rooms, and also for dressing-rooms, a small hanging recuperative lamp should be provided, in a position to command the dressing-table. (A small gas boiling-stove in a suitable and safe position is a useful addition to the lighting arrangements of a bed-room, dressing-room, and night nursery.)

It is hardly necessary to add any remarks concerning the lighting of halls, corridors, staircases, or offices. For the kitchen, however, the necessity of a good light commanding the cooking-range is not always so well remembered as common sense would appear to suggest. Observations respecting the safe disposition of lights, the necessity of good regulating of pressure, &c., do not fall within the scope of these articles.

Warehouse, shop, and office lighting presents so many and so various requirements that it is impossible to treat of them in a general memoir on the subject. Suffice it to remark that the best results will be obtained when practical knowledge of these classes of lighting work is guided by the principles already laid down. Stinting of light is the worst parsimony in shop-keeping; but the choice between powerful light-centres and a multiplicity of small, but brilliant, points of light, must be guided by circumstances. It is, however, possible to state generally that when there is good reflection from bright metal or glass, white walls and ceilings, and the interiors are lofty, the former order of lamps are capable of rendering good service; whereas in much-divided interiors, or shops filled with dull cloth goods, &c., small brilliant lights, of the albo-carbon or like character, are preferable. Reference may here be made to the views expressed by MM. de Montserrat and Brisac upon the general subject, as given in the JOURNAL Vol. LVIII., p. 845.

(To be continued.)

Royal Masonic Institution for Boys.—An appeal is made to subscribers to this Institution to reserve their votes for the next election on behalf of Henry R. Harris, eldest son of the late Bro. Frank Henry Harris, of Abingdon, who was, at the time of his death (Dec. 6, 1891), a member of the Evening Star Lodge, No. 1719, and also a subscriber to the Institution. Bro. Harris, who died after a long illness, left a widow and six children—the eldest being twelve years of age, and the youngest only three months old—very inadequately provided for. The case is strongly recommended by a number of brethren well known to our readers—W. Bro. James Glaisher, W. Bro. John Aird, M.P., W. Bro. Magnus Ohren, W. Bro. W. A. Valon, and many others. Bro. John Ely, of the Abingdon Gas-Works, will gladly receive proxies; or they may be sent to the JOURNAL office, and will be duly acknowledged.

TECHNICAL RECORD.

A PORTABLE PHOTOMETER FOR MEASURING STREET LIGHTS AND ILLUMINATION IN GENERAL.

A Paper read by Mr. Carl Hering before the Engineers' Club of Philadelphia.

Some time ago the writer was called upon, by a Committee of Councilmen from a town in Pennsylvania, to settle a dispute regarding the candle power of the electric street lights, for which the town had contracted with a local Electric Light Company. The Company had contracted to furnish a certain number of incandescent street-lamps of 25-candle power. But, after a year's trial, the town authorities thought the electric lights at 25 candles were not so bright as the gas-lights at 16 candles; and they concluded that they were not getting what they paid for. The matter was referred to the writer, to measure the actual candle power of the lamps throughout the town, and make a report thereon.

The Electric Light Company suggested that the lamps should be taken from the poles, brought to the electric light station, and measured there by means of the ordinary photometer. Although this simple method appeared satisfactory to the councilmen, it was not so to the writer, for obvious reasons which any electrical engineer would appreciate. It was concluded that the only satisfactory way was to measure them while on the poles, on different days, at various times in the evening, and without the knowledge of the Company as to the days or hours when the lights were to be measured. This required the construction of a portable photometer, which had to work equally well in all kinds of wind and weather. It had to be light and small, so as not to attract attention, in order that the Company should not know that the lights were being measured, and take unfair advantage of the opportunity to run up the power. It was also necessary that the results should be quite reliable, as the matter might have to go before the Courts.

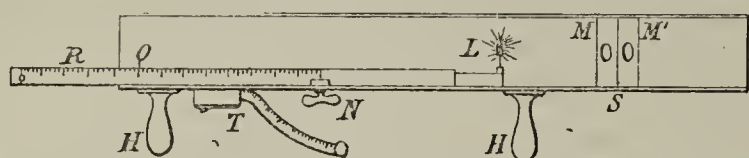
The conditions were, therefore, very hard to comply with. One of the chief difficulties was to get a standard light that could be employed out of doors in a portable photometer. To use a standard candle was out of the question. Its light varies with the temperature, it often requires trimming, and it would be almost, if not quite, impossible to prevent the wind from affecting its candle power; for it is well known that even a person moving about in a photometer-room will make sufficient disturbance of the air to change the lighting power of a standard candle. Besides, such a candle, at its best, is a very poor standard. For this and other reasons, it was decided to try to use the Hefner-Alteneck amyl-acetate lamp. This lamp, as is well known, burns a liquid which is constant in its composition—that is to say, it does not contain varying quantities of more or less highly combustible materials, as benzenes and coal oils do. All the dimensions of the lamp may be doubled with great precision, thus enabling the whole standard to be duplicated with greater accuracy than a standard candle. If the flame is kept at a certain fixed height, by means of a gauge and a wick-screw, the light will remain constant. The original proportions were determined by its inventor by very exhaustive experiments, made under the most favourable conditions with the standard candle; so that this lamp may be taken as representing a fair mean of the average values of standard candles.

In constructing the instrument, it was at first attempted to use this standard lamp in the portable photometer itself. It was suspended on a pivot, so that it remained vertical when the photometer was inclined; the axis of the pivot passing through the centre of illumination of the flame. The lamp was enclosed by concentric cylindrical tubes, with openings at the top and bottom, so that the wind, from any side, would not affect the draught or the flame. Lights were so arranged that the height of the flame could be adjusted without opening the enclosing case. But, notwithstanding all the precautions taken, it was found that the flame burned differently when in the wind-protecting box; and this lamp was therefore discarded as unreliable when employed out of doors.

The next device tried was to take a portable outdoor lamp, such as is used by night watchmen, having a broad, flat flame, and place on one side of it a black screen, with a hole in it just opposite to the whitest portion of the flame. As this part of the flame may be taken as remaining constant for all slight changes in the height, size, or flickering of the flame, the light passing through this fixed aperture may be regarded as constant and steady. The oil used was amyl-acetate, the same as in the standard above mentioned. This was found to work well in a room, and when the photometer was held horizontally; but when used out of doors, or when tilted slightly, it was discovered that the glass or mica shielding the flame from the draught became turbid or blackened; making a very great change in the amount of light transmitted through it. It was noticed also that the flame, like that of a standard candle, appeared to become smaller and less bright in the cold air; and therefore it also was abandoned.

There seemed to be nothing left but to use an electric light supplied by a portable accumulator. This was tried, and was found to be perfectly satisfactory. The lamp used was a small

four-volt incandescent lamp of about 1-candle power, requiring a current of slightly less than an ampère. The accumulators consisted of two cells, placed in a wooden box having a shoulder-strap, enabling it to be carried by the operator at his side. The weight of it complete was about 2 lbs. The cells were sealed with lids before the acid was added; and the whole was covered with a thick layer of powdered carbonate of soda, so that, if any acid came out through the vent-tubes, it would be decomposed and then evaporate. As the voltage of an accumulator will become less and less as it is being discharged, it would change the candle power of the light very materially. To overcome this, the accumulators were chosen of such a capacity that the amount of current used in one set of tests was only about 1-50th of its capacity. The fall in potential for so small a discharge may be regarded as negligible. Furthermore, as the light was turned on for only about half a minute at a time, with intervals of rest of five or ten minutes, the cells had time to recuperate. They were discharged slightly before the test, in order to bring them down to their normal and constant voltage. Comparisons of this light with a standard during different parts of the evening showed it to be quite reliable and constant.



The photometer itself consisted of a light wooden tube of square cross section, 4 inches to a side, about 3 feet long, and open at both ends. The above illustration shows it with one side removed, to allow the inside to be seen. The usual screen *S*, with a grease-spot and mirrors *M*, was placed near the right-hand end, and a square opening left in the side of the tube opposite to it to look through. The tube was blackened inside and outside with a paint made by mixing much lampblack with a little very diluted shellac. This paint, in drying, does not leave any gloss. It was supported by two projecting handles *H*—the right-hand one being nearly under the centre of gravity; so that the whole could readily be supported by the right hand alone. The small electric lamp *L* was secured to a block capable of being slid along the inside of the tube by means of a projecting rod *R*, having a scale attached (as shown), which indicated the distance of the lamp from the screen. This rod, with the lamp, could be securely clamped at any desired distance from the screen by a thumb-nut *N*. A 15-foot tape in a spring case *T*, without pawl and ratchet, was attached on the bottom near the left handle. A small switch (not shown) for turning the electric light on and off was also secured near the left handle.

To use the photometer, it must first be standardized. This is done in any convenient room which can be darkened. The instrument is laid on a table with the standard Hefner-Altenneck lamp, which is placed at a fixed and known distance opposite the right-hand end of the photometer-tube. The small electric light is then turned on, and moved forwards or backwards until the grease-spot seen in the mirror *M*¹ on the right-hand side of the screen, disappears altogether. The left-hand side (towards the small electric light) was not considered at all. This adjustment, therefore, admits of considerable precision, as there is no difficulty in making the grease-spot disappear on either one side or the other. The difficulty is in making it nearly disappear to the same extent on both sides; and it is here that the large personal error enters in ordinary photometric work, in which no two operators will set it alike. After making this adjustment, the electric lamp is firmly secured in that position, and the photometer is ready for use.

To utilize it in measuring street-lamps, or any other source of light, the right-hand end is pointed towards the light in a horizontal, a vertical, or an inclined direction. The small electric light is then turned on, and the whole tube moved towards or away from the light to be measured, until the spot of light again disappears on the mirror *M*¹ to the right of the screen. By measuring the distance between the screen and the light to be tested, and knowing the calibrated value, the candle power of the light is readily calculated from well-known laws. The distance from the screen to the large light is measured by means of the spring tape, which passes directly under the screen, and may be easily read by the operator. The small switch placed near the left-hand handle (not shown in the illustration) enables the current for the small lamp to be turned on and off readily, so as not to burn it longer than just enough for the test.

It will be noticed that in this photometer only the mirror on one side of the screen need be observed—not both, as is usual. The grease-spot may therefore be made to disappear entirely, which admits of an adjustment more accurate and decided than the usual method. It is for this reason that the photometer is even more accurate than the usual one, in which the balance is produced on both sides of the screen. The candle power of the small light, as well as its distance from the screen, need not be known or measured; they must merely remain invariable. This light simply serves as a constant secondary standard of light, which will at all times reproduce the same illumination of the screen as that produced and balanced by the real standard during the calibration; in other

words, it forms an adjustable and portable unit of illumination of the screen as distinguished from a unit of light.

This form of photometer has the further advantage that it can be used to measure "illumination," as distinguished from the candle power of a light. For instance, the illumination on a desk, for reading or writing, the diffused illumination in a room, the light from a north window, or from a chandelier, daylight in general, moonlight on the streets, sunlight, &c., cannot be expressed in candle power. They must be measured in units of illumination; the unit being the illumination produced on a surface placed at a distance of a foot from a standard candle. In measuring such illuminations, the distance from the photometer screen to the source—as, for instance, in the case of daylight—is, from its nature, an immeasurable quantity.

To use this photometer for such measurements, the right-hand end of the tube is made in such a way that it can be taken off, so that the grease-spot screen forms the end of the tube. The photometer is calibrated, as before; but instead of securing the rod containing the little lamp, its position should be read on the scale shown in the figure—the zero of this scale being such that the reading gives the distance of the small light from the screen. Being thus calibrated, it is ready for use. To operate with it—for instance, to measure the illumination produced on a desk by daylight—the photometer is placed vertically so that the screen is on a level with the desk, and the electric light is moved until the grease-spot disappears. From the reading of this position, and that of the calibration, the illumination in foot-candles is readily calculated. From this, the number and position of electric or gas lights necessary to reproduce such an illumination may be readily calculated. For measuring daylight, the auxiliary electric light used must be very much brighter than before—at least 16 candles, and preferably more. As the electric light is very yellow compared with daylight, it is not easy to make the grease-spot disappear entirely; but this is not a serious objection, as great accuracy is not necessary in such measurements.

It is evident that this unit of illumination should be so chosen as to suit the light to be tested; otherwise the tape required to measure the distance might have to be impracticably long. This should be taken into consideration in choosing the distance to the standard lamp in calibrating the photometer. For measuring very bright lights, the standard should evidently be brought near to the screen, so as to make the unit of illumination greater. In the measurements above mentioned, the lights to be tested were from 10 to 25 candle power; and it was thought that from 4 to 6 feet of tape was a convenient distance—being an average of $1\frac{1}{2}$ inches per candle. This would require, as a unit of illumination of the screen, a little less than one foot-candle. For convenience in making calculations, the standard was placed at $14\frac{1}{8}$ inches ($=\sqrt{200}$) from the screen in the calibration. This gave such a unit that the square of the distances in tens of inches is double the candle power of the light to be measured—a calculation which is readily made mentally, at least approximately. A difference of 1-candle power in the unknown light would require a movement of the photometer of about $1\frac{1}{2}$ inches; a fraction of a candle may therefore readily be detected. Hence the photometer was quite sensitive enough for this class of work. The end of the tape was held up to the centre of the lamp by an assistant with the aid of a pole. The spring case kept the tape stretched, so that it was virtually a fixed rule or scale over which the whole photometer was moved. The right-hand end of the tube must be long enough to shield the screen from the light of other illuminants, or that of the moon.

Death of Mr. John Wright.—We regret to record the death, on Monday last week, in his 73rd year, of Mr. John Wright, founder of the business now carried on under the style of John Wright and Co., Limited, in Birmingham. The deceased went to the Midland capital from Chipping Ongar, in Essex; and he gave the name of this county to the gas-stove works he established. Mr. Wright died at his residence, Marden Ash, Edgbaston.

Honours for French Gas Engineers.—We are pleased to find, among the recent nominations as Knights of the Legion of Honour, the names of M. Emile L. F. Cornuault, M. Démétrius Monnier, M. Firminhac, and M. Eugène L. Breitmayer. M. Cornuault, who is personally known to some of our readers, has rendered exceptional service to the City of Paris. It will be remembered that he prepared the report of the proceedings of the last Scientific Commission appointed by the Minister of the Interior to conduct the quinquennial investigation into gas manufacturing operations, with a view to the revision of the Paris Gas Company's treaty with the Municipality; and he also, as a member of the jury, reported on the lighting appliances of the International Exhibition of 1889. Both of these reports have been dealt with in our columns—the latter only a few weeks ago. He is Superintendent of the Marseilles Gas Company; and a Past-President of the Société Technique du Gaz en France. Of the other *décorés*, M. Monnier is a professor at the Central School of Arts and Manufactures, and a member of the Committee of the Société Technique; M. Firminhac is a mining engineer, and a Director of the French Gas-Engine and Mechanical Constructions Company; and M. Breitmayer is the Chairman of the Union des Gaz, and a Past-President of the Société Technique.

THE EFFECT OF IMPURE MATERIALS IN THE AMYL-ACETATE LAMP.

A recent number of the *Journal of the Society of Chemical Industry* contained the following abstract (prepared by Dr. F. S. Kipping) of a communication on the above subject by Herr F. von Hefner-Alteneck, which had appeared in the *Journal für Gasbeleuchtung*.

As the question of the effect of impure materials on the illuminating power of the amyl-acetate lamp has lately been raised, the author has made a number of experiments in this direction with samples of amyl-acetate containing various impurities, which were likely to be either present in, or added to the commercial article. A sample of amyl-acetate, to which castor oil was added in such quantities that the adulteration could not be detected by a specific gravity determination, was also investigated. The following results were obtained:—

Sample I.

Composition	{ Amyl-acetate 80 per cent. }	Moist.
	{ Fusil oil 20 " }	
Specific gravity at 15° C.	. . . . .	0·8645
Boiling-point	. . . . .	106·5° to 142°
Boiling-point with reflux condenser	. . . . .	106·5°
Liquid consumed in half an hour after ignition	. . . . .	4·98 grms.
Deviation from the normal consumption	. . . . .	+ 6·9 p. ct.

Illuminating power clearly too low—on the average about 2 per cent. Position of wick a little higher than the normal.

Sample II.

Composition	{ Amyl-acetate 98 p. ct. }	
	{ Diamylene 2 " }	
Specific gravity at 15° C.	. . . . .	0·8725
Boiling-point	. . . . .	136° to 142°
Boiling-point with reflux condenser	. . . . .	139·5
Liquid consumed in half an hour after ignition	. . . . .	4·62 grms.
Deviation from the normal consumption	. . . . .	− 0·8 p. ct.

Illuminating power, on the average, the same as that of pure amyl-acetate; greatest difference, + 1·5 per cent.

Sample III.

Composition	{ Amyl-acetate 91 p. ct. }	
	{ Alcohol 5 " }	
	{ Castor oil 4 " }	
Specific gravity at 15° C.	. . . . .	0·8745
Boiling-point	. . . . .	120° to 142°
Boiling-point with reflux condenser	. . . . .	120°
Liquid consumed in half an hour after ignition	. . . . .	4·94 grms.
Deviation from the normal consumption	. . . . .	+ 6 p. ct.

Illuminating power could not be determined with accuracy.

Sample IV.

Composition	{ Amyl-acetate 80 p. ct. }	
	{ Isobutyl-acetate 10 " }	
	{ Amyl-alcohol 10 " }	
Specific gravity at 15° C.	. . . . .	0·860
Boiling-point	. . . . .	133° to 142°
Boiling-point with reflux condenser	. . . . .	133°
Liquid consumed in half an hour after ignition	. . . . .	4·64 grms.
Deviation from the normal consumption	. . . . .	− 0·4 p. ct.

Illuminating power practically the same as that of pure amyl-acetate; on the average, 0·4 per cent. higher.

Sample V.

Composition	{ Amyl-acetate 50 p. ct. }	
	{ Alcohol 50 " }	
Specific gravity at 15° C.	. . . . .	0·8408
Boiling-point	. . . . .	81° to 142°
Boiling-point with reflux condenser	. . . . .	81°
Liquid consumed in half an hour after ignition	. . . . .	6·46 grms.
Deviation from the normal consumption	. . . . .	+ 39 p. ct.

Illuminating power about 40 per cent. too low.

Sample VI.

Amyl-acetate	. . . . .	Pure
Specific gravity at 15° C.	. . . . .	0·8735
Boiling-point	. . . . .	136° to 142°
Boiling-point with reflux condenser	. . . . .	139·50
Liquid consumed in half an hour after ignition	. . . . .	4·66 grms.

The composition of the above samples is given by weight.

The quantity of liquid consumed was determined by first burning the lamp for about 15 minutes; the flame being carefully adjusted to the normal height. The lamp was then extinguished, weighed, lighted again, and allowed to burn for exactly half an hour; the loss in weight was then determined, with the results given above. The height of the barometer varied during the experiments from 767 to 758 mm. (30·68 to 30·32 in.) and the temperature from 15·5° to 20° C. (60° to 68° Fahr.).

The results of this investigation, taken in conjunction with others previously published, show that, for all practical purposes, the illuminating power of the amyl-acetate lamp is not appreciably affected by the employment of commercial amyl-acetate containing the most frequently occurring impurities. In the case of those impurities which have a considerable effect on the illuminating power, the rate of consumption is also materially altered. Increased consumption may, however, be accompanied by a decrease in illuminating power, and *vice versa*.

GAS V. STEAM ENGINES FOR MOTIVE POWER.

We have received from Mr. J. Emerson Dowson, M. Inst. C. E., the following particulars of a trial of a 60-horse power (nominal) Crossley gas-engine, with Dowson gas plant, conducted by him at the flour-mills of Messrs. Mead and Sons, Lot's Road, Chelsea, on the 5th inst.

The maximum indicated horse power of the engine was 173·6; the estimated brake horse power, 147·6. The diameter of the cylinders was 17 inches; the length of stroke, 2 feet. The trial lasted eight hours (from 9.40 a.m. to 5.40 p.m.). The total number of revolutions made by the crank-shaft during the trial was 74,751, or 155·73 per minute. The number of explosions in the left cylinder was 25,908, or 53·975 per minute; in the right cylinder, 26,619, or 55·456 per minute. The mean pressure of the indicator diagrams of the left cylinder was 79·90 lbs. per square inch; of the right cylinder, 77·91 lbs. (1) The mean indicated horse power developed in the left cylinder during the trial was 59·30; in the right cylinder, 59·41—total, 118·71. The maximum indicated horse power which would have been developed if the engine had worked at the normal speed of 160 revolutions per minute, and fully loaded, would have been 173·6. The mean temperature of the gas in the bags near the engine was 67° Fahr.; of the air supplied to the engine, 50° Fahr.; of the water overflow from the left cylinder, 125° Fahr.; of that from the right cylinder, 119° Fahr.; and of the boiler-feed water, 75° Fahr. The mean pressure of gas in the holder was 1½ inches; that of the steam in the boiler, 48 lbs. per square inch. The levels of the water and the fire in the boiler, of the fire in the generator, and of the gasholder, were all the same at the end as at the commencement of the trial. (2) The quantity of anthracite consumed in the generator was 584 lbs.; that of coke in the boiler, to get up steam before the trial began, 30 lbs.; do. during the trial, 140 lbs. (3) The quantity of anthracite put in the generator on the morning after the trial, to make up for the waste during the night and when raking out clinkers, was 136 lbs., of which 30 lbs. was returned as good; leaving 106 lbs. The anthracite consumed during the trial was at the rate of 0·615 lb. per indicated horse power per hour; do. with the addition of four-fifths of that which was put in the generator on the following morning, 0·7 lb.; (4) do., with the further addition of the coke used in the boiler, including the getting up of steam, 0·883 lb. The gas burnt was at the rate of about 63 cubic feet per indicated horse power per hour. (5) The anthracite consumed during the trial was about 10 lbs.; the anthracite and coke together about 12 lbs., per 1000 cubic feet of gas made. For cooling the engine, 600 gallons of water were used, or at the rate of 5·03 gallons per indicated horse power per hour; for the boiler, 80 gallons, or 0·08 gallon per indicated horse power; for cleaning the gas, 112 gallons, or 0·11 gallon per indicated horse power per hour—making a total of 792 gallons, or 5·22 gallons per indicated horse power per hour. (6) The water used for gas making was 3·2 gallons per 1000 cubic feet of gas produced; that evaporated in the boiler at the pressure of 48 lbs. per square inch, 4·7 lbs. per pound of coke consumed. The oil employed for the cylinders was 1½ pints at 2s. 9d. per gallon; a like quantity, at 1s. 4d. per gallon, being used for the bearings. The coal gas burnt for heating the ignition-tubes was 4½ cubic feet per hour. (7) The following machines were worked during the trial: 1 pair of stones, 4 feet in diameter; 13 pairs of rolls (250 revolutions); 4 pairs of discs (600 revolutions); 14 ordinary, and 7 centrifugal silks; 4 purifiers; 24 elevators; 2 exhaust-fans; sundry conveyors; pump, shafting, &c.

Remarks.

- (1) Eighteen diagrams were taken on each cylinder, at intervals of about 30 minutes. Each diagram gives the curves of ten consecutive strokes of the indicator. The same indicator and spring were used for both cylinders. The 100-lb. spring was a new one tested by Elliott Bros., who also supplied the counters.
- (2) The anthracite employed was of the usual kind, from the Gwaun Cae Gurwen Colliery Company.
- (3) The coke was procured from The Gaslight and Coke Company.
- (4) As the trial lasted eight hours, instead of the usual working day of ten hours, one-fifth of the waste has been deducted.
- (5) The rate of gas consumed was taken by shutting the inlet of the holder, and timing the fall of the holder 6 feet while the engine was working.
- (6) All the water was pumped from the river by the engine, and run to waste. Usually the water used for cooling an engine flows to and from an overhead tank.
- (7) Coal gas was employed for this purpose, because Dowson gas could not be taken from the main supplying the engine, and there was no separate outlet from the gasholder.

As the greatest load which could be put on the engine during the trial was considerably less than the engine was capable of driving, and as the engine had twin cylinders, a counter was attached to the gas-valve of each cylinder so as to count the admissions of gas, or, in other words, the number of explosions in each. It was not possible to determine the horse power absorbed by the friction of the engine itself, as there were no means of starting it except with belting and a long run of shafting, &c. Messrs. Crossley state that this friction does not exceed 15 per cent. of the maximum indicated horse power; and at the normal speed of 160, and with the mean pressures shown by the 36 indicator diagrams, the maximum indicated horse power was 173·6, and 15 per cent. of this is 26-horse power.

When good anthracite is used, the fire in the generator is not drawn more than once in two or three months, as the clinkers are raked out every day. At this mill it is usual to work the engine 15 hours a day without stoppage; so that the loss of fuel during the night, while the generator is standing, and when the fire is raked, should, strictly speaking, be spread over 15 hours. If the plant were worked night and day, as in paper-mills and other works, there would be no such loss, except when the fires are raked once every 12 hours; and this would be very small, as all that is raked out, except the actual clinkers and ashes, is either returned to the generator or burnt in the boiler. The total quantity of water fed into the boiler during the trial was 80 gallons, or 100 lbs. per hour, including that required for the feed-pump. Neither the boiler nor the steam-piping was coated; and only 4.7 lbs. of water were evaporated per pound of coke consumed. The coke employed in the boiler actually weighs nearly one-fourth the anthracite used in the generator; and it may be fairly assumed that this can be improved. However, taking the plant as it stands, and as it is worked regularly day by day, the consumption of anthracite in the generator (without allowing for waste during the night) is 0.61 lb.; or, making allowance for waste, 0.7 lb. per indicated horse power per hour. Thus any mill-owner who requires steam for certain purposes, and can give the small amount required for the gas plant, can get his motive power, under the gas system, with the unprecedentedly low consumption of 0.7 lb. of anthracite per indicated horse power per hour. Where anthracite cannot be procured at a moderate price, ordinary gas coke of small size can be used; but instead of 0.7 lb., it will then be necessary to use about 1 lb. per indicated horse power per hour.

It may be added that the mill was formerly worked by a non-condensing compound beam engine, and that the gas-engine which has taken its place has worked regularly for nearly four months. The work of the mill varies very little; and it is satisfactory to know that the consumption of fuel during the trial agrees with the average.

The Management of the High Wycombe Gas Company.—Mr. Charles King, whose death was announced in the JOURNAL a fortnight ago, has been succeeded by Mr. T. W. Thurlow, the Assistant Manager; while the post of Assistant Secretary has now been conferred upon Mr. F. Turner, who has been in the employ of the Company for a number of years.

Mr. Richard Williams, an old and respected citizen of Exeter, who died last Sunday week, at the advanced age of 85, was connected with the Exeter Gas Company for the long period of 63 years, during 43 of which he held the position of Secretary. On resigning this office he was appointed a member of the Board; and, being a man of strict business habits and good judgment, he gained the confidence and respect of his colleagues.

"Nos Eclairages" is the title of a little *brochure* from the pen of M. Jules Buse, *fils*, in which he treats in a popular style the three sources of artificial light—electricity, gas, and petroleum oil—devoting by far the larger section of his work to gas, the advantages of which, as compared with the other lighting media, are set forth. Certain appliances by which gas can be consumed economically are illustrated. The book is issued from a printer's in Ghent.

Flame Coloration.—At a recent meeting of the Chemical Society, Professor Smithells described a method of widely separating the two cones of combustion which constitute the flame of a Bunsen burner (see *ante*, p. 68). He has since given the Society a preliminary account of some novel experiments he has carried out on the origin of flame coloration. Trying the effect of introducing metallic salts into the two cones separately, he has found that in most cases no marked differences of coloration are produced. But in the case of copper salts, the inner cone assumes merely a general yellowish luminosity, while the outer cone is brilliantly tinged with the green colour commonly ascribed to the vapour of copper or copper salts. Of the two cones, the inner one is by far the hotter. The chief difference between them, apart from this, is that the inner one is surrounded by an atmosphere containing carbon dioxide, carbon monoxide, water, and hydrogen, but no uncombined oxygen; whereas the outer one is bounded by atmospheric air. The only explanation of the phenomenon that has yet offered itself is that the production of the green colour is connected with the act of oxidation. Further support is lent to this view by the fact that, if copper oxide dust be introduced into the inner cone, a general luminosity devoid of green is produced, but at the same time the outer cone is coloured green. It would appear as if the copper oxide were reduced to metal in the inner cone, and simply glowed as a solid body; the copper being thereupon reoxidized in the upper flames in contact with the air. The hypothesis is therefore tentatively put forward that some flame colorations are at any rate due to ether disturbances accompanying the act of chemical combination, and are not to be ascribed to the mere incandescence of single substances. Further experiments made with the apparatus are conformable to this view; but Professor Smithells has commenced a spectroscopic study of the subject, and has in view the prosecution of independent methods of inquiry. Understanding that the flame-dividing apparatus is likely to come into general use, he has been led to give this preliminary account of the experiments.

THE PRODUCTION OF AMMONIA, TAR, AND HEATING GAS.

A recent number of the *Iron Age* contained the following article by Mr. Alphonse Hennin, of Springfield (Ill.), on the above subject:—

The formation of ammonia during the distillation of coal in closed retorts is well known by gas manufacturers. The phenomena which produce the ammonia are, however, less known, because the study of the percentage of nitrogen in the coal, and of the transformation of that nitrogen into ammonia, is of comparatively recent date. It is only since the practical extraction of ammonia has acquired some importance that scientists have given particular attention to the question.

The ammonia does not exist as such in the coal, or at least the traces found in a native state are so small that they must be considered as an insignificant quantity. Nevertheless, it is found that as soon as the coal reaches a temperature of about 1800° Fahr. in the retort, a large quantity of ammonia is present in the gas; and this phenomenon lasts as long as any volatile matter is distilling. Higher temperature does not seem to render the distillation more active, or increase the quantity of ammonia; but as soon as the temperature falls below the bright red heat, the ammonia disappears from the products of distillation. This goes to demonstrate that the ammonia in the distillation of coal is a secondary product, resulting from a combination of the elements of the coal, occurring only under certain conditions.

It is a well-known fact that ammonia is formed when the nitrogen meets the hydrogen in its nascent state, or when both meet in that state. The nitrogen exists in the coal in the proportion of 1½ to 2 per cent., and appears to be one of the constituents of an organic compound. The formation of ammonia takes place when the coal reaches the bright heat. A distillation made below that temperature does not produce ammonia. Some nascent hydrogen must be in contact with the nitrogen at that particular temperature. It is not derived from the hygrometric water, for that water is vaporized long before the coal has reached the proper temperature for the formation of ammonia. On the other hand, the hydrogen of the coal exists in combination with the carbon, and is set free only during the reactions known as pyrogenous. It cannot, then, from this fact, participate in the formation of ammonia. There must be another source of hydrogen; and it is found in the water of combination of the coal.

It is known that water vaporizes only when the decomposition of the coal is already far advanced. From this fact and the preceding remarks, it seems evident that the ammonia is formed during the distillation by the combination of the nitrogen in the coal with the hydrogen of the water of combination. This conclusion is corroborated by the fact that only a very limited formation of ammonia takes place in the closed retort; it does not exceed 10 per cent. of the total nitrogen of the coal. During the process of coking, with recovery of bye-products, in ovens of the retort type, the production of ammonia is also very low from the same cause. In blast-furnaces, however, where raw coal is used, and although all the coal is consumed, the production does not exceed 15 per cent. of the total nitrogen in the coal; and it seems to be in proportion with the increased supply of hydrogen derived from some water of combination existing in the iron ore and flux, and perhaps from water carried into the furnace with the air-blast.

The production of ammonia in the process of manufacturing gas is a matter of great interest. If all the nitrogen of the coal could be converted into ammonia, the value of this product itself would yield handsome profits on the operation. Indeed, a coal containing 1½ per cent. of nitrogen would produce per ton ammonia equivalent to 164 lbs. of sulphate, which, at the actual price, would represent \$5. The result is, however, not attainable in practice; and it is absolutely out of the question in the manufacture of illuminating gas, because it is not possible to reach the totality of the nitrogen without consuming the coke, which retains about 50 per cent. of that element, and because the luminosity of the gas has to be taken care of.

Long ago Dr. Grouven demonstrated beyond doubt that in a large excess of steam, when the necessary conditions of temperature, time, and contact are supplied, the nitrogen of the coal is converted into ammonia. When it is considered that this process of conversion involves the decomposition of water by carbon, the oxidation of carbon into carbonic acid and carbonic oxide, and the liberation of hydrogen, it is evident that there are there the elements of a process for producing simultaneously large quantities of ammonia and heating gas of high calorific value. Between this theoretical reaction (so well illustrated by Dr. Grouven in his analytical method of the determination of nitrogen) and an economical manufacturing process, there are, however, many difficulties to overcome. The temperature at which the nitrogenous compounds of the coal liberate the nitrogen is evidently suitable to decompose the water and produce the combination of nitrogen with nascent hydrogen; but that temperature exceeds 1800° Fahr., and is considerably above the temperature of the decomposition of the ammonia in its ordinary condition. Dr. Grouven uses quantities of steam equal to 20 or 30 times the weight of the substance. This is absolutely impossible in practice. Not only could such proportions of steam not be economically used, but it would

require an external heating of the coal to maintain the proper temperature; and this fact alone renders its application impossible. Nor can any large excess of steam be applied without decreasing considerably the value of the gas.

In the distillation of bituminous shales in Scotland, steam has long been applied with success in view of increasing the production of ammonia. It has also been applied to coal in gas-generators, with the production of ammonia as the main object; the resulting gas being of little or no value for metallurgy. Lately the use of a very limited volume of steam with air in the ordinary producers has become quite general, for the sole purpose, however, of utilizing the heat of the primary combustion to disassociate water and impart to the gas a certain percentage of energy which would be otherwise lost, but without the intention or result of producing ammonia. None of these processes realized the simultaneous production of ammonia and such heating gas as is required in the metallurgy of iron, steel, &c., where rapidity of heating and melting, with the lowest percentage of waste, is the primordial condition.

These results, after several years of study and experiment, I have accomplished. My process embodies the formation of ammonia equal to from one-half to three-fifths of the nitrogen in the coal, or from three to four times as much ammonia as is produced in the most efficient destructive distillation; the production of an almost ideal gas for regenerative gas-furnaces, either for heating or melting, glass-furnaces, &c.; and, in addition, the recovery of some 17 or 20 gallons of tar. I use ordinary soft coal in an appropriate generator; and when it is heated to the bright red heat needed to liberate the nitrogen from its organic compound, I inject through tuyeres, with a limited amount of air, a certain volume of steam, which, decomposed by the carbon, forms carbonic acid, carbonic oxide, and a large quantity of hydrogen. All the nitrogen present during this decomposition unites with the nascent hydrogen to form ammonia; and the largest part of the hydrogen remains free in the gas. During the decomposition of the steam by the carbon, numerous secondary reactions occur—some developing heat, with formation of ammonia, &c., some absorbing heat; so that when the steam is properly diffused, superheated, and uniformly injected through tuyeres converging to the centre of the glowing mass, a very limited amount of air is needed to maintain the constant high heat required, without alteration or intermission of steam and air.

When the operation is properly conducted, and skill and judgment are applied in the regulation of the temperature in the different zones, with the proper depth of coal, and when the gases are removed from the generator with sufficient velocity under vacuum, the ammonia formed, diluted with the other gases in a proportion of 1 to 1000 or more, is not decomposed, and is collected during the washing, condensing, and scrubbing. Under these conditions, the yield of ammonia corresponds to (say) 50 to 60 per cent. of the total nitrogen in the coal; and it can be collected after distillation from the water of condensation in concentrated crude liquor, sulphate, or any other form desired.

The volume of the gas produced per ton of coal can be estimated at 150,000 cubic feet. The gas resulting from the operation is practically free from sulphur, and possesses high calorific value, as is shown by the following analysis:—

Carbonic acid	10'50
Carbonic oxide	20'00
Methane and homologues	4'50
Hydrogen	38'00
Nitrogen and oxygen.	27'00
Total	100'00

In addition to the above results, some 17 to 20 gallons of tar are recovered, and contribute largely to defray the expenses of the operation.

Mr. D. D. Wilson, the General Manager of the Stockton and Middlesbrough Water Board, has been specially thanked, by resolution of the Board, for the assistance he rendered in the proceedings in connection with the recent arbitration with the Kirkleatham Local Board, and for his general conduct of the business of the Board. This recorded approval of Mr. Wilson's work has been supplemented by an advance in his salary, to date from Oct. 1 last year. We learn that steps are being taken to enforce the award of the Arbitrator (Mr. H. Law) in the above-mentioned arbitration, the terms of which were noticed in the JOURNAL for the 26th ult.

Messrs. Fletcher, Russell, and Co., Limited.—A limited liability Company has just been registered, for the amalgamation of the well-known firms of Messrs. Thomas Fletcher and Co., gas engineers and manufacturers of gas heating and cooking apparatus, of Warrington and London, and Messrs. W. and A. C. Russell and Co., artistic and general ironfounders, of the Scotia Foundry, Pendleton, near Manchester, and London. The Directors of the new Company are to be Messrs. Thomas Fletcher and Alfred Clare, of Messrs. Thomas Fletcher and Co.; Messrs. William Russell, Alexander Russell, and Alexander Neil, of Messrs. W. and A. C. Russell and Co.; and Mr. R. Wallwork, of Messrs. H. Wallwork and Co., ironfounders, Charles Street, Manchester—the first five being the Managing Directors.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

The Composition of the South Metropolitan Company's Gas.

SIR,—I notice in your last issue that, in referring to the South Metropolitan Gas Company's report, you state that the Company have been using a large quantity of petroleum spirit, in substitution for cannel. Perhaps this may account for what appeared to me to be an extraordinary occurrence.

I am a customer of the Company, residing some five miles or so from the Old Kent Road works. A short time ago the gas-meter acted in a very eccentric manner; and thinking that probably it was either want of, or too much, water, I investigated the cause in the usual way. Imagine my surprise when from the syphon plug out came, not water, but gas; conveying a substance which covered my hand with what appeared to be thin tar, but which smelt very much like petroleum.

Will some reader explain the cause; or perhaps one of the officials of the Company will deign to enlighten their consumers?

Feb. 10, 1892.

CONSUMER.

Lighthouse Illumination and the Stranding of the "Eider."

SIR,—Professor Tyndall, Mr. Inglis (the Secretary of the Trinity House), "Nauta," and others, have written to *The Times* on this subject.

Mr. Inglis writes to correct what he calls a misapprehension on the part of Professor Tyndall in describing the St. Catherine's light as a "steadily-shining light." It will strike most people as strange and somewhat amusing to find Mr. Inglis questioning the accuracy of Professor Tyndall in a matter of scientific nomenclature, and attributing to him an erroneous description of a lighthouse illuminant. As I happen to be acquainted with the particular apparatus of St. Catherine's lighthouse, perhaps you will allow me to say that Professor Tyndall's description of it is absolutely accurate. The light shines "continuously;" and, except when there is some defect in the carbons or machinery, shines also "steadily."

It is quite plain that Professor Tyndall's contention is that, if the beam of that light, as it passes the mariner through the annular lenses which revolve round it, were broken up, as in the case of the group flashing lights used at the great lighthouses of Galley Head, Mew Island, and Tory Island, on the coast of Ireland, wind-thrills would be produced, which, in the presence of fog, would probably be more perceptible to the mariner than the mere revolution of a "steadily-shining light" as at St. Catherine's.

From my experience of such lights, extending now over many years, and from the testimony of practical seamen, I am able to go further than Professor Tyndall, and to say that these thrills *have been seen* when the revolving light of the lighthouse itself was *absolutely* invisible. I have no doubt that the same result would follow if a group-flashing light of that kind were substituted for the present "steadily-shining" revolving light at St. Catherine's; and I have a strong opinion that, if the sky-flashing arrangement which was tried at the South Foreland, and of which Sir Leopold M'Clintock said that it produced "a striking thrilling effect which at once caught the eye," had been in use at St. Catherine's, its effect would have been observed by the officers of the *Eider* in time to enable them to steer clear of all danger. I am glad to know that the principle of sky-flashing was recently experimented upon at the Naval Exhibition, at the instance of the Shipmasters' Society, with very marked success. I think it right that your readers should know that, since the South Foreland experiments were completed, the Irish Lights Commissioners have successfully experimented with a new lighthouse burner which, in connection with special lenticular apparatus designed to suit it, will give to a lighthouse between five and six times the power of the largest light now used in the country; and, of course, the illuminating effects of the thrills from such an apparatus would be to this enormous extent greater than anything yet tried in lighthouse illumination.

Professor Tyndall throws out the suggestion that the sudden periodic dropping and lifting of an opaque screen over the electric light, if not already tried, would probably be found a vast improvement on the continuously shining light. This experiment could be made very easily, and almost without expense, and certainly ought to be immediately tried. If, instead of attempting to correct a supposed error in Professor Tyndall's description of the light, the Secretary of the Trinity House had offered to try this experiment, it would, I think, have shown that he was in some degree alive to the interests of the sailor, whose welfare it is the duty of the Trinity House to promote.

"Nauta" refers to the fact that the common flares exhibited on board the *Eider* were seen on shore when the 7,000,000 candles, the nominal light of the St. Catherine's lighthouse, were invisible at three miles distance. Either the 7,000,000 candles is a myth, or, if a reality, 7,000,000 candle power of electric light is evidently inferior to a very much lower candle power represented by a light of less intensity of a different composition. I have tested this point carefully, and have no hesitation whatever in saying that the electric light fails to penetrate fog to a vastly greater degree than the lights of either oil or gas. However much doubted some years ago, this fact is now almost invariably conceded. "Nauta" also falls into the error of supposing that Professor Tyndall spoke of a fixed light. No such expression is in his letter; nor could such an idea be in his mind, seeing that a very short time has elapsed since he wrote, in one of the magazines, a description of the revolving but *steady*-shining light of St. Catherine's lighthouse, and called attention to its performance when a vessel went ashore quite close to it. I quite agree with "Nauta" as to the great value, during fog, of sound-signals; but there are states of the atmosphere where they are of far less value than good light. I have been present at experiments where this was positively proved. Sirens giving two notes, as at St. Catherine's, I have found to be misleading. Two blasts of the same note are much better than two notes of different pitch. The lessons of the loss of the *Eider* seem to me to be threefold: (1) That a sufficient number of

lighthouses should be placed on dangerous coasts. (2) That the lights should be better adapted to arrest the attention of the mariner in fog than those at present in general use. (3) That while sound-signals of the most powerful kind and distinctive character should be used, no consideration as to the usefulness of sound-signals should be allowed to interfere with the placing, at all important lighthouse stations, of the very best lights that can possibly be devised.

Dublin, Feb. 12, 1892.

J. R. WIGHAM.

Service or Distributing Reservoirs, and the Necessity for Covering them.

SIR,—The question comprised in the title to this letter is of very wide application, and must command the attention not only of the experienced water-works engineer and manager, but also of the chemist. It is well known throughout the United Kingdom that water stored in open reservoirs deteriorates very materially in the extreme heat of summer—some waters more than others. If the reservoir is shallow, vegetable growth and the production of animal life will be greater.

Service reservoirs are in most cases intended for distribution rather than for storage; and they usually contain from four to six days' supply. The question of capacity will be determined in a different way in each township; the circumstances being mostly various. The water, being always pumped in, is in constant circulation, and invariably fresh; and a sufficient storage is on hand to obviate any inconvenience arising from a break-down of the machinery (which should be duplicated), bursting of the pumping-mains, a long drought, or extreme frost. In or near the town to be supplied, the reservoirs are placed on the highest ground; if possible, at sufficient altitude to cause the water to reach the houses that may be built on the most elevated parts. Sometimes this is not practicable; and the water has to be pumped from the reservoir to the higher houses.

All reservoirs should be built with separate inlet and outlet pipes, so that, in the event of accident to the mains or the pumps, the contents of the reservoirs will be available. The mains should be of large capacity, whether used for pumping direct or for bringing the water from the storage reservoir by gravitation, so that in case of repairs caused by breakage, the reservoirs may be filled quickly, or while cleaning out the dirty water may be readily drawn off. But if the trunk mains supplying the town are connected with the pumps and the reservoirs, the larger proportion of water will be sent to the consumers before it has been exposed to the light; and that which is not required for the use of the town will go to the reservoir, which acts as a safety-valve for the mains, and allows the storage of two or more days' consumption, according to the dimensions of the reservoir.

The size of service reservoirs will be determined after carefully considering the quantity of water at present consumed per head of the population, and the method of detecting or preventing waste. It will also depend upon whether or not the town is a large manufacturing centre. The variation in the supply per head of the population is not great, except in manufacturing towns; it may be ascertained with the greatest accuracy. If water can be procured by subterranean tunnelling into a mountain, and intercepting the springs, it is obtained pure, fresh, and sparkling, of an even temperature; and it is much preferred to river water, which is cold in winter and warm and insipid in summer. There are instances where the whole supply for a town is thus obtained, and also stored in large subterranean reservoirs and tunnels.

Where there is not a site available for constructing a service reservoir at a sufficient elevation, and the erection of a stand-pipe and tank is deemed too expensive, recourse is had to pumping to supply the higher houses—sometimes over a stand-pipe, and at others direct into the mains. This object may also be effected as in the Brighton water supply, in which case the first cost is the only expense. There a water-motor pumping-engine is used in forcing water from a low-pressure reservoir to one far above the level, and the method may be explained. There are three reservoirs, one situated at Park Road; the second, at Islingwood Road, 82 feet below Park Road; and the third, at Warren Farm, 289 feet above the level of Islingwood Road. The engine is fixed at the Islingwood Road station; and the water coming from the Park Road reservoir to that at Islingwood Road, and passing thence to supply the needs of the inhabitants of Brighton below, will actuate the engine, which, being set in motion, will force a supply of water to the station at Warren Farm, not only 289 feet higher than Islingwood Road, but also 2817 yards distant from it. The economy of this arrangement will be at once apparent. The only motive power is the water, which is afterwards used by the inhabitants living on the lower level; and the only charge upon the Corporation is the interest on the purchase-money. It is entirely automatic in its action, and, having no "dead centre," stops and starts without needing any attendant to be near it. In the event of there being a sufficient quantity of water at the high-level reservoir, the engine will at once stop until more is required.

The old method of constructing open service reservoirs with sloping sides lined with clay, concrete, or rough pitched work, has passed away. It is now requisite that these structures should be built of good material, and be of first-class workmanship. It is not only because of the protection from smoke, soot, and other impurities in the atmosphere, that the covering of reservoirs becomes necessary; for it matters not how pure the water may be when pumped from the chalk or other source, if allowed to remain in the reservoir, vegetable and animal life quickly develop, and in summer time the growth spreads with extraordinary rapidity. This mossy excrescence is produced spontaneously by the action of the sun on pure water; and it makes its appearance early in the spring. The remedy for it can only be found in covering the reservoir, or building it of sufficient depth. In my experience, between 20 and 30 feet are necessary.

An investigation has recently been made into the composition of waters at various depths at some of the American water-works by the Massachusetts State Board of Health; and it has been ascertained that at 30 feet deep the water does not circulate for something like half the year, and therefore becomes less palatable than the top layers of water which are kept in circulation by the wind and rain. With many of the waters experimented upon, this was very marked. In winter

the surface of the water is cooled, and the lower layers of stagnant water mixing with the decomposed organic matter at the bottom of the reservoir, rise to the surface, and give to the water an unpleasant taste and smell. The tables of analysis of water stored in cleaned and uncleaned reservoirs show a superabundance of organisms and suspended organic matter in the uncleaned reservoirs. The evidence is conclusive from these investigations that all deep-well waters should be stored in reservoirs excluded from the light and heat.

The inlet to service reservoirs should be formed as an overflow or a waterfall at the top of the reservoir. This form of cascade aerates and breaks up the water, and has a tendency to keep the whole surface in motion; cooling it, and preventing the growth of algæ. A perfect circulation of the water is often effected by directing the current in a zigzag course through alternate openings in the cross walls which support the covering arches. This kind of vaulted covering is the same as that employed by the Romans. It is carried out in a very simple manner by building a series of brick pillars throughout the reservoir, and throwing semicircular brickwork arches across, or by erecting cast-iron columns, the tops of which are provided with brackets for carrying rolled wrought-iron girders, from which spring concrete or brick arches. An overflow is necessary, to prevent the reservoir from being over-filled. An electric gauge, directly communicating with the engine-house, is also necessary, for indicating the exact height of the water.

Filter-beds are seldom vaulted over in this country, for what reason it is difficult to discern, as one would suppose it is more necessary to protect the filter than the reservoir; the former being so extremely shallow. If reservoirs are uncovered, the water should be passed through a screen of sand and gravel. This will obviate the necessity for continuous cleaning, and prove more economical in working.

From a careful consideration of many reports throughout the country, we must conclude that pure water drawn from the wells is by Nature productive of both animal and vegetable life; and if the conditions of storage are favourable, the spontaneous growth of both is very rapid. This growth commences early in May, and continues until maturity is reached about August, when it readily leaves the sides and bottom of the reservoirs, decays, and rises to the surface, giving off an unpleasant odour in doing so. Constructing reservoirs of a depth of from 20 to 30 feet is a partial remedy for this; and cleaning them out three or four times a year is also necessary. But, whether they are built near the town or otherwise, it is absolutely necessary that reservoirs should be covered. The cost of covered service reservoirs may be calculated at about £4 per 1000 gallons capacity. The very expensive practice of building massive piers and brick arches, although it is the system mostly employed in this country, may be safely departed from, and a covering of iron or wood, with a layer of sawdust, substituted. The covering is merely to exclude soot, light, and heat, and to prevent the growth of algæ, &c.; it also keeps the water at a uniform temperature.

Feb. 12, 1892.

INSPECTOR.

Oil-Lamp Accidents.—An inquest was held at Grantham last Tuesday before the Borough Coroner (Mr. A. H. Malim), touching the death of George Bell, a labourer, which took place at the hospital on the previous day, through burns caused by the overturning of a paraffin lamp at his lodgings. The jury found that deceased was "Accidentally burnt to death by the upsetting of a paraffin lamp."—Four persons were injured by the explosion of an oil-lamp at Trowbridge last Saturday week. A woman named Knowler was replenishing the lamp when her daughter (aged five years) approached too close with a lighted candle, causing the oil to explode. Mrs. Knowler and her baby were badly burned. The girl who held the candle also received shocking injuries to her face, arms, and legs; and the sister of Mrs. Knowler was seriously injured.

The Quality of the Gas at Middlesbrough.—The minutes of the Middlesbrough Corporation Gas Committee for the past month contain a long report by the Gas Manager (Mr. David Terrace) on his investigations into the complaints which have been made of the poor illuminating power of the gas. The blame is laid upon the consumers' burners and fittings; and the report sums the matter up as follows: "Consumers imagine it is our duty to give them an abundance of light in every room, and if they do not get it, the gas is blamed; whereas, in nearly every instance, the fault lies with themselves. It is no argument to them to say that the light is good in one or two rooms and bad in others. The gas, in their view, must be bad if they do not get sufficient light through bad fittings, burners, and globes. Our contention that these are at fault is as nothing in comparison with their conviction that it is the gas; and they boldly tell you so, notwithstanding analyst's reports and otherwise. Consumers, as a rule, do not come to the fountain head to have their grievances remedied. We are always pleased to advise the consumers as to what may be wrong. When it is the service-pipe or meter, we put same in order, and point out the defects in the fittings, burners, &c."

Cagliari Gas and Water Company.—A very satisfactory statement of affairs will be laid before the shareholders of this Company at their annual meeting to-day. The receipts on revenue account for the past year amount to £23,610; and the expenditure to £11,003—leaving after the usual deduction for sinking fund and a further £1000 for the reserve fund, a net revenue of £12,607. The amount available for dividend, including the balance brought forward from the preceding year, is £16,970, out of which an interim dividend at the rate of 6 per cent. per annum was paid, amounting to £4500. The Directors now recommend a dividend at the rate of 8 per cent. per annum for the half year ending Dec 31. last, which will require £6000, and make a dividend for the year of 7 per cent. (£10,500). They also recommend that a bonus of 5s. per share be paid; and this will absorb £1875. These various payments will amount to £12,375, and a balance of £4595 will remain to be carried forward. As to the progress of the business, the water receipts show an increase of £327, when compared with those of the previous year. The receipts from gas exhibit an increase of £556; and those from residuals, £496. The unaccounted-for gas only averaged 4½ per cent. of the make over the whole year, or the same as in the previous year.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

Friday, Feb. 12.

FOG AND SMOKE ABATEMENT.

LORD STRATHEDEN AND CAMPBELL presented a Bill to amend the Acts for abating the nuisance arising from the smoke of furnaces and fireplaces within the Metropolis; and it was read the first time.

VISCOUNT MIDLETON asked if Her Majesty's Government were prepared to issue a Royal Commission "to inquire into the causes of the prevalence of fogs in London; to ascertain how far and by what means they are preventable; and to make such recommendation as, after inquiry, they may deem advisable."

LORD SALISBURY said he was afraid he could not assent to the proposal for a Royal Commission; but he would heartily support the appointment of a Committee, if the noble Lord would himself choose the members and be the Chairman.

HOUSE OF COMMONS.

Friday, Feb. 12.

LIGHTHOUSE ILLUMINATION.

MR. LEA asked the President of the Board of Trade whether it was correct that the officers in the *Eider*, recently wrecked on the Isle of Wight coast, were unable to see the light of St. Catherine's lighthouse; whether that light was less effective in fog than the Wigham triform group flashing gas-light on Tory Island, off the north-west coast of Ireland; whether he would consider the advisability of supplementing the electric light at St. Catherine's by the vertical sky-flashing light recommended by the Shipmasters' Society of London and others; and whether, in the meanwhile, the experiment for producing thrills in fog, recommended by Professor Tyndall in his letter to *The Times* on the 3rd inst., would be tried at St. Catherine's.

SIR M. HICKS-BEACH: In the deposition made before the Receiver of Wreck by the master of the *Eider*, no mention is made of the light of St. Catherine's having been seen by the officers of the ship, which struck on Atherfield Ledge in a thick fog about $3\frac{1}{2}$ miles from the lighthouse. Upon the second and third paragraphs of the honourable member's question, I have been in communication with the Trinity House, who state as to whether the Wigham light at Tory Island is more effective in fog, that this can only be estimated from the results of the experiments at the South Foreland, which were conclusively in favour of the electric light. Experiments in sky flashing, so far as they have gone, have not been encouraging for the adoption of that system; and the Elder Brethren are in communication with the Shipmasters' Society on the subject. Professor Tyndall's letter of Feb. 3 was written under a misapprehension. Very powerful and perfect thrills in fog are sent from the illuminating apparatus at St. Catherine's; a sudden flash of more than 6,000,000 initial candle power being given for five seconds, followed by an equally sudden eclipse of 25 seconds.

BILLS TO ORIGINATE IN THE UPPER HOUSE.

The Chairman of Ways and Means (the Right Hon. L. H. Courtney) reported that, having conferred with the Chairman of Committees of the House of Lords (the Earl of Morley) on the subject, it had been determined by them that the following Bills in which our readers are interested should originate in the Upper House: Ashton-under-Lyne Water Bill, Barrow-in-Furness Corporation Water Bill, Bradford Corporation Water Bill, Bristol Gas Bill, Cleator Moor Local Board Gas Bill, Glasgow Corporation Water Bill, Ipswich Corporation Bill, Kilmarnock Corporation Water Bill, Liverpool United Gas Bill, Llanbradach District and Aber Valley Water Bill, Newport Corporation Bill, North Shields Water Bill, Oxford Gas Bill, Pontypridd Water Bill, Rhymney Valley Gas and Water Bill, Southborough Local Board Gas Bill, Swansea Corporation Water Bill, Swinton and Pendlebury Local Board Bill, Tredegar Local Board Water Bill, Uttoxeter Water Bill, and Western Valleys (Mon.) Water (Gas Purchase) Bill.

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Thursday, Feb. 11.

(Before the MASTER OF THE ROLLS and Lords Justices FRY and LOPES.)

Ungar v. Sugg.

This was an appeal by the plaintiff from the judgment of Mr. Justice Wright, varying the order of the Chief Clerk (Mr. Harwood Clarke). The action was for an injunction to restrain defendant from issuing certain threats, and to recover damages for the loss he had sustained by those threats. The action was originally brought in the Chancery Division; but, while awaiting hearing, it was transferred to the Queen's Bench Division, and was tried before Baron Huddleston and a jury, with the result that the latter found that the plaintiff had not infringed the defendant's patent. A judgment was accordingly entered for the plaintiff with costs; an inquiry being directed to ascertain the damages which the plaintiff had sustained in consequence of the Defendant's threats. This was prosecuted before Mr. Harwood Clarke, extending over fourteen days; and in the result the sum of £1348 was awarded to the plaintiff. From this finding the defendant appealed; and upon the matter being carried before Mr. Justice Wright, he reduced the damages to £500.* From this decision plaintiff now appealed; alleging, first, that the Judge had fixed at too late a date the point of time from which the damages should be assessed; secondly, that if the learned Judge was right as to the point of time, he had taken a wrong measure of damage—in fact, had made a guess, whereas the Chief Clerk had taken the damage at the actual amount proved. The defendant had given a cross notice of appeal to further reduce the damages; but this was not proceeded with.

MR. MORTON DANIEL appeared for the plaintiff; Mr. JENKINS represented the defendant.

THE MASTER OF THE ROLLS, without calling upon the respondent's Counsel, said the point the Court had to determine was whether or not the amount awarded by the Judge was sufficient. The defendant thought his patent was infringed, and consequently sent round circulars warning persons against purchasing Mr. Ungar's lamps. There was nothing wrong in this, so long as the defendant believed the infringement was going on. But in this he made a mistake, and consequently became liable for the result of the threats he had issued. He was not liable for the damage which was the result of any rumour circulating in the trade which was not the result of his act, but merely for the damage caused by his own act. The Chief Clerk, having minutely investigated the facts, took the whole of the loss upon the sale of the lamps from the time of the first threat down to the time the action was brought, and attributed to the threats every bit of loss sustained by the plaintiff. Upon the matter coming before Mr. Justice Wright, he at once saw that the Chief Clerk was wrong. Accordingly, he took what was a business-like view of the loss; and after carefully considering the whole of the facts, he reduced the amount to £500. He (the Master of the Rolls) saw no reason for differing from this conclusion, and therefore the appeal must be refused, with costs.

COUNTY OF LONDON ASSESSMENT SESSIONS.

Sessions House, Clerkenwell, E.C.—Monday, Feb. 8.

(Before Sir P. H. EDLIN, Q.C., Chairman, and a Bench of Magistrates.)

Judgment in The Gaslight and Coke Company's Assessment Appeals.

To-day the judgment of the Court was delivered in these important appeals, the hearing of which extended (with intervals) from May 25 to Nov. 18 last year; the proceedings being fully reported in the JOURNAL at the time.

THE CHAIRMAN: These appeals, 128 in number, are brought by The Gaslight and Coke Company against the Assessment Commissioners of the several Metropolitan parishes into which their system of mains and service-pipes extends. The various questions arising have necessitated a very close and careful investigation of the Company's accounts of receipts and expenditure, and of the other materials furnished, for the purpose of enabling us to determine these questions, and to estimate fairly and fully the rateable value of the appellants' property. A consolidation of these appeals was properly agreed to at the outset; but the several respondent Committees were not at one upon the more material questions involved; and it has consequently been necessary to collate the conflicting estimates they have presented, as well as to consider them respectively in contradistinction to the contention of the appellants' Engineer, and the valuers called on their behalf. There have been assessment appeals of greater complexity in last year's enormous list, but certainly none of more pecuniary importance to the suitors; the difference here between the highest and the lowest of the estimates submitted for our consideration approximating closely to £600,000 in alleged rateable value, and involving, if we take 5s. 2d. as the average of the parochial assessment in the area, an annual aggregate liability for rates exceeding £150,000 a year. It will be understood that we are here contrasting Mr. Eve's and Mr. Valon's valuations with that of the Accountant of the Company—these showing the largest differences. But if we take the highest valuation presented on the Company's side, and compare it with the lowest submitted by the parishes, even then the difference in the alleged values exceeds £216,000; and the annual liability to rates, in the same proportion, would be £55,000. The importance of these appeals is therefore obvious; and I would observe that there can be no just complaint with regard to the time we have bestowed upon them. I pass on from these preliminary remarks, suggested by the peculiar nature of this litigation, to state the conclusions at which we have arrived. That there would be material differences of view in the valuation of works of such vast extent and magnitude, was to be expected; but I must be pardoned for remarking that I was not prepared for such wide divergencies of professional opinion as have been manifested in these cases. We were asked by Mr. Littler to contrast the several totals, and the component figures in the valuations presented by the respondents' surveyors, with the near approach to unanimity and accord of judgment shown by the witnesses for the appellants. We have before us a synoptical table of these conflicting views; and there could be no better proof of the inherent difficulties of the task, nor indeed any better assurance that the witnesses brought by the respondent Commissioners have exercised independent judgment in dealing with it. The more material variances are in the amounts credited for the working capital; but, wide apart as are the totals urged, it is to be observed that many of the comparisons suggested by this table would be misleading unless regard be had to the differing method pursued in the valuation. Moreover, with regard to several of the more prominent items in the accounts, the variances, when investigated in detail, will be found to affect only slightly the general result; corresponding or similar allowances having been included under different headings. I am referring to some of the more prominent items. Nor is there on either side any material difference of opinion as to the proper method of formulating the account for the purpose of arriving at a co-equal proportionate subdivision of parochial rateable value; and the form adopted in previous cases relating to the assessment of gas and water companies has been properly followed. It is not my intention to state in detail the figures at which we have arrived in respect of either of the controverted items in the computation of the working capital, or of the statutable or other deductions for expenditure claimed by the Company. We have appreciated justly, I consider, the pertinence and force of what was urged with regard to the competition to which the Company are subjected, and may be increasingly subjected, by the adoption of electric light, and by the use of other means in vogue for producing light; and, on the other hand, we have not overlooked the power of the Company to raise the price of their gas—these being important elements for consideration in estimating the lettable value of their works. We followed also, with patience and

* See JOURNAL, Vol. LVIII., p. 28.

attention, the arguments based on the tables of averages calculated on the returns and receipts and expenditure appearing in the Company's published accounts for past years; and I should hesitate to say that these tables have not been of use in this inquiry. But in awarding allowances for expenditure where the cost of labour and of materials fluctuates, and the manufacture is subject to various contingencies of an obstructive character, the figures thus deduced would be unsafe guides for valuation purposes unless there be consideration of such varying circumstances. It is far safer to rely on the results of recent practical experience. It will be distinctly understood that the Court has accepted, as the substantial basis—the mean basis—for its estimates, the reports of the Company, and the returns furnished of its actual receipts and expenditure, during the twelve months ending June 30, 1890; due regard, of course, being had to the considerations arising from the circumstances affecting the expenditure during that period, as we gather them from the evidence before us. These are the values constituting the assessment of the entire property. We find the landlord's share, subject to deductions for rates, to be £620,500. We separately assess the stations and the other indirectly-productive portions of the works at £250,000, and we assign to the directly productive portion—to the "live mains," as they have been called—the rateable value of £370,500. Now, with respect to this latter portion of the works, we think the gross value should be fixed by adding one-fifth of the rateable value, calculated, of course, after deduction has been made for rates. Thus there will be an allowance of one-sixth for repairs, insurance, and maintenance, in respect to that portion; but for the other part of the works the statutory allowance should be one-fifth. Here, for arriving at the gross value, the addition to the net rateable value will therefore be 25 per cent. The distribution between the several parishes will, of course, be according to the well-established rule. The allocation of rateable value will be proportionate to the receipts of the Company in each parish; that is to say, the distribution will be in the same ratio—the same relative proportion—as the actual receipts in each parish bear to the total receipts of the Company. It therefore follows that, as the rates have to be deducted before the net rateable value can be fixed in any parish, the distribution or apportionment of value must first be made; and there will be a proper deduction therefrom for rates, according to the poundage actually levied in each parish respectively. I suggest that an accountant should be appointed on each side for the purpose of calculating the proportionate allocations and the proper deductions for rates in each case. Here again, be it observed, these calculations have to be made in respect of the receipts of rates in the account year. Something was said on the last occasion [*ante*, p. 117], by Mr. Poland and Mr. Danckwerts, I think, with reference to the valuation of the Company's station and unproductive works in St. Pancras. Their value, be it what it may, forms part of the £250,000 ascribed to the whole of the Company's structural works in this district; and if a valuer cannot be agreed upon between the parties to assign a fair proportion of this amount to St. Pancras without appealing to the Court, we will appoint one, or, if it be preferred, deal with the matter ourselves. There is another question, and it is one of importance. The costs of these appeals must have been enormous—this being the seventeenth day of our meeting for the trial of them. We will say nothing as to any award of costs until we have before us, in juxtaposition, first, the rateable value in each parish as now assessed; secondly, the value assigned by the Assessment Commissioners; and, thirdly, the deduction therefrom claimed by the appellants.

Some discussion followed as to points which might arise on the judgment, in the course of which

Mr. POLAND stated that, in one or two of the parishes he represented, it might become an important question as to what part of a main was to be treated as indirectly productive; because, of course, the particular parish in which that main was would be entitled to any benefit they could derive from it.

The CHAIRMAN said he apprehended that there would be some difficulty in this respect; and he was not at all sure that it would not be the duty of the Court to visit on the parishes which should raise such an unnecessary question, after this long investigation, the costs of it. He certainly did not understand that this was an open matter with regard to any parish except St. Pancras. It would be observed that the Court had adopted Mr. Ryde's valuation of the stations and productive mains. Mr. Ryde's own figure was £250,000; and he (the Chairman) should be very sorry to find any one of the respondent Commissioners objecting to this valuation.

The proceedings were then adjourned till the 19th inst., when the report of the accountant will be received, and any other matter which may arise on this case will be considered.

Sales of Shares.—At Worksope last Wednesday, a number of shares in the *Worksope Gas Company* were offered for sale by auction, with the following results: Five £5 7 per cent. shares were sold at £8 10s. each; twenty other shares produced an advance of 2s. 6d.; six £10 8 per cent. old shares fetched £9 2s. 6d.; fifteen similar shares, £8 12s. 6d. —At Bury St. Edmunds last Thursday, Mr. H. Lacy Scott submitted to public competition various shares in the *Bury St. Edmunds Gas Company*. Ten fully-paid shares (1879 capital) were first sold; £17 being the top price realized. Twenty-five fully-paid shares (1849 capital) were next offered. The highest price obtained was £22; 20 of the shares being withdrawn, as were also 25 shares of the 1859 capital. —Mr. Lees, of the Wool Exchange, E.C., recently sold 50 £5 shares (£2 10s. paid) in the *Redhill Gas Company* for £6 5s. each. —At the Auction Mart last Wednesday, Messrs. Edwin Fox and Bousfield sold some fully-paid £10 shares in the *Walton-on-Thames and Weybridge Gas Company* at £10 5s. to £10 10s. each, and some shares of similar value in the *Woking Water and Gas Company* at £9 5s. —At Southampton on Friday week, Mr. W. Burroughs Hill sold by auction 200 new shares in the Southampton Gaslight Company at prices ranging from £36 15s. to £37. —Last Tuesday, Mr. A. Richards sold the following shares: 77 paid-up shares of £5 each in the *West Ham Gas Company*, for £847; 90 shares, £6 paid, in the *Crystal Palace District Gas Company*, for £810; 20 shares of £10 each in the *Walton-on-Thames Gas Company*, for £210.

MISCELLANEOUS NEWS.

BRENTFORD GAS COMPANY.

The Half-Yearly Report and Accounts.

The shareholders of this Company will hold their half-yearly meeting next Friday; and the report which has been prepared for presentation by the Directors states that they have available for dividends the sum of £61,607. They therefore recommend the declaration of a dividend at the rate of 5 per cent. per annum on the 5 per cent. preference stock, of 12½ per cent. on the consolidated stock, and of 9½ per cent. on the new stock, 1881, all subject to income-tax. Referring to the works, the report mentions that the settings of inclined retorts at Brentford and Southall have been completed, and are working satisfactorily; and, with regard to the new gasholder at Southall, the unfavourable weather of the last few months has delayed its completion, but it is in a very forward state. On the subject of residuals, it is remarked that the prices obtained during the half year have been very low, owing to the state of business generally, and especially to the stagnation in the cement trade, which has materially affected the sale of coke; but as matters become more settled, it is confidently expected that business will revive, and values return to their former level. As to the appeals which the Directors have deemed it their duty to enter against the new assessments, the shareholders are informed that these have not yet been heard. In concluding the report, the Directors say that the business continues to increase in a marked and healthy manner, and to meet the ever-growing demand, they are, of course, obliged to make corresponding additions to the manufacturing plant. For this reason, they have decided to offer for sale, by tender, during the present half year, a further sum of £30,000 of new 1881 stock.

Turning to the revenue account, it will be seen that there has been an increase in all the items of income, excepting from the residual products. The sale of gas produced £86,567, as against £84,320 in the corresponding half of 1890. The rental of meters and stoves amounted to £3632, as compared with £3335. The residuals yielded £22,196, as against £26,525—coke being almost entirely responsible for the difference. The items of rents and transfer fees (about £92) bring up the total receipts to £112,487. On the other side of the account, the manufacturing expenses total to £66,536; and an examination of the various items making up this sum shows that there have been some considerable increases. Coals cost something like £4000 more; carbonizing wages, upwards of £1000 more; and repairs and maintenance, £4500 more. The outlay for distribution came to £6428; for lighting and repairing public lamps, £1404; and for rents, rates, and taxes, £4734. The last-named item has increased by about £1200. Under the heading of management, £3646 was spent; and three or four other small items bring up the total expenditure to £83,731, as compared with £72,458 in the corresponding period of 1890. The balance carried to profit and loss account is £28,756, as against £41,803. The quantity of coal and cannel carbonized in the six months was 58,046 tons (of which 892 tons were cannel); and from this was produced 597,511,000 cubic feet of gas.

BROMLEY GAS CONSUMERS' COMPANY.

In the report of the Directors of this Company for the half year ending Dec. 31, 1891, which, with the accounts, will be presented at the ordinary meeting of the shareholders on the 25th inst., they state that, in their opinion, satisfactory progress has been made in the Company's business. Although the winter quarter of the past half year was on the whole abnormally mild, the consumption of gas exceeded that of the corresponding remarkably cold and foggy half of 1890 (which itself showed an increase over that of 1889 of 10 per cent.) by 4,628,000 cubic feet, or 6 per cent.; and notwithstanding that the reduction of 3d. per 1000 cubic feet in the price has benefited the consumers, and thus diminished the gas-rental by £925, the profits have been sufficient to provide, within £393, enough to pay the debenture interest and the dividends recommended. The Directors remark that the use of gas for cooking and heating purposes is also rapidly becoming more general; showing an increase in the six months to Dec. 31 last to the extent of 12½ per cent. in gas cooking-stoves, and of upwards of 100 per cent. in ordinary gas-fires. Owing to the mild season, the sale of coke and its price have decreased in comparison with the corresponding half year; and the stocks left on hand, both of this commodity and of sulphate of ammonia, are unusually large. The profit and loss account, including £1504 brought forward, shows a balance of £6174; and the Directors recommend the declaration of dividends at the same rates as last half year—viz., 11½ per cent. per annum on the ordinary 10 per cent. shares, and 8½ per cent. per annum on the ordinary 7 per cent. shares (amounting together to £5064); and that the balance, £1110 be carried forward. The extension and alterations in the mains, referred to in the last report, have been completed; and the coal elevator and conveyor has been brought into use with satisfactory results. The Directors contemplate making during the current year several alterations and enlargements of the plant on the works, and also of the mains for the supply of the Shortlands district. For this purpose they will require to make a further issue of shares in the course of the summer; and it is expected that from £4000 to £5000 will have to be raised. With regard to the manufacturing operations, which are carried on under the supervision of Mr. W. Woodward, the Company's Engineer, the accounts show that 8499 tons of coal were carbonized in the past six months; the production of gas being 83,116,000 cubic feet, of which all but 1,284,800 cubic feet was accounted for. The residual products were: Coke, 8499 chaldrons; breeze, 843 chaldrons; tar, 93,440 gallons; sulphate of ammonia, 42 tons 2 cwt. 2 qrs. The total receipts on capital account to Dec. 31 last were £138,175; the expenditure being £136,453 17s. 9d. (of which a net sum of £2924 17s. 6d. was laid out in the past six months). The balance has consequently been brought down to £1721 2s. 3d. The Company, however, still have share capital to the amount of £56,825 unissued, and borrowing powers to the extent of £17,500 unexercised.

NEWCASTLE AND GATESHEAD GAS COMPANY.

Annual Report.

From the annual report of the Directors of the Newcastle and Gateshead Gas Company, which will be submitted at the meeting of the shareholders to-morrow, we learn that the revenue for the past year amounted to £219,393, and the expenditure to £175,799; leaving a balance of £43,594 as profit. Adding to this the undivided profits brought forward (£60,651), gives an amount available for dividend of £104,245, which the Directors propose to appropriate as follows: Interest on debenture and loans, £5094; intermediate dividend of £4 12s. 6d. per cent., less income-tax, paid in August last, on £550,000 stock, £24,801; and to the payment of a similar dividend for the second half year, £24,801. These sums make a total of £54,697, and leave a balance of £49,548 to be carried forward. There is an increase in the receipts, arising principally on the gas accounts. On the other hand, the expenditure is £25,132 more than last year, caused mainly by the high price paid for coal, on which item alone the increase is £20,963. The Directors are, however, glad to announce that the coal contracts made for the current year show an average reduction of 2s. 3d. per ton, which, on the quantity carbonized, will be a very large saving, and justifies the reduction in the price of gas of 2d. per 1000 cubic feet. During the year 11 miles of pipes have been laid in extensions and renewals; 1304 new branches have been laid; and 1243 old branches renewed; 695 meters have been repaired, tested, and refixed; 208 ordinary street-lamps have been erected; 25 specially large lamps fitted for private consumers; and there is an increase of 254 cooking-stoves fixed, making the total number on hire 1289. The contract for heightening one of the holders at the Redheugh works has been satisfactorily completed; and the erection of a new holder at the same place, which will increase the storage capacity by about 3 million cubic feet, is now in course of construction. In order still further to meet the continually increasing demand for gas, the Directors have been obliged to extend the producing power at Redheugh, and have commenced the building of a retort-house, one-third only of which will be completed at present; the remainder to be carried out as occasion may require. The Directors, having found it necessary to raise and issue further capital, have summoned an extraordinary meeting of proprietors to be held at the termination of the ordinary meeting, at which resolutions will be proposed giving them power to raise £50,000 of the additional capital authorized by the Act of 1879, in such sums, and at such times, as they may deem advisable.

PROVINCIAL GAS AND WATER COMPANIES.

From the reports and financial statements of the several Gas and Water Companies mentioned, we have extracted the particulars contained in the following paragraphs:—

Gas Companies.

In the annual report which the Directors of the Barnsley Gas Company submitted to the shareholders at their meeting yesterday, they recommended, in addition to the interim dividend, a further payment of 4 per cent. on the general capital stock and "F" shares, 3 per cent. on the "C" preference shares, and 3½ per cent. on the "D," "E," and paid-up calls on the "G" shares (less income-tax in each case). This, they stated, would necessitate the withdrawal of £1226 from the reserve fund. They also called attention to the satisfactory increase in the sale of gas, which would have enabled the Company to pay the dividends recommended without recourse to the reserve fund had not the large expenditure for coal nearly absorbed the increased earnings. The quantity of gas sold was 105,139,200 cubic feet, yielding £18,927; and the amount of coal used was 13,880 tons.

The tenth annual meeting of the Bromsgrove Gas Company was held yesterday week. The report of the Directors stated that the high price of coal had in a measure been provided for by an increase in the sales. Some further extensions had been made in the Lickey district, from which the demand for gas was steadily increasing. The revenue account showed a balance available for division of £1004, with which it was proposed to pay the same dividend as last year—viz., 7 per cent. per annum on the ordinary shares, and 7-10ths of 7 per cent. on the whole of the "B" shares. In moving the adoption of the report, the Chairman (Mr. W. Jefferies) said the Directors had been mindful of the interests of the public as well as of the shareholders, and had not advanced the price like many other companies. They hoped for a reduction in the price of coal; and the consumers might depend that it would be a very serious thing that led them to increase the charge for gas. He considered the year's operations very satisfactory. Mr. Ledbury, as a large shareholder, questioned whether the sum which was drawn from the reserve fund last year to maintain the dividend should not now be replaced, and suggested a deduction from the proposed dividend of 1 per cent. Ten years ago, with a capital of £10,000, they had a reserve fund of £600, and now, with a capital of about £20,000, the reserve fund was only £250. The Chairman contended that the dividend was justified. They had spent £600 on new purifiers and increased the insurance, and had yet earned a 7 per cent. dividend. He did not think they had been in a better position during the last 25 years. The report was unanimously adopted; and the dividend recommended was declared.

The shareholders of the Calverley and Horsforth Gas Company held their half-yearly meeting last Wednesday. In the report which was submitted, the Directors made a few remarks concerning the growth of the business. They stated that the increased consumption of gas (especially in the eastern portion of the district adjoining Leeds) had necessitated considerable enlargements of plant, and the revision and improved arrangement of the main arteries and routes of the supply of gas. In place of mains varying from 10 to 4 inches, a new main of 10 inches had been laid all the way from the works to Newlay, the lowest point in the Company's area of supply; and this had been carried forward as an 8-inch main from Newlay through Horsforth to the old gas-works at that place. The mains and branches had been so fitted with valves that, should any part of Horsforth require an increased supply, it could be

furnished at once from the mains without difficulty or expense. During the year the retort-house had been entirely rebuilt, improved, and re-fitted. The whole cost of this had been placed to a renewal account; and altogether upwards of £1300 had been spent on renewals in the year. Improvements were also being effected in the purifying-house that would ensure the consumers being supplied with some of the best and most pure gas in the kingdom. The number of meters in use had increased by 103 during the year. In the same period £2620 had been expended on capital account, which had been met by calls on the new shares. (Some figures from the accounts were given in the JOURNAL last week.) The Directors recommended that dividends at the rate of 10 per cent. per annum should be paid on £14,000 of original stock, and 7 per cent. on £18,200 of new shares, both of which had been fully earned. The report was unanimously adopted.

The ordinary general meeting of the Chester United Gas Company was held yesterday week; the Chairman of the Company (Mr. F. L. Bagnall, J.P.) presiding. The report which was submitted stated that there was a balance of £4682 to the credit of profit and loss account, after providing for interest on loan capital and the dividend on preferential stock; and the Directors recommended the declaration of the statutory dividends in respect of the half year ended Dec. 31. It was gratifying to the Directors to be able to report that the gas supply had been ample and of good quality, and also that during the past year (as in the previous one) there had been a steady and continuous increase both in the number of consumers and in the use of gas apparatus for cooking and heating purposes, resulting in a very considerable increase in the sale of gas and of rental. There was also a larger return from the sale of residuals; but nearly the whole of the additional income was absorbed by the extra cost of coal and labour and maintenance of apparatus—leaving only an additional balance of £250 to the credit of profit and loss account for the year. Towards the end of the year, the value of residuals fell considerably; and the Directors could hardly anticipate so favourable a return from this source for the current year. The reduction to consumers by way of discount off the current rates for gas in the twelve months amounted to £1140. Taking the whole year, the Company sold upwards of 12,250,000 cubic feet of gas more than in 1890; thereby increasing the gas-rental by rather more than £1800. There was also an advance in the return from residuals of £465. The expenditure was higher by £2040 (of which £1500 was due to coal); leaving a net increase of profit of about £225. The gas unaccounted for during the year averaged 3.07 per cent. on the production. The make of gas per ton was 10,128 cubic feet. The meeting, which was of a merely formal character, was brought to a close by a cordial vote of thanks to the Chairman and Directors, passed on the motion of the Mayor (Mr. C. Brown).

The annual report of the Directors of the Ipswich Gaslight Company says that the profit and loss account shows a balance of £12,204, including the sum of £4128 brought forward from the previous year. Of this amount £3578 has been applied in payment of an interim dividend for the half year ending June 30 last. The Directors recommend a further dividend of 13s. per share upon the "A" shares, 10s. 6d. per share upon the "B" shares, and 10s. per share upon the "C" shares—making, with the interim payment, a dividend for the year of 11½, 9, and 8½ per cent. respectively. A balance will then remain of £3749. The Directors report, with considerable satisfaction, an increase of nearly 8 per cent. in the sales of gas; and coming as it does on a large increase in 1890, it is all the more satisfactory. There is also a large increase from residuals. Unfortunately all the residual products have recently fallen in value; and therefore the Directors expect a decrease under these heads during the current year. Further, all kinds of material continue high in price, especially coal; and although they hope to buy cheaper when next in the market, it is not likely that the difference in price will be very marked. In view of these contingencies, and especially of the necessity of spending a considerable amount of money this year upon larger mains, the Directors remark that it will probably be wise to raise the price of gas to 3s. per 1000 cubic feet. The continued increase in the consumption of gas renders it necessary to enlarge the trunk main from the works. The Board have therefore authorized the Company's Engineer (Mr. J. T. Jolliffe), to lay a 24-inch pipe from the works to Salthouse Street, and from thence an 8-inch pipe to Bridge Street.

At the half-yearly meeting of the Malton Gas Company last Wednesday, the Directors reported that the sale of gas during the past six months showed a small increase on the corresponding period of 1890; but, owing to the abolition of the charge for meter-rents, and a larger outlay upon repairs and renewals, the amount of profit for the half year was not so large. After making provision for interest on mortgages and reserve fund, £1622 was available for division; and the Directors recommended a dividend at the usual rate of 10 per cent., free of income-tax. They also announced that they had resolved to pay off £100 of the money borrowed on mortgage, and to use the reserve fund in its place. The report was adopted on the motion of the Chairman (Mr. S. King). In responding to a vote of thanks, the Manager (Mr. H. Tobey) said the abolition of the meter-rents was equivalent to a reduction of 2d. per 1000 cubic feet in the price of gas, which was now nominally only 2s. 10d. in the borough.

Water Companies.

The ordinary meeting of the Camborne Water Company was held on Thursday last. From the Directors' report it appeared that the total capital expenditure to Dec. 31 last was £21,333, of which £13,000 was raised in calls, and £3000 on debentures, bearing interest at the present time at 3½ per cent. A dividend was declared in August last on the "A" shares at the rate of 8 per cent. per annum, and on the "B" shares of £5 12s. per cent. The revenue account shows receipts during the past half year for water-rents amounting to £1035. The profit on the working was £724, as against £665 in the previous six months. The report was adopted; and a dividend at the same rate as the interim payment was declared.

The accounts which were presented at the seventeenth half-yearly meeting of the Chester Water Company last Thursday, showed the largest result of any one half year during the existence of the undertaking, and a dividend was declared at the rate of 7½ per cent. per annum (free of income-tax), upon the consolidated stock, and 7 per cent. per annum upon the new ordinary stock (1874), which is the

largest dividend they are allowed to declare. The half-year's working showed a surplus of revenue over expenditure of £2686.

The accounts of the Cleveland Water Company for the past half year, which were presented at the meeting of the shareholders last Wednesday, showed a disposable balance of £2500. The Directors proposed the declaration of a dividend at the rate of 6 per cent. per annum on the original and "A" shares, and £4 4s. per cent. per annum on the "B" shares, free of income-tax, and that £250 be added to the contingent fund. These payments, the report said, would absorb £2122, and leave £378 to be carried forward. In the course of the proceedings, Mr. Simpson asked if the chief part of the additional expenditure on capital account was caused by the extension of the mains to Coatham. The Chairman (Mr. Wharton) answered in the affirmative; and then Mr. Simpson desired to know what would be the position of the Company if the Kirkleatham Local Board did not take the supply arranged for from them. The Chairman replied that the Directors were satisfied that they had safeguarded the interests of the shareholders in any event. The Vice-Chairman (Mr. Whitwell), speaking later, said that they had the best legal advice on their position; and a thorough examination of the Company's watershed showed that they could supply 200,000 gallons of pure water per day without encroaching on their storage, which was equal to six months' supply. The report and accounts were adopted.

The half-yearly meeting of the Colne Valley Water Company was held last Tuesday, at the Charing Cross Hotel. Mr. J. R. Hollond presided; and, in moving the adoption of the report and statement of accounts (which were noticed in the JOURNAL last week), stated that the new pumping-engine had been working very satisfactorily, and had quite borne out the estimate of saving which the Directors put before the shareholders when they were about to enter upon the contract for it. The total water-rental for the half year had been £6134, as against £5795 in the corresponding period of 1890; being an increase of £339. The advance in the first half of the year was £335, which made a total increase for the entire year of £674. The saving which had been effected in the pumping expenditure during the past six months had been £511. Multiplying this by two, gave them £1022 for the year. From this had to be deducted the dividend of 3 per cent. on the new shares (£290), which left about £750 as the saving realized by the new engine. In the half year they had laid 105 fresh supplies in the general district, and 89 in the higher district; and these represented an additional income of £243. As to the quantity of water pumped, during the half year ending December, 1890, the daily supply for domestic purposes was 22 gallons per head; in the half year ending June last, it was reduced to 20½ gallons; and in the past half year it was further reduced to 19 gallons. This he attributed to the detection of waste water by the Deacon meters. Mr. C. T. Part seconded the motion; and after a few remarks from Mr. Hepburn concerning one or two slight accidents to the new engine, it was unanimously carried. A dividend at the rate of 3 per cent. per annum was declared; and, in compliance with the wish expressed by shareholders at previous meetings that the Directors should receive some remuneration for their services, a resolution was passed to the effect that they be paid the sum of £500 per annum.

The half-yearly report of the Directors of the South Staffordshire Water-Works Company shows that the business continues to expand in a satisfactory manner. The number of houses laid on during the past six months was 1524; making the total supplied 75,224. The gross amount of water-rates was £39,210, as against £38,443 in the corresponding period of the previous year. The Directors have transferred a further sum of £1000 to the depreciation fund, which now stands at £5186. After providing for interest on debenture and preference stock, and after appropriating the £1000 to the depreciation fund, the amount remaining for division (including £3094 brought forward) is £18,334; and the Directors recommend the declaration of a dividend for the half year on the ordinary stock at the rate of 5½ per cent. per annum, less income-tax. The amount of this dividend is £14,802; and there will remain £3532 for the credit of the next six months.

The annual meeting of the Weardale and Shildon Water Company was held on Monday last week. In moving the adoption of the Directors' report, the Chairman (Mr. D. Dale) stated that there had been an addition to capital of £3629. The net revenue amounted to £28,481, including £3458 brought forward from December, 1890. The gross receipts in 1891 were £34,272, as against £32,644 in the preceding year—being an increase of £1628. The working expenses for 1891 were less by £284. This gave, with the increased receipts, a net improvement on 1890 of £1912; and it was due to this that they had been enabled to raise the dividend to 4½ per cent. per annum. The undivided profit to be carried forward was £4093. The unallotted shares (889) of the fourth issue were offered to the shareholders in November last at £3 premium, and had been taken up. The motion was unanimously carried.

The half-yearly accounts of the Whitby Water Company show a disposable balance of £2116, as against £2081 at the corresponding date of last year. The Directors recommend a dividend of 8 per cent., or 16s. per share (free of income-tax), which will absorb £1600, and leave a balance of £516 to be carried forward to next half-year's account. The Directors record the death of no less than three of their colleagues—viz., Mr. T. Thistle (who has been Chairman of the Board since 1874), Mr. T. P. Yeoman, and Mr. J. N. Clarkson.

Opposition to the North Shields Water Bill.—A public meeting of ratepayers was held at North Shields a few days ago, for the purpose of consenting to the opposition of the Town Council to the Bill of the North Shields Water Company. The Mayor (Alderman J. F. Spence), in moving a resolution to that effect, said he thought the ratepayers would all agree with him that they were already very heavily rated for water. They were paying at the rate of 1s. 6d. in the pound, which was the highest the Company were at present allowed to charge; but they proposed to increase the rate to 2s. in the pound. Therefore it was high time the Corporation were up and stirring themselves, and asking the consent of the owners and ratepayers to oppose such a large increase. Alderman Elliot seconded the motion, which was unanimously carried.

BRADFORD CORPORATION GAS AND ELECTRICITY SUPPLY.

The Financial Position of the Departments.

At the Quarterly Meeting of the County Borough Council of Bradford last Tuesday—the MAYOR (Alderman T. Priestley) presiding—Alderman F. Priestman made his usual half-yearly statement regarding the financial results of the working of the Gas and Electricity Departments.

Alderman PRIESTMAN, in the course of his remarks, said that the revenue account of the Gas Department for the half year ended December last showed an apparent loss of £868. The profit for the corresponding period of the previous year was £3238; so that there was a total difference between the two periods of about £4000. The amount of coal carbonized during the six months was 76,614 tons—being an increase of only 1475 tons—while the cost had been £49,362, or an increase of £3800. This extra cost was accounted for, not so much by the rise in the price of coal, as by the fact that the cheap contracts extending over two years had been completed, and that the price for coal in the year 1891 had been the current price. There was an increase in wages of £750; but the cost of repairs of mains and services showed a decrease of £1000. In the item of interest on loans, there was a decrease of £200; and there was a diminution in income-tax, consequent on lessened profits, of £100. The total expenditure was £97,109, as against £93,443 in 1890. On the other side of the balance-sheet, there was an advance of only £1600 in the income from the sales of gas; the amount being £66,096, as compared with £64,407 in the second half of 1890. Coke had realized £13,433; being a diminution of rather more than £1100. Tar had produced an amount less by £960 than in 1890. The present contract for tar was at the rate of 25s. 6d., while the current price was from 19s. to 21s.; so that he apprehended there would be a further reduction when the existing contract expired, unless some considerable advance took place in the meantime. The chemical works had produced £500 less than they did a year before; but there was an increase of £200 in the sale of oxide. The total income was £96,241, as against £96,681 in the corresponding period of 1890. The items he had mentioned showed the whole of the variations which had taken place on both sides of the revenue account. To this account it must be remembered that the whole cost of lighting the streets was really charged. From a statement prepared by the Lighting Inspector, it appeared that, at the end of last year, there were 7187 lamps in the borough, of which 750 were Bray lamps. It had been carefully estimated what these would cost; and he was assured that the figure would be as near as possible £21,000. The profit for the half year preceding that of which he had been speaking was £6250; so that there was virtually a profit for the year of £26,400, in spite of the apparent loss of £800 on the past half-year's trading. Everything had been charged to revenue account with the exception of the extensions at the Birkshall works now going on and the stoking machinery. There was still a balance on appropriation account of £24,975; a restoration fund in the bank untouched amounting to £25,761; and an amount for premiums on debenture stock of £1743. He believed the gas-works were in an admirable state of efficiency, and were quite capable of supplying an increased quantity of gas if required. Proceeding to speak of the Electricity Department, Alderman Priestman said he was pleased to be able to say that the anticipations expressed by him a year ago had been amply fulfilled. On July 1 there was about £100 worth of goods in stock. Salaries and wages had amounted to £726; but this included wages for a number of men who had been working in the streets. Fittings to machinery had cost £176; coals, £255; water, £23; land (in rent), £83; miscellaneous items, £158; rates and taxes, £38; bank interest and commission, £120—making a total of £1700. Bank interest and commission would not come to nearly so large a figure in future. The Borough Accountant had borrowed money at 3 per cent.; so that the interest would not have to be paid again into the bank. On the income side of the account stood the sum of £3592 for electricity supplied, and the same amount for stock on hand as on July 1. This left a balance of £2001 to the net revenue account. With regard to this account they had to pay for interest on loans £545; sinking fund, £392; income-tax, £92—making a total of £1030, and leaving a net profit for the half year of £971. The interest and sinking fund had been paid from the very commencement. The first half-year's loss on the concern was £1079; the second, £732; the third, £315; and the fourth, £30—a total of £2157. After subtracting from this £971 profit, a loss of only £1186 remained. A great many misleading statements had been made outside by people not authorized to make them. They had been made to members of the Council with a view of inducing them to think that the working of the Electric Lighting Department had been carried on at a very considerable cost and in a very inefficient manner. He was not able to say at present what the cost of coal per horse power was in the working of the engines. To carry out such a test, it was necessary to have a separate engine and boiler, to weigh the water, and weigh the coal. Somebody had stated to him that the cost was about 16 lbs. per horse power per hour. He hoped very soon to be in a position to have a test made; and he would ask some independent gentleman to verify the facts and figures. He would bring before the Council an exact statement with regard to the efficiency, not only of the engines, but of the boilers themselves. The coal which had been consumed during the half year, without reckoning the stocks at the beginning and end, which were about the same, was 865 tons, or 1,942,640 lbs. The total cost of this coal had been £342; and when he reckoned the number of Board of Trade units sold, which were 154,431, he found that the cost of coal per unit had been 12.58d., not 30d. and 34d., as he had heard it stated outside the Council. He believed it was usually admitted that a Board of Trade unit was equal to something between 1½ and 2 horse power; and so, if the matter were reckoned out, it would very soon be found what had been the number of pounds of coal consumed per horse power. The average price of coal—and this was a very important thing to take into account—had only been 7s. 7d. delivered at the works. They had to consider a great number of things in reckoning up how many pounds per horse power were burned. In the first place, there was the banking up of the boilers all the night and all the day when the light

was not on. There was also the lighting of the station. Nothing whatever was reckoned for this; and there was always in the evenings a very large amount of coal consumed for this purpose. Then there was the resistance in the mains, which was an entirely unknown quantity. But he was informed that 20 per cent. was a low estimate of the amount required to get the current through the full system before it acted; and this had to be accounted for in estimating the consumption of the lamps. Another very important direction in which coals were consumed very rapidly was in the trials of the engines. Every one of the engines before it was passed and paid for had undergone a full twelve hours' running without standing for a minute; and whenever these trials had not been satisfactory, they had been made over and over again, and the last engine, he might say, had not been passed, and had not yet been paid for by the Corporation. Therefore he could not estimate, nor could anybody else, the amount of coal used in these trials, which were of a very severe character. He hoped these figures would be closely gone into by the electric lighting journals, and that there might be a discussion upon them; so that it might be seen whether any other station was better than their own, and if so, why—in order that, if they extended their electric lighting plant, they might make any change in the system which might appear desirable. But he ventured to say that Bradford would come out, if not the best, at least among the best, economically considered, of all the stations in existence; and his own opinion was that if they had to start again, and if they were well advised, they would commence exactly on the system on which they started three or four years ago, and which system they had carried on so far successfully, and successfully not only from a scientific point of view, but, as he had been glad to be able to show, from a financial point of view as well. He moved that the minutes of the Gas and Electricity Committee be adopted.

Alderman MORLEY seconded the motion, which was agreed to.

WIGAN CORPORATION GAS AND WATER SUPPLY.

Committees and their Capital Expenditure.

At the Monthly Meeting of the Wigan County Borough Council last Wednesday week—the MAYOR (Mr. Woods) presiding—there was a discussion on the question of the various Committees reporting to the Finance Committee before incurring expenditure on capital account.

Alderman LAMB, in moving the adoption of the minutes of the Finance Committee, said there was an important matter recorded therein to which he thought reference ought to be made. It was a resolution of the Committee that all Committees of the Corporation, before incurring any capital expenditure, be requested to report to the Finance Committee what sum they proposed to expend, in order that the latter might consider the matter, and report to the Council whether the contemplated expenditure was within their borrowing powers, and, if not, what steps were to be taken to obtain such powers. Further, that no expenditure on capital account should be commenced until the Finance Committee had reported that the contemplated expenditure was within the borrowing powers of the Corporation. The matter arose, he believed, in consequence of a letter having been received from the Local Government Board, with reference to the powers that were being sought to increase the capital of the Water Committee. In the course of that inquiry, it transpired that the Water Committee had exceeded their authorized borrowing powers by a sum approaching £7000; and the Local Government Board, in their letter to the Corporation, wanted to know what explanation the Committee had to offer for having spent that money without having obtained power to do so. This was no doubt very serious; and he hoped the Committee would be able to frame such an answer to the letter as would satisfy the Local Government Board to grant the increased power sought for. The Gas Committee, he continued, had obtained power to borrow £30,000; but they were, from time to time, to procure the sanction of the Local Government Board to their expenditure. They had spent £29,424; but they had not hitherto sought the sanction of the Local Government Board, as they ought to have done. He should like to point out that they were very near the end of their tether; and they had not obtained powers to borrow money in advance of their existing unexercised powers, amounting to £500. Their capital expenditure was constantly going on; and he should like to point out to them that it was a matter of the utmost importance that they should immediately take steps to increase their borrowing powers, if it was their intention to spend any additional money. The effort to obtain these powers might supply the opportunity of getting the expenditure which had been incurred justified and allowed, but that remained to be seen. He was afraid that it was a very awkward question for the Gas Committee to answer; but there it was. Then the Sanatorium Committee during the past twelve months had already spent £1000 in excess of their expenditure for last year; and the Streets Committee had expended at least a similar sum. These two Committees had exceeded the estimates prepared at the beginning of the financial year by between £2000 and £3000. Now, it was no use preparing estimates if they were not to be adhered to and no regard paid to them afterwards; because that money could not be spent without incurring liability for its repayment. He did not know whether the spending Committees had considered how the money was to be repaid; but in all probability there would have to be an enlargement of the rate. That was an unpleasant position to contemplate, but in this case he thought it would become necessary. A corporation could not spend money without making arrangements for paying it; and he thought it wanted from time to time the exercise of very great care in that expenditure. The resolution was a step in the right direction and stipulated that there should be from time to time conferences or interviews between the various Committees and the Finance Committee. He assumed that the last-named Committee was that which was looked to to provide the means; and it was necessary that they should be informed what other Committees were spending and contemplating spending.

Mr. CHALK seconded the motion.

Alderman PEACE said that he would like to take the opportunity of

saying a few words on the resolution which the Committee had passed at his suggestion. After the clear and explicit speech of Alderman Lamb, he thought it was absolutely necessary that this course should be closely followed, for the protection of the Corporation. No doubt each member of the Committees of the Corporation was charged with a certain amount of work to do; and they all did their best for the town in laying out their schemes and proceeding to carry out their work, with the result that in many cases their actual legal powers had been over-stepped for want of proper consideration. Now, this was a matter which naturally belonged to the Finance Committee; and after the large number of instances in which various Committees had spent money without having legal power to borrow, it was most desirable that a check should be put upon their financial operations by the Finance Committee.

Alderman RICHARDS said that, as the Water Committee had been mentioned, he should like to be allowed a few words in reply; and, in the first place, he wanted the Council to understand that the Water Committee were probably in a different position to that of any other. The members would remember very well that some years ago the water was in a most filthy condition, and so much so that, when the late Chairman held office, he was very much alarmed, and felt that something ought to be done. Accordingly, the work of putting the undertaking in better order was commenced, and had gone on up to the present time with the greatest possible success; and to show that the Finance Committee were thoroughly aware of what was being done, he need only mention that the Chairman of that Committee had himself visited the works and seen the improvements. Although the Water Committee had overspent their borrowing powers, he thought they were perfectly justified in doing so; for the improvements had all been so successful that, if an inspector came down to look at them, he would be able to see works equal to, if not superior to, any in the country. Again, it must be considered that they could not wait for the long, red-tape process of the Local Government Board. They were bound to get on with the work, or else be poisoned by the filth that was coming down to Wigan; and on that account alone, he asserted that the Committee were justified in doing what they did.

Mr. JOHNSON said the only objection he could find to the Water Committee spending this money was that they had not kept in view the argument that they should not nullify or set at naught an Act of Parliament.

Alderman ACKERLEY assured Mr. Richards that they all heartily approved of what the Water Committee had done; but that did not affect the importance of the step which the Finance Committee had taken. Without wishing to carp at the Water Committee, he asked them to suppose that these works had not turned out successful; what position would the Committee have been in then? The money would have been spent all the same; and it would have been a most difficult matter to get the borrowing powers sanctioned. What Mr. Richards had said, only pointed out the wisdom of the Council in adopting this resolution.

The motion was then passed.

BRIGHOUSE LOCAL BOARD GAS SUPPLY.

Proposed Extension of the Works.

Last Tuesday, Major-General C. Phipps-Carey, R.E., one of the Inspectors of the Local Government Board, held an inquiry at Brighouse into an application made by the Local Board for power to borrow £17,000 for the purposes of their gas undertaking. The plans of a proposed new gasholder-tank, retaining-walls, &c., for the construction of which the proposed loan was asked, were placed before the Inspector, and explained by Mr. J. Parkinson, the Gas Manager to the Board, who had prepared them. The Inspector read the notice calling the inquiry, and asked if there was any opposition. Mr. Parkinson replied that there was none whatever. He then, at the request of the Inspector, proceeded to give a number of statistics in support of the application. He stated that the population of the district in 1881 was 7965; in 1891, 10,276—an increase in the ten years of 2311, being the largest of any local board district in the parish of Halifax. The rateable value of the district for general purposes was £31,176. The total indebtedness of the Board on gas and water works, works of drainage, public offices, and cemetery was £24,191 13s. 5d. The gas undertaking was purchased by the rate-payers in 1846; and in 1884 a Provisional Order was obtained by which the Board were empowered to borrow £15,000 for its extension. The whole of this had been spent; and since then the Board's borrowing powers had been increased by an amount of £45,000 in respect of which the £17,000 now asked was the first application. It was made in order to erect a new holder at the works; the last having been put up in 1868. The annual production of gas in 1871 was 24,698,000 cubic feet; in 1881, 44,743,000 cubic feet; in 1891, 69,572,000 cubic feet; and the consumption was still on the increase. The bulk of the gas was consumed within the district. The existing gasholders had a storage capacity of 140,000 cubic feet. The average consumption of gas per diem in the winter season was 400,000 cubic feet. This showed that they could not store half a day's consumption. To increase the storage capacity, they proposed to erect a holder capable of containing 750,000 cubic feet of gas; and they estimated that this would meet the requirements of the district for the next 30 years. For some time the selling price of gas had been 2s. per 1000 cubic feet net; and the profit last year on the gas undertaking, after transferring £450 to the general district rate fund, was £1113 19s. 9d. The new holder and tank would be constructed entirely of wrought iron, and would be annular in form. The foundations would be 15 feet below the ground level; and at the bottom there would be a layer of concrete 12 inches thick. The tank would be of iron; and the holder would be in three lifts. It was estimated that the tank would cost £7000; the holder, £8000; and the remaining £2000 of the loan asked for would be spent in building the retaining walls, supplying the connections and mains to the holder, and in laying a 21-inch main. It was imperative that the work of construction should be entered upon at once, as storage capacity at the works was absolutely needed. On one occasion during the winter now

passing, the supply failed to meet the demand made upon it; several of the mills having to remain unlighted in order that the householders and shopkeepers might have a gas supply. Even if the work were started at once, there was some doubt as to whether the new holder could be ready for use next winter.

The inquiry was of a somewhat prolonged character; the Inspector going very minutely into all the details of the scheme. He expressed his personal satisfaction with the proposal; and subsequently, in company with Mr. Parkinson and several members of the Board, visited the gas-works, where he inspected the site of the proposed holder, and expressed himself highly satisfied with the efficiency and management of the works.

THE DANGERS OF MINERAL OILS.

In the course of an interesting paper on the use of oil for lighthouse illumination, read by Mr. E. Price Edwards, of the Trinity House, at the Society of Arts last Wednesday, he alluded to the dangers attending the employment of mineral oils of low flashing-point in domestic lamps. He stated that he had just tried five different kinds of oil in lamps of similar construction, and had taken the temperature of the oil in the reservoir of each after five hours' burning; the bulb of the thermometer being kept in the oil during the whole period. Sample No. 1 had a flashing-point of 248° Fahr. with the Abel test; No. 2, 154°; No. 3, 114°; No. 4, 86°; No. 5, 76°. The temperature of the oil after five hours' burning was as follows: Samples Nos. 1 and 2, 86°; No. 3, 87°; No. 4, 85°; No. 5, 88°. The author applied a flame to the filling-hole of each lamp in succession; and from the first three there was no indication of vapour, although the flame was put completely into the reservoir. On applying the flame to the fourth, there was a slight indication of disturbance; but on putting it to the fifth, an explosion immediately took place—a tongue of flame about a foot long shooting up from the hole, and the flame of the burner being forced up the chimney by the pressure of the exploding gas in the oil in the reservoir. These tests proved that a large quantity of inflammable vapour had been formed with the fifth sample of oil; and the author commended the fact to the serious consideration of all users of mineral oils. He showed how easily an accident might occur with such oil as that standing last in the list. Supposing, he said, while the storage of vapour existed in the lamp, the reservoir required replenishing with oil. The filling-hole would perhaps be opened, and the vapour liberated. It might then ascend to the flame through the air-holes, or be ignited by a lighted taper or match brought near to show how much oil should be poured in; and in either case the consequences would possibly be very serious. The author expressed the hope that the Legislature would, in the interests of the general public, put such restrictions on the traffic in, and the use of, all oils which give off dangerous vapours at temperatures below 100° Fahr., with the Abel test, as will prevent such oils from being distributed all over the country for general use. That oils of inferior quality are sold is evidenced by the fact that at Trowbridge only a few days ago four persons—mother, sister, and two daughters—were severely injured by an explosion, from the effects of which one subsequently died. It appears that a quart of paraffin oil had been procured from a shop in the locality, and the mother was engaged in replenishing an ordinary house-lamp, when the explosion was caused by one of her daughters (a child five years old) approaching too near with a lighted candle.

Sale of the Holt Gas-Works.—At Farndon last Wednesday week, Mr. Cunnah sold by auction the Holt and Farndon Gas-Works. They have been worked for some years by the late Mr. Hughes; and, since his death, by his executors. Bidding started at £400; and eventually they were knocked down at £500.

Electric Lighting for Blackburn.—The Blackburn Corporation have instructed Mr. T. Burton, an Electrical Engineer, to map out a large central area for illumination with the electric light. The parliamentary powers of the Corporation expire in August next; and it is intended to have at least 2000 lights going before then.

The Smethwick Gas Undertaking.—At the monthly meeting of the Smethwick Local Board last Friday, the Gas Committee reported that the sale of gas for the year ended Dec. 31 last amounted to 145,465,900 cubic feet; being an increase of 4,365,100 cubic feet over the previous year. The increase in the rental account amounted to £613. The demand for gas during the preceding winter having exceeded the productive power of the works, necessitated consideration of the question of providing such additions and extensions of plant as would enable the Committee to meet the increasing requirements on the part of the public. There has been a progressive increase in the make of gas during the past ten years, equal to about 25 per cent. Having thoroughly investigated the matter, the Committee decided to recommend the Board to adopt Klönne's regenerative furnaces, and to entirely refit the retort-house on this principle, which will increase its productive power by upwards of 50 per cent., or equal to a daily make of 1,440,000 cubic feet of gas, against 860,000 cubic feet per day by the present retorts; besides which great economies will be effected in labour, fuel, &c.—the saving in this respect being estimated at £1031 in one year, based upon last year's working. The other additions to plant which the Committee found it necessary to recommend the Board to adopt, comprised a new chimney, station meter, exhaust, condenser, washer, offices, and stokers' mess-room. Mr. Brookes moved the adoption of the report, and also a resolution authorizing the Clerk to apply to the Local Government Board for their sanction to a further loan of £9000 to defray the cost of the extensions at the gas-works as recommended by the Committee. He pointed out that it was absolutely necessary that the alterations should be made, as they were now working the existing plant to its utmost capacity; and if the consumption continued to increase in the future in a similar ratio to the past, they would soon be unable to supply the requirements of the district. The Committee considered the new furnaces would amply repay them, and that, under the circumstances, they were justified in incurring those expenses. The motion was carried unanimously.

ELECTRIC LIGHTING FOR PORTSMOUTH.

The New Scheme Agreed to.

At the recent Quarterly Meeting of the Portsmouth Town Council, the Electric Lighting Committee were successful in getting passed the report on Professor Garnett's scheme for the supply of electric light in the borough which they first presented a few weeks ago (see *ante*, p. 120). It will be remembered that the Committee recommended that the portion of the resolution previously passed by the Council adopting Mr. Shoolbred's scheme be rescinded; that Professor Garnett's scheme should be adopted; and that they should be authorized to acquire a suitable site for the central station. Alderman Ellis, in moving the adoption of the first recommendation, said Mr. Shoolbred's estimate in respect of the private lighting scheme was that each lamp would earn £1 6s. per annum; whereas it came to the Committee's knowledge that the average earnings of a lamp were only £1. They invited Mr. Shoolbred to prove his estimate; but the only English town he cited in support of the figure of £1 6s. was Bradford. He (Alderman Ellis) then went to Southampton, where the nearest electric lighting station was in existence, and found that the average earnings per lamp were only 18s. To adopt Mr. Shoolbred's scheme, under the circumstances, would probably have meant a loss of thousands of pounds of the ratepayers' money per annum. Under these circumstances, the Committee felt it was only the right thing to do to come before the Council, admit their mistake, and make the present recommendation that the resolution adopting Mr. Shoolbred's scheme be rescinded. Professor Garnett's report, he added, did not reach them for many days after this decision had been arrived at in Committee. Mr. Dittman seconded the resolution, which was agreed to. Alderman Ellis then proposed the adoption of the second clause, recommending that the scheme and report of Professor Garnett should be adopted, that he be appointed Consulting Engineer, and that Messrs. Waller and Mandeville be appointed Superintendent Engineers, the fees for both together being £1500. He remarked that the Committee were not proposing any new-fangled notion which had not been tried in other towns, but one which would, when the whole of their lights were going, give a profit of £3000 per year. Mr. Foster seconded the proposition. Sir W. Pink moved, as an amendment—"That it be an instruction to the Electric Lighting Committee to consider, and obtain information as to the possibility of utilizing tidal power for the lighting of those parts of the borough contemplated in the Provisional Order, and to report to the Council." He supported his view by reading a letter from Colonel Crease, who pointed out the value of the power of the tide at Langstone Harbour. Another letter which he read was from Sir F. Bramwell, who held a similar view. Mr. Miller seconded the amendment. Mr. Fuller stated that he was satisfied the tide could be utilized; and if they could save £2000 a year by such a system, it would be worth waiting six months for. There was some further discussion on the amendment, but eventually the resolution was carried. The third clause, with respect to securing a site for the central station, was also agreed to.

ELECTRIC LIGHTING BY GAS COMPANIES IN THE COLONIES

The Rockhampton (Queensland) Gas Company's Electric Lighting Scheme.

In November, 1889, the Rockhampton Gas Company obtained an amended Act from the Queensland Government to enable them to supply electricity for all public and private purposes within the municipality of Rockhampton and the borough of North Rockhampton, including the bridge over the River Fitzroy, which separates the two townships. The Company have been carefully watching the growth of the electric lighting industry; and about three months ago they issued a circular with the object of ascertaining what success might be expected to result from the establishment by them of a central station. The townspeople responded so well, that the Company have decided to put down plant at once for the supply of electricity. For this purpose, they have purchased a very suitable site on which to erect their central station, and the supply will embrace three zones. Within a radius of 500 yards from the station, the system will be the low-tension (2-wire), at 110 volts; beyond this area it will be the alternate current transformer system; and for the public street lighting, negotiations for which have been opened up with the Council, direct currents will be employed—the lamps being placed at the intersections of the various streets. The town being laid out on the block system, like Melbourne, the lighting will doubtless be effective. Thus the station will be able to supply all demands at whatever distance. Plant for 1000 low-tension lights of 16-candle power and 500 alternate current lamps of 10-candle power will be put up to begin with. Among the first consumers are St. Paul's Church, which will be lighted by eight Brockie-Pelt arc lamps, each of 500-candle power; the Liechhardt Hotel will have 120 lights; and sundry shops, private houses, &c., will make up altogether about 850 lamps of 16-candle power. The supply will begin about July next. The whole of the work has been planned by, and will be carried out under the supervision of, Mr. A. E. Neal, the Company's Electrical Engineer. The Company will also undertake to furnish isolated installations in Queensland.

A New Water Reservoir for Wakefield.—The Water Committee of the Wakefield City Council have accepted a tender from Mr. Thomas Oliver, of Topley, near Sheffield, for the construction of a reservoir in connection with the new water-works at Green Withens, for the sum of £120,995.

Exhibition of Gas Appliances at Darlington.—An exhibition of gas cooking-stoves and gas-fires was opened by Alderman Sedgwick in the Corn Exchange, Darlington, last Tuesday afternoon. The exhibition was arranged by Messrs. Richmond and Co. Limited, of Warrington and London, through the Corporation Gas Department; and Madame Gothard, of London, was engaged to give a series of free practical lessons on cookery.

LINCOLN CORPORATION WATER SUPPLY.

An important report was submitted to the Lincoln Town Council last Tuesday week, by a Special Committee, on the different sources of supply of water for the city, and as to whether any other and better sources can be obtained. The report dealt very exhaustively with the matter; but it will suffice to give here the conclusions at which the Committee arrived. They state: "(1) That the existing water supply is sufficient as regards quantity for the present and near prospective needs of the city, and that any inconvenience produced in very dry seasons (by lowering the Fosdyke, Brayford, and the Lower Witham), in consequence of taking water from the Upper River Witham, can be obviated by a comparatively small expenditure in obtaining increased engine power at Torksey. (2) That the water now supplied to the district is, at least, a fair second-class water; and, having regard to the general health of the inhabitants within the limits of supply, and to the fact that London and many large towns take their water supply, either wholly or in great part, from rivers, and still maintain a low death-rate, the Committee do not recommend the Council to incur the cost of obtaining any new supply, even if such new supply were obtainable. (3) That it cannot be said, with even a distant approach to certainty, that any other supply of pure and wholesome water, sufficient in quantity for the requirements of the district, can be obtained at a reasonable cost. (4) That borings, as suggested by Mr. De Rance, might or might not show that a sufficient supply of water for the district could be obtained. The approximate cost of these borings and other works is as follows: At Scothern—Two wells sinking, &c., £1126; one mile of headings, £528; pumping, land, and contingencies, £1046; total, £3000; six miles of 12-inch pipes, £8500; 85-horse power engine to raise a million gallons per 24 hours, £8500—total, £20,000. At Boultham—Boring to a depth of 20 feet, 24-inch tubes, £14,160. In case trial-tubes of 16 inches were used, the expense would be one-third less—viz., about £10,000; and if water were found, the additional outlay might then be incurred. If the water would not rise to the surface, the cost of a small engine to pump it must be added. At Collingham—Boring to a depth of 1000 feet, 24-inch tubes, £6000; nine miles of 18-inch pipes to engines, £17,424; land, &c., £500; total, £23,924. This estimate supposes that no pumping will be required at Collingham, and that the water will flow to Lincoln by gravitation; but if, as Mr. De Rance thinks will be the case, pumping should be necessary, 50 per cent. must be added to this sum, making it £35,886." On the suggestion of the Chairman of the Committee (Mr. E. Pratt), it was resolved to simply receive the report, and to postpone the discussion.

BEYROUT WATER-WORKS COMPANY, LIMITED.

The Annual General Meeting of this Company was held on Tuesday last at the Offices, 17, King's Arms Yard, E.C.—Mr. E. EASTON in the chair.

The report which was presented stated that the gross revenue for the past year amounted to £12,474, against £12,282 in the previous year; being an increase of £192. After making proper allowances for proportion of cost of new machinery and depreciated value of stores, and carrying £1000 to reserve for contingencies, a net balance remained of £6829.

The CHAIRMAN said that the report showed that the business was steadily, although perhaps slowly, extending; and taking into account the visitation of cholera on the Syrian coast during the year, the Directors were fully satisfied with the progress made. The gross revenue exhibited an increase; and if they could obtain what they were seeking for—an extension of the concession—this increase would be of great importance in the future.

Mr. J. MORRIS seconded the motion.

The CHAIRMAN then read a letter from a shareholder (Mr. R. Canton), in which he commented upon the unsatisfactory results of the working of the concern. They had now, he said, reached the twentieth year of their existence; and there was still no prospect of paying a dividend. This being the case, he suggested that perhaps arrangements could be made with the Trust which had been formed for the purpose of acquiring water companies' properties for taking over the concern, as he believed that such a Trust could better afford to wait for their profits than private individuals.

Mr. MORRIS said that the Directors had been trying to get the concession extended; and it would be a very great boon to the Company if they could get another 30 or 40 years added. Their present concession was for 40 years, 20 of which had already run out. The troubles in Turkey and Egypt had brought them into their present difficult position; and if they could get an extension of the concession, they might suggest to the shareholders some means of reconstructing the Company.

The CHAIRMAN remarked that he did not think any Trust would care to take over the property. The income, however, was steadily increasing; and if they could be sure of that income for 30 or more years, they might be able to make the shares to a certain extent valuable. The Directors had not received any fees for the past 16 or 17 years.

After further discussion, the resolution was carried.

The retiring Directors (Messrs. Easton and Morris) and the Auditors (Messrs. Moore and Son) were re-elected; and the proceedings then terminated.

Business Change.—Mr. A. Russell, who was formerly with Mr. R. Marshall, of Glasgow, has joined Mr. T. Marks in business as cannel and gas coal merchants, at 53, Waterloo Street, Glasgow.

A New Gasholder for Swansea.—Owing to the demands which are made upon them, by the growth of the town and the outlying districts, the Swansea Gas Company have found it necessary to extend their storage accommodation. In consequence, they have placed in the hands of Messrs. John Aird and Son the contract for a new holder, which will be capable of containing nearly a million cubic feet of gas, and which they hope to complete in about twelve months.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

When making my remarks last week upon Dr. Ivison Macadam's testing of the gas supplied in Edinburgh and Leith, I was unaware whether the gas he tested at 56, Hanover Street was from the Edinburgh or Leith works. The premises are in the Leith district, but very near its outer edge; and as the coupling up of the mains has not yet been fully carried out, it would have been dangerous to say, off-hand, from which of the works the supply to them was derived. I have now learned, on reliable authority, that both the gases Dr. Macadam tested were from the Edinburgh works. The discrepancy of two candle-power, I presume, arose from the tests not having been made at the same time; and from the fact that the apparatus used at Hanover Street was only temporarily fitted up. I understand that Dr. Macadam made only one test, which was not sufficient. It is but just to him, however, to say that he did not put forward the result as indicating any delinquency on the part of the Gas Commissioners. He had but a very limited commission from the Merchants' Association; and no one would know better than himself that he was treading upon very slippery ground in making a single test in a building not fitted up for testing purposes and with temporary appliances. Had he been a less capable man, he would probably have denounced the Gas Commissioners for the difference in illuminating power; but he not only did not arrive at an adverse conclusion himself, but he carried the Merchants' Association with him.

A statement has got into one of the local evening papers this week to the effect that, owing to the extra outlay for coal, &c., it is feared that the price of gas in Glasgow is likely to be advanced 3d. per 1000 feet, thus bringing it up to 2s. 9d. The writer of the paragraph says he has been told that this should have been done last year, if the Gas Committee had had the courage to face the public. He asks, What says the Convener, or rather ex-Convener, to this? I suppose the question is put to ex-Bailie M'Laren, who was long the active and enthusiastic Convener of the Finance Committee, but is not now a member of the Town Council. That gentleman does, I am aware, entertain the notion that the price of gas will have to go up in Glasgow. We shall see by-and-by.

The Watching and Lighting Committee of the Kilmarnock Town Council recently agreed to offer the Corporation Gas Committee a lump sum of £650 on account of gas for lighting the existing public lamps during the coming season (inclusive of the illuminated clocks,) the quantity of gas allowed for each lamp to be 2½ cubic feet per hour; a like proportion being paid for any additional lamps that may be erected. When the proposal came before the last meeting of the Town Council, Bailie Wilson said that the question of street lighting had been before the Watching and Lighting Committee for some time; and he thought it must be admitted by those persons who were in the habit of watching the street lamps, that the amount of light given out by them was ridiculously small. During the last twenty years, the gas consumers had reduced the debt by £22,000. Surely, then, it was quite reasonable for the Committee to expect, seeing that the public had paid that amount of money, that they should get some little benefit from the gas-works. They were asking 2½ cubic feet of gas per hour instead of 2 feet as at present. The speaker went on to say that they had plenty of precedents to go by—Greenock, Hamilton, and Paisley all subsidized local taxation to a large extent; and he did not think that the Gas Corporation, in agreeing to the proposed arrangement, would be doing more than their duty to the inhabitants of Kilmarnock. Mr. James Browne, Convener of the Gas Committee, was of opinion that the question should not have been brought before the Council until the Committee had had time to discuss it; but Bailie Wilson submitted that it was desirable to get a recommendation from the Council, as it might have some influence on the Committee.

At the same meeting of the Council, there was submitted by the Gas Committee a statement of accounts in connection with the gas-stove department from its commencement up till last month, as prepared by the Town Chamberlain. This showed that the total expenditure had been £598 15s. 7d.; the income in all amounting to £205 12s. 5d.—or an excess of expenditure of £393 3s. 2d. Against that there was £332, as purchase price of stoves on hire, together with 12½ per cent. profit on gas sold for fires, stoves, &c. (£34). These two items reduced the loss to £25 10s. The Gas Committee's report went on to say that during the month from Dec. 14 to Jan. 14 there had been manufactured 12,193,800 cubic feet of gas; being an increase over that of the corresponding month of 1890-91 of 1,196,800 feet. The illuminating power of the gas was an average of 26 standard candles.

I have frequently observed friction among the members of the Dunbar Gas Commission; but the matters in dispute were not, as a rule, worthy of being taken notice of here. This week, however, a subject has been started which is both important and unpleasant. At Wednesday's meeting of the Gas Commissioners, Bailie Anderson, the recently appointed Convener of the Gas Commissioners, made a long statement in which he alleged that he had discovered that the coal supplied to the gas-works was short in weight. In one lot of invoices, he had found 2 tons 12 cwt. of shortage, in a second 2 tons 2 cwt., and in another 11 cwt.; but that in the last two waggons he found an excess of 5 cwt., while another wagon was 6 cwt. over weight. Bailie Anderson complained that Mr. Cuthbert, the Gas Manager, did not keep him informed as to what was going on, but acted on his own responsibility. He also stated that their coal contracts for the year were nearly exhausted, and asked for instructions. Mr. Smith, the late Convener, defended Mr. Cuthbert, who, he said, was very reliable and a man of great experience; and he characterized Bailie Anderson's action as "downright spite" towards the Manager. An unseemly wrangle went on for some time, out of which nothing came except that the Gas Commissioners were empowered to deal with the matter of the coal supply. It transpired that the coal contractors had been written to with reference to the shortage. They had expressed surprise, and stated that they went by the colliery weights, which were correct; and they wished to have the railway company's weights to submit to the collieries. It was evident that Bailie Anderson proceeded upon the railway company's weights; and without saying

anything against their accuracy, it is just possible that the short weight might be attributable to the risks of transit. There can be no doubt that the colliery weights, are accurate; and if the coal sent out is not delivered at the gas-works, it must have disappeared on the road—for which the railway company ought to be responsible. To a small gas-works, a few tons of coal are a matter of consequence; and Bailie Anderson is right to insist upon exactitude in weight. I scarcely think, however, he was justified in his tone towards the Gas Manager. It is certainly the Manager's duty to report to him whatever he may discover to be going wrong. But the Convener should also keep his eye upon all that goes on; and if short deliveries of coal have been going on for some time, he ought to have found it out and checked it sooner than he did.

Mr. Whimster, the veteran Engineer to the Perth Gas Commissioners, is in trouble again with reference to the capacity of the gas-works. A few years ago, somewhat extensive additions were made to the retort-house and storage portions of the works; and these have been, and are still, sufficient to cope with an increased output—the present trouble being, as it is in certain other places, with the disposal of the spent lime. This is difficult to sell; and in the Perth works it has accumulated to such an extent that storing it is complained of as costly. In a report which Mr. Whimster has submitted to the Works Committee on the subject, he recommends that either the lime should be recalcined, or that the purifiers should be added to and rearranged, so that, by the partial use of oxide of iron, the quantity of lime required might be considerably reduced. The matter was reported to the Gas Commissioners on Monday night; and they instructed the Works Committee to consider it in conjunction with reports submitted by Mr. Whimster on the same subject in the years 1887 and 1890.

As I have for some time anticipated they would, the Police Commissioners of Inverness have for the present given the *quietus* to the hasty proposals which were being made to have a portion of the burgh lighted by electricity. The proposal seemed to be little more than the fad of one member, Bailie Jonathan Ross. It was knocked on the head by Mr. W. J. Smith, who brought out that Bailie Ross's Special Committee had expended £142 16s. 7d. upon preliminary inquiries, and had not been able to produce a feasible scheme—in fact, were not even able to agree upon the system of power which they would adopt in the event of their going in for an installation. Mr. Smith thought they made a mistake at the beginning in employing engineers who knew nothing about electricity. The proposal was made by Bailie Ross that they should continue their investigation by consulting a practical engineer. Provost Ross was opposed to their going any further with the inquiry in the meantime. His information, he said, was that an electric lighting scheme would cost between £30,000 and £40,000; and he thought they must just tell the community that the electric light was impossible in the present circumstances. By nine votes to eight the Commissioners discharged the Special Committee. The corollary to that resolution was the confirmation of the resolution of the Gas and Water Committee to proceed with the enlargement of the gas-works. An attempt was made to get the Commissioners to agree to a modified scheme, whereby £2300 less would be required; but in view of the rapidly increasing consumption of gas, it was thought advisable to proceed with the proposal of Mr. Thomson, the Gas Manager. The Commissioners do well to place their confidence in Mr. Thomson, who has conducted the business with marked ability in all its departments, and particularly in the working of the sulphate of ammonia plant, which is their latest addition to the works. The extension of the gas-works is to be proceeded with at once.

An interesting little function took place a few days ago in the old retort-house of the Dalmarnock works of the Glasgow Corporation. Mr. Robert Dobbie, one of the foremen (in which capacity he has served for over twenty years) celebrated the fiftieth anniversary of his wedding day; and it was decided among his workmen to present him with a golden wedding gift, in the form of a purse of sovereigns, an ivory-handled Malacca walking-stick, and a pair of gold-rimmed spectacles for his good lady. These were handed to Mr. Dobbie in due form by Mr. Manwell, the Works Manager, in the presence of Messrs. Patterson, Warden, Frane, M'Intyre, and Craig, and a gathering of about 400 of the workmen.

My attention has been called to a mistake which was made by Mr. Kenneth Fraser, the Convener of the Gas and Water Committee of the Inverness Corporation, and which was reproduced in this column on Jan. 12, in a statement to the effect that their output of gas was increasing at the rate of half-a-million cubic feet per annum. The annual increase, I am informed, is from 3½ to 4 million cubic feet.

The dispute between the Falkirk and Larbert Water Trust and Messrs. D. Y. Stewart and Co., of Glasgow, the contractors for the recently-constructed water-works for the district, was to have been brought before Mr. J. M. Gale, M. Inst. C. E., of Glasgow, as Arbitrator, in Edinburgh, last Tuesday; but on the previous day a settlement was effected, which obviated the production of evidence. The terms agreed upon are that the contractors acknowledge that the works have not been completed in the terms of the specifications; and they agree to pay to the Trustees such sum by way of damages as may be fixed by Mr. J. Watson, of Bradford, and Mr. J. Wilson, of Greenock.

Gas Meter Inspectors' Dinner at Liverpool.—Last Tuesday evening, the Liverpool Gas Company's meter inspectors and their friends, presided over by Mr. J. Grisenthwaite, Superintendent of the Department, had dinner together at the Pembroke Hotel. The usual loyal and patriotic toasts having been given, the health of the Treasurer of the Company (Mr. J. F. Robinson) was heartily drunk with musical honours. The Chairman then made some remarks about the Company and also the automatic gas-meter. He referred to his remarks at the last annual dinner, when he anticipated that about 2000 would be fixed during the ensuing year; and he was pleased to say that his anticipations had been realized, with 600 over, making 2600 fixed, and 1077 applications still on the Company's books awaiting attention. The remainder of the evening was pleasantly passed in listening to some well-rendered songs and instrumental selections.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, Feb. 13.

Sulphate of Ammonia.—The market does not show increased activity. Still spot parcels keep moving off fairly; but, in consequence of the low quotations made for second-hand parcels, prices are somewhat easier. At Hull and Leith, business is reported at £10 8s. 9d.; and at Liverpool, dealers have accepted £10 6s. 3d. to £10 5s.—a price which does not harmonize with the figures obtained at the works for good Lancashire makes. At the close, there is rather more inquiry; and a further decline is therefore not foreseen. The dulness of the Continental demand is freely commented upon; but the fact is generally overlooked that the orders have been taken by the speculators. Nitrate offers at 9s. 6d.

LONDON, Feb. 13.

Tar Products.—Considerably more business in the lighter tar products is reported. Benzol is realizing a better price; and solvent naphtha is in greater request. Toluol, however, remains neglected; but if producers would only take care that the difference between the value of 50's and 90's benzol was kept in parity, toluol would improve. It must not be forgotten that carbonizers do not produce toluol. Creosote and common oils continue to be a drug. But producers are now burning them as fuel very largely; and this, taken in connection with the lessened production, will soon relieve the glutted stocks. There is more inquiry for creosote oils; but the price for it does not tempt distillers. Carbolic acid is moving off slowly; but as there are no stocks, and the demand is still fairly good, it is hoped the value will improve with the advance of spring. Anthracene continues a "dead letter." Several important contracts for tar have been let, at prices ranging between 16s. and 20s. The average prices for the week may be taken as follows: Tar, 18s. Pitch, 33s. Benzol, 90's, 2s. 5½d.; 50's, 1s. 9d. Toluol, 1s. 4½d. Solvent naphtha, 1s. 3d. Crude benzol naphtha, 30's, 1s. Creosote, nominal, 1d. Crude naphthalene, 30s.; hot pressed, 40s. Crude carbolic, 1s. 1½d. Crystals, 5½d. Creosote, 8½d. Anthracene, 30 per cent., "A" quality, 1s.; "B," 8d.

Sulphate of Ammonia.—Makers are beginning to despair of any improvement in this market. Business is difficult; and the demand seems to be remarkably slack for the time of the year. This is all the more curious, since nitrate is not only firm and dear, but in some ports distinctly scarce. All sorts of prices are quoted; and business has actually been done at £10 to £10 8s. 9d., less 3½ per cent., according to position, conditions, and delivery. Gas liquor (10-oz.) is quoted at 6s. 6d. to 8s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The demand for nearly all classes of fuel continues to quieten down throughout this district; but except in some inferior descriptions, there is still no appreciable giving-way in prices. Supplies, however, of the better classes of coal are gradually becoming in excess of requirements for house-fire purposes; while common round coals, which are only in moderate demand, are becoming more plentiful in the market, and in many cases colliery proprietors are barely maintaining late rates. At the pit mouth, best Wigan Arley is still firm at about 12s. 6d. per ton; Pemberton four feet, and second qualities of Arley average 10s. 6d. to 11s.; common house-fire coals, 9s. to 9s. 6d. per ton. The lower qualities of round coal are still quoted at about 8s. to 8s. 6d. at the pit mouth, for steam, and forge purposes, but these are the top figures; while for shipment, good qualities of steam coal are readily obtainable at about 10s. to 10s. 3d. per ton, delivered at the ports on the Mersey. Best qualities of engine fuel meet with a ready sale, at late rates; but common sorts of slack are again hanging upon the markets, and to secure business, lower quotations are being very freely made. At the pit mouth, burgy averages 6s. to 6s. 6d.; best slack, 5s. to 5s. 6d.; medium sorts, 4s. 3d. to 4s. 9d.; and common descriptions, 3s. to 3s. 6d. per ton.

Northern Coal Trade.—The northern coal trade has been decidedly easier during the past few days; though the dread by some users of the outcome of the miners' agitation, has led to more shipments and to a little check to the decline in prices. For best Northumbrian steam coal, as low as 9s. 6d. per ton f.o.b. has been taken, and the contracts for the Swedish railways have been at lower rates. The price for the bulk of the coals, taking an average of the freight, represents something like 9s. 3d. per ton f.o.b., and that over the shipping season. For second-class steam and small steam coals the prices are correspondingly low. Gas coals are also lower on the last few days; and now about 8s. 6d. to 8s. 9d. per ton f.o.b. may be taken as the rate for best Durham gas coals, prompt delivery. For contracts over the season, a less price is being taken; so that it is clear that the rates for coals have fallen considerably. It is very doubtful what will be the outcome of the wages agitation; but its occurrence points to the desirability of stocks of coal in users' possession being well maintained. Bunker coals are lower, and the very best screened qualities have been reduced from 12s. to 11s. per ton f.o.b.; while unscreened qualities are correspondingly low. For manufacturing coals, owing to the strike of the engineers, there is now a very limited demand, and with large supplies, the price is very weak in consequence. Household coals are very dull. In coke, best blast furnace qualities are fairly steady at from 15s. 6d. to 16s. per ton f.o.b. Gas coke is very quiet—the strike at the cement works having allowed stocks to increase. The price is weaker generally.

West of Scotland.—An easier feeling is noted in the coal trade of this district; the mild weather both in this country and on the Continent is against prices. There is very little forward business reported; the transactions being chiefly of a prompt or early description. The following are last week's prices f.o.b. at Glasgow Harbour: Splint, 9s. to 9s. 3d. per ton; main coal, 7s. 9d. to 8s.; steam, 10s. to 10s. 3d.; ell, 8s. 6d. to 8s. 9d. The exports of Scotch coal during the week were 109,449 tons—an increase on the previous week of 9000 tons. For the first five weeks of the current year, the exports reached 521,933 tons; or 156,555 tons more than during the same period of 1891, when business was much interfered with by the railway strike.

Reduction in the Price of Gas at Doncaster.—At a meeting of the Doncaster Town Council last Wednesday, it was resolved, upon the recommendation of the Gas Committee, to reduce the price of gas from 2s. 11d. to 2s. 6d. per 1000 cubic feet, and to allow 3 per cent. discount upon all annual accounts from £50 to £75, and 10 per cent. upon those exceeding the latter amount. As services and meters have been fixed free, and no meter-rent charged, for the past two years, the consumers have good reason to be satisfied with the Corporation gas undertaking, the practical management of which is in the hands of Mr. R. Bridge.

Accident at the Wolverhampton Gas-Works.—Last Wednesday afternoon a distressing accident occurred to John Townsend, who is employed as a labourer at the Stafford Road Gas-Works, Wolverhampton. As a railway coal waggon was being shunted on the metals in the yard, the poor fellow accidentally fell in front of the moving vehicle, which passed over him. One of his thighs was dreadfully lacerated; and it is anticipated that amputation will have to be resorted to. He has also received other injuries to his hands and side, and had to be removed to the General Hospital. Townsend is about 35 years of age, and has been a servant of the Wolverhampton Gas Company for many years.

Electric Lighting at Hawick.—On Monday night last week, the High Street of Hawick was illuminated by the electric light. The work has been carried out by Messrs. Mavor and Coulson, of Glasgow, who are of opinion that they can light the streets cheaper by electricity than by gas, provided motive power can be obtained from Wilton Lodge. The Town Council have arranged to make a three months' experiment; and, in the meanwhile, the driving power is supplied by the engine at the sewerage works. The cost of the experiment will, it is said, considerably exceed £100. Referring to this matter, a local paper says: "The electric light experiment from one point of view has succeeded; from another—that of the public expectation—it has failed. Of course, the public might not be justified in expecting so much; but there is no question that they have been sadly disappointed. One thing is certain—the money is as good as thrown away. We are informed that the entire cost of the experiment will not be far short of £200. We hardly think it is worth two hundred pence, from a practical point of view; for we know just as much about the electric light as we knew before, and no more."

The Gas Question at Eccles and Swinton.—Last Wednesday afternoon a deputation from the Eccles Local Board met the Gas Committee of the Swinton and Pendlebury Local Board to arrange, if possible, for clauses to be inserted in the Bill promoted by Swinton, so as to avoid opposition from Eccles. Mr. Peter Hampson, who presided, said that the Swinton Board were quite desirous of meeting Eccles in an amicable manner, and would agree to anything that was fair and reasonable. Mr. George Trenbath (the Clerk to the Eccles Board) stated at considerable length the clauses which the latter Board were desirous of inserting in the Bill. These were as to the differential rate; the control of the lamplighters, Swinton to retain the control of the formanship; the quality of the gas and the raising of the standard of illuminating power from 14 candles to 18 candles (the quality given by Salford); and the insertion of a clause enabling the Local Boards to constitute a joint-gas authority, Eccles to supply their own district, as distinguished from the original scheme that it should also supply the out-districts, including Irlam, Cadishead, Worsley, and Little Hulton. After considerable discussion, it was agreed on behalf of Eccles that the proposals should be reduced to writing, in order that they might be considered by the Swinton Board.

New Offices for the Ipswich Gaslight Company.—Last Saturday week, the Ipswich Gas Company formally entered into occupation of new offices which they have erected in Carr Street. At 11 o'clock in the morning, the Directors and the Secretary and Manager (Mr. J. T. Jolliffe), with other heads of departments, assembled at the main entrance. The Architect of the building (Mr. J. S. Corder) presented a silver key to the Chairman of the Board (Mr. Sterling Westhorp); and that gentleman, after expressing a hope that good fortune would attend the enterprise, and congratulating his colleagues upon the completion of the work, proceeded to unlock the door and take possession. The ceremony was very brief and simple; but later on, an excellent luncheon was served in the Board-room. The new building has a frontage to the street of 32 feet; and up to the first-floor level, it is constructed of Scotch red sandstone. On the ground floor is the general office and the private room of the Secretary and Manager. Nearly the whole of the first floor is set apart for trade purposes. At the end of the landing, is a large Board-room in which will be held the annual meetings of shareholders. In the rear is a room in which the Directors will meet; and the whole space at the back is reserved as a show-room for gas fittings and appliances. The new offices, occupying as they do a central position in the town, will be a great convenience to the public.

Business Transfer.—The gas engineering and ironfounding business which has been for years carried on by Messrs. J. T. B. Porter and Co., at Gowt's Bridge Works, Lincoln, has been disposed of by them to their Manager (Mr. W. Bralsford) and a gentleman associated with him in partnership, who will carry it on in future under the style of "Porter and Co.," under the personal supervision of Mr. Bralsford, who has for 23 years taken an active part in the concern.

Morris and Cutler's Patent Condenser.—This appliance, we learn, is already in use in 70 important gas-works; and Messrs. S. Cutler and Sons have in hand the third order they have been entrusted with from Manchester (for the Bradford Road station), as well as two condensers, each of 1½ million cubic feet per day, for the Belfast Corporation Gas-Works. They have also received instructions to supply others for Harrogate, Ramsgate, Brazil, and Hong Kong.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 289.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon invest-ment.
£			p. c.					£ s. d.
GAS COMPANIES.								
590,000	10	15 Oct.	10½	Alliance & Dublin 10 p. c.	10	16-17	..	6 3 6
100,000	10	"	7½	Do. 7 p. c.	10	11½-12½	..	6 0 0
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105-107	..	4 13 5
100,000	20	27 Nov.	8	Bahia, Limited	20	12-14	..	11 8 6
200,000	5	12 Nov.	7½	Bombay, Limited	5	6½-7	..	5 7 1
40,000	5	"	7½	Do. New	4	4½-5½	..	5 14 1
380,000	Stock	13 Aug.	12½	Brentford Consolidated . . .	100	210-220	..	5 11 4
150,000	"	"	9½	Do. New	100	157-162	..	5 14 2
220,000	"	16 Sept	11½	Brighton & Hove Original . .	20	40-42	..	5 9 6
888,500	Stock	16 Sept.	5	Bristol	100	98-103	..	4 17 1
320,000	20	15 Oct.	11½	British	20	43-45	..	5 0 0
50,000	10	28 Aug.	11½	Bromley, Ordinary 10 p. c.	10	18-20	..	5 15 0
51,510	10	"	8½	Do. 7 p. c.	10	13-15	..	5 13 4
328,750	100	2 Jan.	6	Buenos Ayres (New) Limited	100	52-64	..	6 5 0
200,000	100	13 Aug.	8	Do. 6 p. c. Deb.	100	93-96	..	5 18 6
150,000	20	15 Oct.	13½	Cagliari, Limited	20	25-27	..	5 10 0
550,000	Stock	15 Oct.	10½	Commercial, Old Stock . . .	100	240-250	..	5 10 3
130,000	"	30 Dec.	4½	Do. New do.	100	190-195	..	3 13 2
800,000	Stock	30 Dec.	13	Do. 4½ p. c. Deb. do.	100	118-123	..	5 13 0
200,000	"	"	10	Continental Union, Limited .	100	225-230	..	5 2 7
75,000	Stock	16 Sept.	10	Do. 7 p. c. Pref.	100	185-195	..	5 0 0
486,090	10	29 Jan.	10	Crystal Palace District . . .	100	190-200	..	5 0 0
354,060	10	"	10	European, Limited	10	19-20*	..	5 0 0
5,470,820	Stock	12 Feb.	12	Do. Partly paid 7½	7½	14-15*	..	5 0 0
100,000	"	"	4	Gaslight & Coke, A, Ordinary	100	215-219*	+1½	5 9 7
665,000	"	"	10	Do. B, 4 p. c. max.	100	94-97*	+1	4 2 5
30,000	"	"	5	Do. C, D, & E, 10 p. c. Pf.	100	245-250*	+2	4 0 0
60,000	"	"	7½	Do. F, 5 p. c. Prf.	100	116-121*	+½	4 2 9
1,300,000	"	"	7	Do. G, 7½ p. c. do.	100	169-174*	+1	4 6 2
463,000	"	"	10	Do. H, 7 p. c. max.	100	148-152*	-1	4 12 1
476,000	"	"	—	Do. J, 10 p. c. Prf.	100	241-246*	+1	4 1 3
1,061,150	"	11 Dec.	4	Do. K, 6 p. c. Prf.	100	145-150*	+1	4 0 0
294,850	"	"	4½	Do. 4 p. c. Deb. Stk.	100	112-115*	+1½	3 9 7
908,000	"	"	6	Do. 4½ p. c. do.	100	118-123	..	3 13 2
3,800,000	Stock	12 Nov.	12	Do. 6 p. c. do	100	160-165	..	3 12 9
75,000	5	26 June	6	Imperial Continental . . .	100	222-226	-1½	5 6 2
560,000	100	1 Oct.	5	Malta & Mediterranean, Ltd.	5	4-4½	..	6 13 4
541,920	20	27 Nov.	6½	Met. of Melbourne, 5 p. c. Deb.	100	108-110	-1	4 10 11
150,000	5	27 Nov.	10	Monte Video, Limited . . .	20	15-16	..	8 2 6
60,000	5	30 Sept.	7	Oriental, Limited	5	8½-9	..	5 11 1
166,870	10	26 Feb.	2	Ottoman, Limited	5	4-5	..	7 0 0
420,000	100	3 Nov.	6	Pará Limited	10	2½-3½	..	—
500,000	100	1 Dec.	6	People's Gas of Chicago—				
150,000	10	15 Oct.	10	1st Mtg. Bds.	100	100-105	..	5 14 3
500,000	Stock	28 Aug.	15½	2nd Do.	100	100-105	..	5 14 3
1,350,000	"	"	12	San Paulo, Limited	10	10-11	..	9 1 10
200,000	"	"	13	South Metropolitan, A Stock	100	272-277	+2	5 11 11
725,000	"	30 Dec.	5	Do. B do.	100	225-230	..	5 4 4
600,000	Stock	16 Sept.	11½	Do. C do.	100	238-243	+5½	5 7 0
WATER COMPANIES.								
729,331	Stock	30 Dec.	10	Tottenham & Edm'ton, Orig.	100	138-143	..	3 10 0
1,720,560	Stock	15 Oct.	8	Chelsea, Ordinary	100	256-261	..	3 16 7
544,440	"	30 Dec.	4½	East London, Ordinary . . .	100	204-209	..	3 16 7
700,000	50	11 Dec.	8	Do. 4½ p. c. Deb. Stk. . . .	100	136-140	..	3 4 3
708,000	Stock	12 Feb.	10½	Grand Junction	50	100-104	-1½	3 16 11
1,043,800	100	30 Dec.	9½	Kent	100	263-268*	..	3 18 4
406,200	100	"	7½	Lambeth, 10 p. c. max. . . .	100	225-230	-2½	4 2 7
260,000	Stock	30 Sept.	4	Do. 7½ p. c. max.	100	189-194	..	3 17 4
500,000	100	12 Feb.	12½	Do. 4 p. c. Deb. Stk. . . .	100	120-123	..	3 5 0
1,000,000	Stock	29 Jan.	4	New River, New Shares . . .	100	330-340*	+1	3 11 4
902,300	Stock	30 Dec.	6½	Do. 4 p. c. Deb. Stk. . . .	100	123-126*	..	3 3 6
126,500	100	"	6½	S'thwk & V'xhall, 10 p. c. max.	100	146-150	-1½	4 6 8
1,155,066	Stock	11 Dec.	10	Do. D 7½ p. c. do.	100	140-145	..	4 9 8
				West Middlesex	100	245-250	-2½	4 0 0
						*Ex div.		

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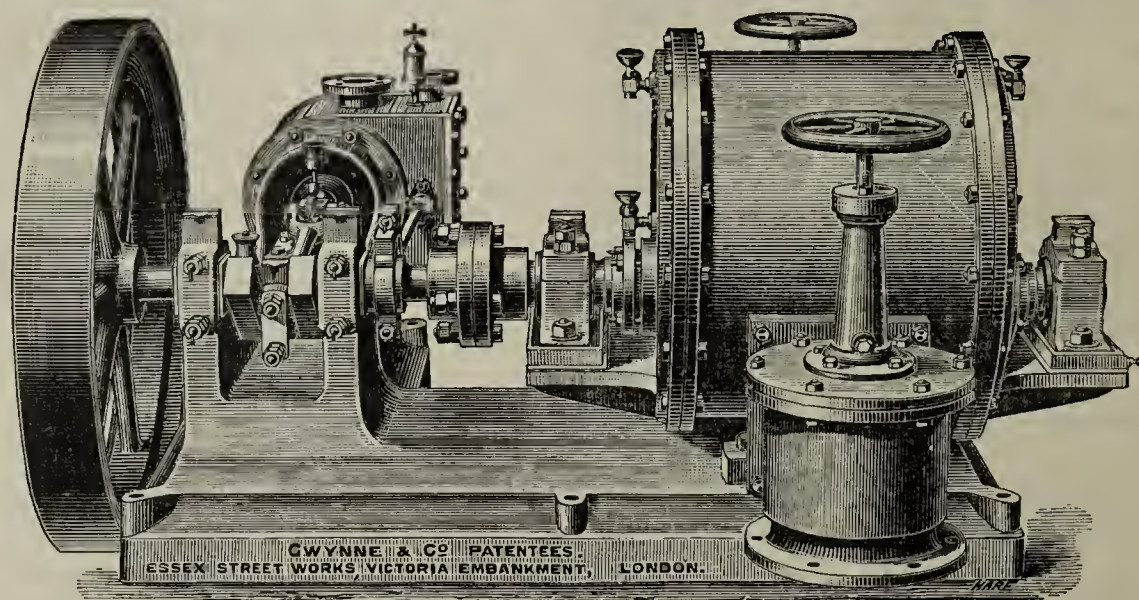
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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

THE

JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, FEBRUARY 23, 1892.

The South Metropolitan Meeting.

THE meeting of the South Metropolitan Gas Company on Wednesday last was fairly well attended; and the assembly was repaid for the trouble of making a pilgrimage to London Bridge in threatening weather by an interesting speech from the Chairman, Mr. George Livesey. Everybody who knows Mr. Livesey also knows that he is a man of strong views respecting a variety of points of gas-works administration, and that in his case "out of the fulness of the heart the mouth speaketh." We believe that the South Metropolitan Chairman hardly ever gets on his legs at the general meetings of the Company without having registered an inward vow to "make it short." But the

result usually is that his stock of experiences and his vivid perceptions of the hour refuse to be condensed; and so by the time he sits down he discovers that, after all, he has spoken at some considerable length. There are certain topics that rarely fail of being touched upon whenever Mr. Livesey addresses a meeting of gas shareholders; prominent among them being capital expenditure, the sliding scale, and the condition of gas-works labourers. Of course, he dealt with all these, and more, last Wednesday; but, in addition, he had a very pressing matter to discourse upon in the depreciated value of coke. This subject was put in the first part of the Chairman's speech, as it occupied the forefront of the Directors' report. It is Mr. Livesey's opinion, as it unquestionably has all along been ours, that there has been no solid justification for the enormous advance in the price of coal which has afflicted all classes of buyers during the past year or two. That there was less justification for this advance than there was for that of the coal famine years 1873-5 is maintained by Mr. Livesey from the circumstance that this time residuals—coke, tar, &c.—have not participated, as they did then, in the expansion of value of the raw material. To follow the lessons drawn by Mr. Livesey from these facts, it is necessary to piece together the first and the penultimate portions of his address, because in the former he states the case of his Company in regard to the questions of coal and coke values, and in the latter he shows how the sliding scale has modified the position of Gas Companies since 1875. Measured by the drain upon the reserve for the double purpose of avoiding unnecessary increase in the price of gas and keeping up the normal dividends, the strain of the last two years has been more severe than that of 1873-5. But yet in every case the last pinch has been overcome at less cost to the public than the first; and this effect, Mr. Livesey urges, is due to the action of the sliding scale. It is impossible to avoid the reflection that this argument, which really bore more upon the action of The Gaslight and Coke Company than upon the circumstances of the South Metropolitan Company, supplied a better apology for the former than was furnished to Colonel Makins for his address at the recent meeting in the Horseferry Road.

Upon the labour question Mr. Livesey is naturally more prone to talk than ever, since his appointment on the Royal Commission. Here day after day the procession of witnesses from the classes of employers and employed files before him; and he would be more or less than human if he did not apply to the statements he hears in this way the test of his own experience of the workman in peace and war. Mr. Livesey is anxious to make others understand that, so far, the experiment which he has adopted at the South Metropolitan Gas-Works is a great success. It is a matter which he has very greatly at heart; and so he talks about it as freely as all men do concerning the things which are uppermost in their minds. Mr. Livesey is very much more than a man of one idea. His mind responds to many notes; but it vibrates and finds utterance in vivid speech when the chord of Labour is struck in its presence. It is very likely that some of his audience at these meetings fail to share his enthusiasm for essaying to solve this modern riddle of the Sphinx—the question of Labour. Whether there are any such or not, they seem quite content to take their Chairman as they find him; and the South Metropolitan shareholders, as a body, appear both interested and pleased when Mr. Livesey talks to them at large on the topics that so obviously interest himself.

Upon the subject of the libel case of *Higgins v. Ward*, the Chairman was able to give explanations which, if they had appeared sooner, might have prevented the circulation of much silly and malicious rumour. It now appears that the plaintiff in this suit appealed to the South Metropolitan Directors—his employers—for protection against the slanderous aspersions upon his character which Ward, the paid Assistant-Secretary of the Gas Workers' Union, thought fit to vent in public in the supposed interest of Trade Unionism. The necessary protection was given; and the man's vindication and his assailant's discomfiture were complete. It is possibly a matter for congratulation among Trade Unionists and their press supporters that the £200 damages, and costs, given to the plaintiff in this case by the Court, cannot be recovered, since the Trade Union official had nothing to distrain upon. The consequences of the judgment cannot, however, be

other than unpleasant to the individual in question ; and they will also serve as a salutary check to other loose-tongued gentry of the same breed, which is a sufficient public gain.

The expenditure of capital upon new works, and the upkeep of meters and stoves, were also dealt with by Mr. Livesey, who, moreover, mentioned the subject of the nominal rate of dividend, and the real return to investors in the Company's stocks. This last was the principal topic discussed from the body of the hall ; one proprietor asking whether it would not be possible to adopt some such scheme of unification of capital, upon the basis of a dividend more nearly expressing the return to investors who have bought their stock at a premium, as those which have recently been suggested. In his reply, the Chairman gave it to be understood that the matter had not been overlooked by the Board ; but he disclosed cogent reasons why no such projects should be meddled with by those responsible for the safety of the Company's capital.

The Consequences of the Coal Porters' Strike.

IT has been stated that there was more than met the eye in the recent strike of London coal porters at the behest of their Union officials ; and that if these wire-pullers had been able to maintain their position, a general revival of the "strike policy" would have taken place all over the country. When it was discovered that, although willing enough to turn out by order, the coalies were disposed to think for themselves with regard to the justification for, or the policy of the movement, the order to return to work was given to prevent the appearance of a complete breakdown of the Union organization, which would have occurred at the end of the week or the beginning of the next, when the men intended to go in with or without official permission. Our suggestion of last week, that the apparent reluctance of the East-end coalies to resume their employment was really due to a desire on their part to keep "Saint Monday" before turning in again, was borne out by the facts ; for on Tuesday there was a general falling-to upon the old terms. It is not pretended, even by the Union Press, which claimed the result of the strike as a victory for the men, that the conditions of their employment have been altered in the slightest degree whatever. The notice issued by the employers' Society was not withdrawn or modified in any way, and so the members of this organization retain their asserted liberty to employ any man they please, irrespective of whether or not he belongs to a Union ; and they have successfully defended themselves from falling under the fate, with which they were threatened, of being made agents for enforcing the payment of Union subscriptions. Fresh evidence has transpired in the meanwhile to prove that the central station Electric Lighting Companies of the Metropolis were caught, when the strike began, in a far less favourable condition for keeping up their supplies of current for a week of no coal deliveries than are the Gas Companies when subjected to a week of thick fog. It has even been reported that the manager of one electric light works was driven to appeal for help to the superintendent of one of the London gas-manufacturing stations, and begged for the promise of a few tons of coal out of store if the strike should last over the end of the week. The gas engineer, it is said, did not commit himself to any engagements of this nature ; but, having an eye to business, he sent the applicant some loads of coke, with advice to try whether this fuel would serve the turn.

It is notorious that the fundamental principle of the New Trade Unionism is the aphorism that what is sauce for the goose is *not* sauce for the gander. Thus, while it is the depth of iniquity for an employer of labour to refuse to employ unionists as such, it is held, by those to whom Tom Mann and Co. are the prophets of a new dispensation, that it is the height of virtue for unionists to refuse (when they dare) to work with freemen. This principle has never been more crudely exhibited than it is in last week's number of the *Trade Unionist*, where in the same column the coalies' strike is glorified as a brilliantly successful operation "to resist the open and formal establishment of a systematic black-list," and the action of the conductors of the paper in "black-listing" two County Council candidates is maintained as proper and reasonable. There is plenty of "moral" in this little bit of inconsistency, for those who take the trouble to pick it out.

The Chartered Rating Appeal—A Disputed Point.

THOSE of our readers who have followed the great assessment appeal of The Gaslight and Coke Company, and may have expected, according to promise, that the whole affair would have been finished last Friday, must possess their souls in patience for yet another week. On the day named, the matter was "mentioned" in Court ; but the point raised, although of grave importance, was purely a preliminary one to the final apportionment, the settlement of which has been again postponed until next Friday. It has transpired that the parties take diametrically opposite views of the meaning of the Court with reference to the valuation of the "landlord's share," which is fixed, by the terms of the judgment, at the sum of £620,500. The words of the judgment are : "We find the landlord's share, *subject to deduction for rates*, to be £620,500." The following sentences go on to explain how this amount is to be treated. It now appears that the appellants wish to construe the phrase in italics as meaning that the whole amount of rates payable is to be deducted from the sum stated ; but the respondents hold that it only means that this sum is to be corrected by the difference between the rating now to be fixed and that which prevailed in the account year, which constitutes the datum for all calculations by both parties. This view has been sanctioned by a so-called "Explanatory Note," handed down by the Chairman, the text of which will be found in another column. Meanwhile, however, the appellants have had time to appreciate the difference which the two readings of the Chairman's phraseology would mean to them (it is said that this difference would be upwards of £30,000 a year) ; and accordingly they appeared in force before the Court on Friday, with the object of getting their view of the point adopted by the Chairman. The plot was soon disclosed by the appellants' leading Counsel, Mr. Littler, Q.C., who proceeded to characterize the "Explanatory Note" already referred to as a "substituted judgment"—a statement which on the instant aroused the Court into strong antagonism. After nearly an hour's talk, in which the appellants' view was advanced by their Counsel in every shade of argument, from meek pleading by Mr. Castle, to the minatory bluster of Mr. Danckwerts, Sir Peter Edlin was left maintaining his right to explain his own judgment in his own way ; and the net result of the day was to add some more heavy figures to the tremendous costs incurred. This has indeed been one of the most remarkable assessment cases on record, whether it is judged from the complexity of the proceedings or the amount of money involved. We hope to be able to state next week exactly how much both sides have gained or lost by the appeal ; but meanwhile it may be remarked that the opinion is held by many that the Company will have little cause for satisfaction with the way in which matters have gone.

The Board of Trade Report upon Private Bills and Orders.

THE Board of Trade have issued their customary report upon the proposed Private Bills and Provisional Orders of the session, as noticed in another column. The nature of these projects for legislation, so far as gas and water supply is concerned, has already been explained in the JOURNAL. From this report it appears that there are 19 Bills relating, either wholly or in part, to the supply of gas—all English. There is not a single Scotch or Irish Gas Bill in Parliament this year ; so that if any scheme for the devolution of Private Bill Legislation to local Commissioners of Parliament representing either of the sister kingdoms is carried into effect this session, as threatened, it will not affect the Westminster practitioners in this particular line of business. Taking the whole class of Gas, Electric Lighting, and Water Bills together—43 in number—it is reported that the total capital proposed to be raised under these schemes amounts to £9,447,900, or no less than £7,026,572 more than in 1891. The particulars of all the proposed measures are neatly tabulated in the usual way in the report. The manner in which the Bills are grouped is stated ; but nothing is specially mentioned with regard to new clauses. Some of the Gas Bills do contain a few novelties, however, as will have been already seen by our abstracts ; and the dealings of Parliament with these may prove interesting, so far as they go. The most remarkable feature of the whole class of Bills is not in the gas, but in the water schemes ; and it is Wales which is to be most affected by this year's Private Bill business.

The Dealing in Chartered Residuals.

It looks as if the questions of fact and of policy opened up at the recent meeting of The Gaslight and Coke Company are to grow more serious the longer they lie open to the public gaze. Referring to the subject of the dealings of the Company in residuals, which was raised by Sir F. Mappin, and temporarily disposed of by an adroit repartee of the Governor, Colonel Makins, we have now to state that a correspondent has drawn our attention to the evidence in the case of *Stockman v. Dasnières*, which was reported in our "Legal Intelligence" in the issue for May 13, 1890. This was an action arising out of a transaction in pitch. It is unnecessary to repeat the story as laid before Mr. Justice Day and a special jury; but the point of it which bears upon the Chartered system of disposing of residuals consists in the statement made in evidence that "the plaintiff bought for himself, in a rising market, 1000 tons [of pitch] from Mr. W. G. Blagden, the agent for The Gaslight and Coke Company (who has the larger proportion of the pitch for sale on the London market); *resold the stuff to Mr. Blagden* on the 13th of that month at a profit of £56 5s.; and on the same day bought again for Mr. Dasnières, at a further advance in price of 1½d. a ton." Now, be it observed that we offer no comment whatever upon this evidence, in so far as it affects Mr. Blagden personally or as a business man. The report is strictly *bonâ fide*; and its accuracy has never been called in question. The matter comes before us again, however, in the new form of an illustration of the gravamen of Sir F. Mappin's interpellation of the Chartered Board. The point of the reference is contained in the words which we have italicized; and the whole question is as to how this record is to be reconciled with Colonel Makins's statement of the 5th inst., that the agent of The Gaslight and Coke Company for the sale of residuals "never buys an ounce or a ton for himself." Believing, as we are justified in doing from this report, that Mr. Blagden on at least one occasion did buy a residual for himself, the query as to whether he was or was not permitted to do so by the terms of his appointment under the Chartered Board is, in the first place, a matter for the parties to this arrangement. There is nothing culpable in buying or selling pitch in the ordinary way of trade; and the Chartered Board are within their right in making any agreement they think good in the interest of the Company for the disposal of their residuals through an agent who may be in the trade. It is also competent for a shareholder to address an inquiry to the Board upon the subject; and we suppose it will not be gainsaid that, when such an inquiry has been publicly made, it is reasonable to expect a trustworthy answer to it. The situation now created is exceedingly awkward, and requires to be cleared up with the least possible loss of time. We are called upon to mention the matter for the sake of correcting a public statement of the Governor of the Company, which appears to be, on the face of it, misleading; just as was his citation of Cambridge as a town where the price of gas had been advanced by 10d. per 1000 cubic feet, which we were called upon to put right last week. Moreover, it does not rest with us to give or withhold publicity in regard to this affair. The whole report of the case cited has been reprinted from our columns, not by us, and is apparently being circulated widely among persons presumably interested in the class of transactions referred to; and our readers will await with pardonable curiosity the explanations which the Chartered Administration, or the other parties concerned, may have to offer of the circumstances as they stand.

Death of Mr. W. H. Michael, Q. C.—We regret to record the sudden death, on the 15th inst., at Schloss Labers, Meran, Tyrol, of Mr. W. H. Michael, Q. C., the well-known Parliamentary Counsel, and joint author, with Mr. Shires Will, of the standard work on "The Law of Gas and Water Supply" with which their names are associated. Deceased was in his 71st year.

Presentation to Mr. J. B. Fenwick.—Last Thursday, Mr. J. B. Fenwick, Manager of the Windermere Gas and Water Works, was presented with a testimonial by his friends in that town, on the occasion of his leaving to take the position of Manager of the Retford Gas and Water Works, to which, as announced in the JOURNAL a few weeks ago, he has lately been appointed. The testimonial consisted of electro-plated adjuncts to the dinner-table and a choice set of table cutlery, accompanied by a scroll bearing an inscription commemorative of the event. The gift was suitably acknowledged by Mr. Fenwick.

ESSAYS, COMMENTARIES, AND REVIEWS.**GAS AND WATER COMPANIES IN THE STOCK MARKET.**

(For Stock and Share List, see p. 356.)

THE past week was a very dull one for the Stock Exchange, and business was flat, stale, and decidedly unprofitable. It is hard to find a single redeeming feature about the entire period. The Continental Bourses were much depressed, and nothing at home showed a ray of brightness. Even American rails gave way; while as for home rails, nothing cheerful could be looked for in a week of blizzards and snow-blocks. *A propos* of rails, an interesting feature was the renewed attempt, adroitly engineered by the Stock Exchange, made at the North-Western meeting on Friday, to force the obnoxious Forged Transfers Act down the throats of the Board. Our views concerning this "Act for the Encouragement of Forgery, and for enabling stockbrokers to pocket their commissions without having earned them," have been fully expressed before; and we find nothing in the latest arguments advanced in support of it, to change our opinion as to the utterly wrong principle upon which it is founded. The manner in which Lord Stalbridge dealt with this attempt was excellent; and he is evidently determined not to allow his Board to be coerced by interested agitators. The Money Market is in a better condition, and rates are hardening. The Gas Market has not shown much activity, and there is but little change to note in values. Movements have not been uniform, but rather in accord with the special circumstances of each issue; though there does appear to be a more general disposition to invest in the preferentially secured stocks. Gaslight "A" opened firm, and was steadily though moderately dealt in at about 217½ every day until Friday, when a parcel was done "specially" at 216; and the quotation was knocked down 1. The debenture stocks were in demand; and the 6 per cent. issue rose 3. The preferences and the limited were fairly active, and sellers of "H" raised their price one point. South Metropolitans were much more brisk and very firm; the "B" especially realizing good figures, though the quotation was only put up 1. Commercial were quiet, and they look firm. Suburbans and Provincials were unchanged. The Tottenham and Edmon-ton Company appear to have had a good half year; having earned their 11½ per cent. dividend within a pound or two. Of the Continentals, European was firm; but Union was not quite so strong, and Imperial suffered a fall of 1½. Among the rest, the only changes were in South Americans; Buenos Ayres and San Paulo receding ½ each. The Water Companies are about as they were; the only variation being a relapse of 1 in Grand Junction.

The daily operations were: Gas opened well on Monday, but did not attain any degree of activity. Advances were made of 1 each in South Metropolitan "B," and Gaslight 6 per cent. debenture; and ½ in ditto "H." Tuesday's business was mostly in Gaslights and South Metropolitan "B," which were firm; but Imperial Continental fell 1½. Prices continued equally good in the Gas Market on Wednesday; but Grand Junction Water receded 1. On Thursday, business was about the same; and the general tendency to firmness was maintained. Friday was much quieter, and a fall of 1 in Gaslight "A" and ½ in Buenos Ayres took place. Gaslight 6 per cent. debentures, however, advanced 2. Business on Saturday was very limited; but prices had a healthy tendency generally, though San Paulo lost ½.

RICHARDS AND PAYNE ON THE METROPOLITAN WATER SUPPLY.*

To write upon the subject of the Metropolitan Water Supply, and yet "to abstain from taking any side in the present controversy," would seem to be a somewhat difficult and self-denying task. It has, however, been fairly well performed by the two barristers, learned in the law, who are the authors of this book; the feat being accomplished mainly by adhering as closely as possible to the historical and legal elements of the question. We have thus a digest and a compilation; giving a bird's eye view of a very wide field. The book is dedicated, by permission, to Sir John Lubbock, as Chairman of the London County Council. In this there is nothing incongruous; for, although Sir John has expressed an opinion that the Companies were the best custodians of the water supply, he is in no sense a partizan. The dedication, in fact, simply implies the absence of any intention to attack the Water Companies. In the history of this subject, it is interesting to note that the Commission of 1851, consisting of Mr. Graham, Mr. Miller, and Mr. Hofmann, reported in favour of the existing supply on several points; one being that putrefactive decomposition takes place less rapidly in hard than in soft water. It was further declared that "the advantages of the present sources are enhanced by the enormous quantity of water they are capable of supplying." Disadvantages were enumerated, due to flood waters and the presence of sewage. These are matters which, of course, have been dealt with very differently since that date. Concerning the inconvenience of using hard water for domestic purposes, the

*"The Metropolitan Water Supply." By H. C. Richards and W. H. C. Payne, Barristers-at-Law. London: Argus Printing Company, Limited.

Commissioners remarked that the hardness of the London water was of the least objectionable kind; being of a temporary character, capable of being diminished to a considerable extent by boiling. With regard to the result of giving a supply of soft water to the Metropolis, it was objected that the "antiputrescent" quality of the hard supply would be lost, and the water rendered less fit for the few days' storage which must always be had in reserve to meet the casualties of city distribution. A greater discoloration of the water resulting from oxidation of the iron pipes was also to be apprehended than that which was observed with the existing hard and alkaline supply. If the evidence of Mr. Homersham was to be relied upon, there was little fear of a want of water. This Engineer calculated that the area of land sloping towards Watford, consisting for the most part of chalk hills, embraced more than 1200 square miles, and was capable of yielding 408 million gallons daily if required. This estimate may be excessive; but it was independent of whatever might be obtained from the chalk beds to the south-east of London. The Commissioners concluded their report by an emphatic recommendation of the chalk spring water, both in respect to its quality, and the fact that the sources were near at hand. They contended that, "with such a noble application of the chalk spring water in view as the supply of the Metropolis, it would be a desecration to permit that water to be wasted on other uses, and most impolitic to allow the possession of it to pass into private hands."

It is a question whether we have not to go back to the Commission of 1851, known as the Chemical Commission, for the best and truest light on the Metropolitan Water Question, so far as the physical facts are concerned. The Royal Commission of 1867, under the presidency of the Duke of Richmond, presented an admirable report in 1869, but scarcely advanced the subject any further, except to show that the river and well supply combined was adequate and satisfactory, or could be made so. The Rivers Pollution Commission, which followed later on, reported in favour of the spring and deep-well water in the same manner as the Chemical Commission of 1851. The Rivers Pollution Commissioners were satisfied that an abundant supply could thus be obtained, and of the purest quality. Without admitting that the absolute surrender of the river supply would be wise, or is at all needful, we wish to draw attention to the circumstance that eminent authorities who have desired to see the river supply abandoned, have not felt it necessary to advise recourse to a source of supply outside the Thames and Lea watersheds. If we wish to see schemes of this nature advocated, we must go to the reports of the London County Council; the assumption being made that the quality of the present supply is seriously defective, and that the quantity will soon prove inadequate. In respect to quality, the water supply has undergone material improvement in recent years; and as for quantity, there is evidence enough in the work before us to show that there is no ground for apprehension.

The more recent events connected with the London Water Supply are included in the book—coming down to November last, when the Court of Common Council resolved to give the requisite Parliamentary Notices for the introduction of the London Water Bill agreed upon between the Corporation and the County Council. So much for history. There are sundry chapters on law, concerning which we are told: "It is no easy task to unravel the Acts of Parliament which, bound together, constitute the law which regulates the relationship between the Water Companies and the State." Some reflections are cast upon the Companies with reference to this state of things; it being made to appear that the "learned and powerful counsel" employed by them have been too clever for the Select Committees of Parliament. This part of the book, indeed, shows a little departure from the neutral tone generally adopted. Something might have been said as to the way in which Parliament has damaged the Companies, by substituting rateable for annual value as the basis of charge for the supply. A very considerable sum has thus been lost to the Companies, in direct contravention of an established right.

We may presume that the authors of this useful compendium had in view the probability of a serious struggle in Parliament during the coming session, on the subject of the Metropolitan Water Supply. The projected Royal Commission—down to which date the book does not proceed—disposes of any such idea. A couple of years will probably elapse before we get into the thick of the fight; and by that time Messrs. Richards and Payne will perhaps issue a fresh edition of their work, giving the latest particulars. In the meantime, the book will be of service to all who wish to know something as to the history and position of the London Water Companies.

The Vacancy in the Board of the Brighton and Hove Gas Company.—There has been a very persistent rumour of late as to the probable successor to the late Mr. Fuller on the Board of the Brighton and Hove General Gas Company. Influenced doubtless by what has recently appeared in our columns on the subject of the "mutual help" association of certain combinations of directors, auditors, &c., the report of the Brighton Company, after alluding to Mr. Fuller's death, states that "in accordance with the provisions of the Company's Act of 1881, the vacancy at the Board will not be filled up."

ELECTRIC LIGHTING MEMORANDA.

Mr. W. H. Preece on the Cost of Electric Lighting—The Cost of Incandescent Lamp Renewals—Electric Lighting at Bradford and Newcastle.

IN the course of the very plausible statement respecting the question of electric lighting which Mr. W. H. Preece was permitted to lay before the readers of the *Daily Graphic*, he not only asserted generally that the electric light is actually capable of competing with gas upon an equality as regards cost, but he ventured upon an ingenious explanation of the reason why consumers of electricity find in practice their lighting bills increased. It is that users of electric lamps will not be content with the same quantity of light that they had been satisfied with from gas; and so, as they insist upon having more lamps, the cost is increased accordingly! This is an audacious statement; but it is tolerably well known how the truth stands. Mr. Preece, and those who side with him in his forlorn attempts to make users of electric lamps doubt the evidence of their pockets, have to make use of a series of assumptions, which they industriously trot out time after time with a touching reliance upon the boundless credulity of the British public that recalls the manner of the late lamented Dr. Kenealy. These assumptions are—first, that every gas-burner in domestic use burns after the rate of 5 cubic feet per hour; second, that these gas-burners never give more than 10 candles illuminating power; third, that a nominal 8-candle incandescent electric lamp affords quite as much light as the foregoing. When the much-enduring subscriber to a central station electric lighting company discovers that, whatever the nominal candle powers involved, he needs, for reading or working, at least twice as many incandescent electric lamps as he used to have gas-burners, Mr. Preece humorously says that it is because he likes more light. It is not in his "brief" to admit that, lamp for lamp, gas is at least twice as effective as electricity; but we have a perfect right to prefer this interpretation of the admitted facts.

The interesting question of the durability of incandescent lamps, which so potently affects the cost of the light to the consumer, is being investigated again, this time in France. So long as the manufacture of these goods is a monopoly in England, it will be vain to expect any definite information on the subject from English sources. It appears, however, that at the laboratory of the Compagnie Popp, of Paris, a series of experiments is in progress which have for their object the determination of the variation in illuminating power of an incandescent lamp during its life, of its mean efficiency for power consumed, and its average durability. These experiments began last March, and are not yet finished; but, in the meantime, an account of some of the results obtained has been published by the author (M. Dujon) in *La Lumière Electrique*. Three makes of lamps have been taken for the purpose of the experiments; and already M. Dujon claims to have deduced for each certain constants which, when inserted in the proper formulæ, give the average fall in illuminating power with use and the durability of the lamp at a stated voltage. M. Dujon appears to have found that there was not much difference between the initial efficiencies of the different lamps tested, and that in most cases the final efficiency lay between 4.5 and 5 watts per candle power—thus confirming English and American rules. The suitability of any make or description of lamp for use in every case must be determined by the costs of current and of renewals. In London, for example, current is charged for at most at 8d. per unit, and lamps cost 45d. each; while in Paris the charges are 1 fr. per unit for current and 2.50 frs. for a lamp. Hence it is more economical to press the lamp hard in Paris than it is in London. Commenting upon these statements, the *Electrical Review* remarks that an English Edison-Swan lamp, starting at about 10-candle power, will burn for 900 hours at a mean illuminating power of 78.8 per cent. of the initial; and that the cost of maintenance, at London prices, would be after the rate of 0.039d. per candle power per hour. In concluding his paper, M. Dujon says that, in his opinion, no appreciable improvement in carbon filament lamps is to be expected; and he suggests that refractory metallic oxides may be tried with advantage in the construction of vacuum lamps.

Bradford and Newcastle-upon-Tyne are foremost among the English towns that have been provided with central station electric lighting undertakings—the one by the enterprise of the Local Authority, the other by that of a local Company. Some accounts relating to the working of both ventures have lately been published; and while we take these for what they may be worth, we do not accept them in either case as fully setting forth the circumstances. It must be obvious that until a few such plants have been worn out, or have broken down, it is impossible to determine the fair rates of depreciation or of upkeep allowable in their case; and this is as much as to say that the accounts can be made to show anything that the exigencies of the management may require. Speaking for the Bradford installation, Mr. Alderman Priestman claimed a profit of £971 upon the working for the past half year, which is a wonderful burst of prosperity, seeing that the previous six months showed a loss of £30. There seems to be some mystery about these accounts, for Mr. Alderman Priestman confesses his inability to state the coal consumption per horse power of the machinery at the station. It appears, however, that somewhere about 865 tons of coal were burnt during the half year to generate

the 154,431 units of electricity sold; so that, as the coal only came to 7s. 7d. per ton delivered, or £342 for the whole, its cost per unit must have been 0.53d. In our news report published last week, which was also reproduced by the electrical journals, Mr. Alderman Priestman was made to say that the coal cost 12.58d. per unit. This is one of the great advantages of a free press—that a reporter may make a public man talk nonsense. Seeing that in Bradford the charge for electricity is 6d. per unit, it would be interesting to know how the ingenious reporter for the local newspaper could reconcile in his own mind this exaggerated cost of coal with the asserted profitable working of the municipal undertaking. At Newcastle, no such precise statistics transpire; but the Company pay a 5 per cent. dividend. This is quite as good as can be reasonably expected. The Directors do not now entertain any wild hopes of superseding the use of gas on Tyneside, if they ever did cherish such a dream; and they seem to be perfectly content to take a comparatively insignificant place beside the Newcastle Gas Company. It is quite according to the modern style, however, for the Chairman of the electrical concern which earns £4800 a year, as against the Gas Company's £220,000, to affect to patronize the latter, and to pretend to "represent the leading energy of this age." It will never do, of course, to "be small and look small." Words are cheap even though electricity be dear; and it would be churlish indeed to grudge the electricians the comfort of that prophet's mantle in which they are so fond of wrapping themselves. It is with no envious feelings that we survey the progress of the Newcastle and District Electric Lighting Company, which seems to be doing good work in its degree. There is doubtless room for a good deal more of the same kind of work in Newcastle; and there is not the remotest probability that anything the electricians can do will hurt the Gas Company.

The Use of Gas in Lighthouses.—At the Institution of Civil Engineers this evening, Mr. D. C. Salmond, Assoc. M. Inst. C. E., will read a paper on "The Illumination by Gas of the Tory Island Lighthouse," on the north-west coast of Ireland.

Commercial Gas Company.—Subject to audit of the accounts, the Directors of the Commercial Gas Company will recommend dividends at the rate of 13 per cent. upon the old stock, and 10 per cent. upon the new, for the half year ended Dec. 31 last.

Increasing Use of Gas for Industrial Purposes.—As an example of the growing use of gas in industrial operations, a customer of Messrs. Fletcher, Russell, and Co., Limited, recently applied to them for an estimate of the cost of a number of Bunsen burners ranged on an iron tube 6 feet long, and calculated to consume about 380 cubic feet of gas per hour. In his letter, the customer stated that he had called upon eleven users of gas for commercial purposes, and obtained orders from them on the understanding that he would give them the necessary instructions for use. These parties had already, he said, ordered goods which would require something like 1300 cubic feet of gas per hour. These incidents show clearly that the supply of gas for workshop purposes will for some time to come tax the producing power of gas companies.

Manchester District Institution of Gas Engineers.—The Honorary Secretary of this Institution (Mr. S. S. Mellor, of Northwich) has notified to the members that the twenty-second annual meeting will be held at the Grand Hotel, Manchester, next Saturday. The retiring President (Mr. T. O. Paterson, Assoc. M. Inst. C. E., of Birkenhead) will open the proceedings, and occupy the chair during the transaction of the introductory business, consisting of the election of Mr. H. Simmonds, of Colne, as a member, and of the Vice-Presidents and officers for the current year. He will then introduce his successor, Mr. Chas. Armitage, of Lancaster, who will deliver his Inaugural Address. Mr. T. Newbigging will afterwards read his paper on "Management," prepared for the November meeting. At the close of the business the members will take tea together.

The Siemens Electrical Laboratory at King's College.—Last Friday, Sir W. Thomson, President of the Royal Society, formally opened the laboratory of electrical engineering which has been founded in King's College, London, by Lady Siemens, in memory of her husband, Sir William Siemens, and as a record of his discoveries in electrical science. The cost of the laboratory has been entirely defrayed by Lady Siemens, who has also placed at the disposal of the Council of the College a sum of money which will be ample to maintain it in proper efficiency. It is to be called the "Sir William Siemens Laboratory." It contains a steam-engine and boiler, direct and alternate current dynamos of latest design, and a full equipment of instruments of the newest construction. Students are admitted to special courses of lectures and laboratory work after having passed two preliminary years in the Engineering Department of the College, or on producing certificates of proficiency in physics, chemistry, and mathematics. The laboratory is under the charge of Professor John Hopkinson. In making the presentation on behalf of Lady Siemens, Sir W. Thomson remarked that, as a member of the Council of King's College, it was with sincere pleasure and satisfaction that he saw the completion of the laboratory. Lady Siemens earnestly hoped that the desire which prompted her to take this form of memorial to her husband would prove of help in carrying out the advancement of the special branch of science which was so full of interest to him.

THE CRYSTAL PALACE ELECTRICAL EXHIBITION.

THIRD NOTICE.

If the electric light fittings now exhibited at the Crystal Palace leave a good deal to be desired in respect of meritorious design and original application, they are shown in sufficient bulk to impress beholders with the idea that there must be a good deal of business done in this class of goods. It appears, moreover, to be a trade that is centred in London. This is a point worth noticing. The usual advantages of cheaper labour, fuel, and rent, which still operate to enable provincial and country manufacturers of gas-fittings and furnishing hardware, do not seem to govern the nascent trade in fittings for incandescent electric lighting; and even firms originating in Birmingham, like Evered's, who have gone largely into this class of work, are careful to proclaim the fact that it is all produced in Drury Lane. Is this revival of the London production of the best class of metal work due to the circumstance that the renaissance of the so-called "hammered iron" goods, which are so largely employed in electric light fittings, occurred in London?

We have mentioned hammered iron; and it is really astonishing how popular this kind of smith's work has recently become. The public seem to neglect electro-plate for it; and even wrought copper and brasswork, including *repoussé* ware, takes an inferior place in comparison with it. Again, in hammered iron goods, the ribbon work, which is not strictly speaking hammered at all, is not so well liked as the rod work, a great deal of which is wonderfully fine. In executive skill the modern smiths certainly equal, if they do not surpass, their mediæval precursors; but in originality they cannot compete. The factory system leads to the wearisome multiplication of the same patterns, while it cheapens the goods; and the result is that the purchaser of a "thing of beauty" turned out under the modern system can never be certain that he will not see the same object in the house of every one of his friends, which is most annoying.

Imitations of candles apart, it is abundantly evident, from what may be seen at the Palace, that the new sort of lamps have not inspired anybody with acceptable new ideas in lighting. Yet there has been a great deal of painful striving after originality, most of which has, however, failed to attain even to the level of the grotesque. The plain, unadorned incandescent lamp is not lovely; and when employed in all its native crudity it is strongly suggestive of ship lighting to anyone who has ever made a trip in a modern steamboat, where it appears at its very best. The difficulty in the artistic employment of the incandescent lamp is essentially the same as that which has baffled modern decorators in the case of gas-burners—its brilliancy as compared with old-fashioned lamps and candles. We want the light it affords, and do not want to look at the light-source itself. The more powerful the light, the less occasion does it give for the trifling fripperies of fitting-out that belong to small lights, such as candles. Despairing of success in disposing of such brilliant light-sources as the incandescent lamp, the first thing the "artistic" decorator does with it is to bury it in semi-opaque glass, or cover it with a heavy shade—of course, at enormous cost in illuminating power. The only alternative is to make the light still more dazzling by setting it in the focus of a brilliantly reflecting mirror, made in the shape of a frond of fan-palm, an arrum-sheath, or some such natural form. This is undoubtedly the most theoretically economical way of arranging an incandescent lamp pendant or bracket; and there are many examples of it, excellently well made, at various stalls in the Palace. But these reflectors throw shadows, which require to be corrected by other lights; and so the theoretical economy is not realized in practice.

At some stalls the observer will be tempted to inquire where are the incandescent lamps—these being so hidden under pretty silken and laced shades. On the whole, we are inclined to regard these as the most successful examples of their kind. There is no reason why the nature of the light should always be proclaimed by the display of the lamp itself, with its irradiating filament. Indeed, there is every reason, on the score of protection for the eyesight, why this should be kept out of the direct vision. It is both convenient and desirable, however, that the character of the system of lighting should be manifested, although not obtruded, by the appearance of the fitting. Thus the incandescent electric light does not require a localized store of combustible material, like the solid candle or the fluid oil, which in turn demands a vase to contain it in close proximity to the light. Neither does it need a pipe connection, as gas does. But it obtains all the necessary supply of electricity through a pair of small wires; and it has no great weight of its own. When these considerations are intelligently expressed, the result at any rate does not give offence, even when it does not yield positive pleasure. We opine that that has the rudiment of a good incandescent electric light fitting which quietly, but unmistakably, acquaints the observer at the first glance that it is not a candle, to need renewal at short intervals; nor an oil-lamp, to need trimming; nor gas, dependent upon a rigid pipe connection; but is something *sui generis*, which is to be taken exactly for what it is, whatever the ultimate result may be. Surely this ought to be sufficient recommendation. If incandescent

electric lighting is all its partizans claim for it, is it not enough that it does not exist by consuming oxygen locally, and does not possess flame; and why should it ape any other system of artificial lighting?

Circumstances, however, are too strong for the decorators; so that, whether or not they wilfully imitate, in the shape of their lamps, other means of lighting, most electric light fittings do, as a matter of fact, repeat the uses of other systems of lighting. Thus we see many electric table and standard floor lamps, shaded, which might be oil lamps of the ordinary kind for all that can be seen. In these examples, the necessary connecting-wires are distinctly objectionable, as they straggle across the table and over the carpet to the nearest wall-plug. The suggestions of entanglement and consequent upsetting inherent in this method of connection are most disturbing. Imagine having to warn everybody in the room to take heed to their steps whenever they have occasion to approach the standard lamp; and what sport a toy dog would have with the cotton-covered wire! Incandescent lamp pendants have already been mentioned; and as to brackets, it is enough to say that they very often remind one of gas-brackets. When the decorators attempt the quaint and ornamental, they are never successful. Messrs. J. E. H. Gordon and Co., for instance, make a specialty of the employment of a well-known kind of sea-shell as screen reflectors for incandescent lamps; the shell being placed *in front* of the lamp, which is supported on a stumpy bracket. An example is shown of a boudoir in white enamel paint, with these shell screens equally spaced along a high dado, or low frieze. The effect is not happy; and the same may be said of attempts to use these shells in connection with conservatory lighting. It is not merely that the aspect of an interiorly-lighted sea-shell is *bizarre*; the whole thing suggests a pantomime device rather than a light to live with.

Messrs. Rashleigh Phipps and Dawson endeavour to create an effect by an ingenious employment of glass beads as screens for lamps. They are not singular in using the "Bead-Ray-Diffusers," as they are called, which are merely bags of faceted glass beads strung together with wire or cotton, and slipped over the incandescent lamp bulb. The result is a poor imitation of a cut-glass bulb; and the device must be pronounced a trumpery one. But this firm draw particular attention to their own specialty in glass-ball screens, which consist of a pair of perforated sheets of metal, held (say) half-an-inch apart in a frame, so as to accommodate in the hexagonal perforations glass balls, which can, of course, be arranged in any desired pattern. This may not be a bad idea for a short window-blind, although one would think it would quickly show dust; but it makes very heavy and dim lanterns. Messrs. Rashleigh Phipps and Dawson appeal for notice of their Assyrian Mosque, Italian Dining-Room, and Japanese Drawing-Room lighting; but it occurs to us that a little homely lighting—something less suggestive of the café, the theatre, and the bazaar—would have paid the firm equally well.

Another example of what to avoid in lighting is supplied by Messrs. Graham and Biddle, who have a stand where they show a variety of Oriental pots and pans made into stands for incandescent lamps. We have seen the same thing done much cheaper with a tallow candle and an empty ginger-beer bottle; but we never truly admired the combination. Again, Messrs. F. and C. Osler show a pavilion in which cut and engraved crystal glass is the principal attraction—the electric lighting being a secondary consideration. But even here confusion reigns; for the corners of the pavilion bear statuettes carrying sham oil-lamps, in which the usual flames are replaced by incandescent bulbs. Although their justification is lacking, the oil reservoirs remain in evidence. Some of the least objectionable lamp-fittings in the exhibition are shown by Messrs. Faraday and Son and Messrs. Shirley and Co.

Messrs. Siemens Bros. and Co., Limited, are responsible for an exhibition of lighting in the Pompeian House which is hardly the sort of thing one would expect to see identified with a firm of their standing. All day this well-known apartment is locked up; but at a certain hour, for an extra charge of sixpence per head, the trustful public are admitted to witness an exemplification of theatre lighting by electricity, which is ranked as of sufficient importance to be entered on the daily time table of the Palace. We attended this thrilling spectacle, and, in company with about a dozen other visitors to the Palace (whose admission fees must therefore have swelled the Siemens revenues by several shillings), saw an amiable young gentleman play for about ten minutes with a set of keys, whereby he succeeded, after some delays, in producing several different lighting effects upon a scene displayed in a small model theatre. The idea of demanding admission-money for such a performance is simply preposterous; but not more so, perhaps, than the notion that the electric lighting interest is likely to be advanced by it. It is true that, after a tedious delay in shifting keys and making other clicking arrangements, the amateur showman was able to increase and diminish the brilliancy of the lighting before and behind the scene, and to display "daylight" and "moonlight" effects of the stereotyped character. But seeing that the lighting was much more jerky than that which would have been available by the simple means of a row of gas-burners commanded by a common lever cock, the peculiar value of the show is open to question. After having witnessed this amazing triumph of the electricians' skill in theatre lighting, we are yet

of opinion that the average theatre-goer would prefer a dawn that did not come upon him by "leaps and bounds."

It may seem odd that we have been able to write two critical notices of the electric lighting at the Palace Exhibition without mentioning the much-advertised Edison and Swan screen of 10,000 incandescent lamps, which were meant to bewitch all observers; but we hope to deal with this and other matters of an equally pressing nature in the next article.

Fletcher, Russell, and Co., Limited.—In another part of the JOURNAL will be found the prospectus of the Company which has been formed, as announced in our columns last week, to acquire and work, as one concern, the two businesses hitherto carried on by Messrs. T. Fletcher and Co., of Warrington and London, and Messrs. W. and A. C. Russell and Co., of Pendleton and London. The capital consists of £150,000 in shares and £50,000 in debentures. Of the former amount, £50,000 will be in cumulative preference shares of £10 each, bearing 6 per cent. interest, and £100,000 in ordinary £10 shares; but of the latter shares only 7000 will be first issued. The debentures will be for £100 each, and will bear interest at the rate of 5 per cent. The vendors will take 3100 preference and 3800 ordinary shares, fully paid, and debentures for £31,000, in part payment of the purchase-money (£160,000). The remainder of the first issue of shares and debentures—comprising 1900 preference and 3200 ordinary shares and 190 debentures—are now offered to the public. The books of the amalgamated firms have been examined by Messrs. Harmood Banner and Son and Messrs. Thomas, Wade, Guthrie, and Co.; and the latter certify that the average aggregate profits, taken over a period of 3½ years ending Aug. 31, 1891 (from which date the concerns will be acquired by the Company), amounted to £25,877 without allowing for depreciation.

Presentation to Mr. Drury, of Vauxhall.—On Saturday last an interesting presentation was made to Mr. C. D. Drury, who is relinquishing his position as Assistant-Engineer to Mr. C. C. Carpenter, in order to take charge of the Hendon works of the Sunderland Gas Company, to which he has been lately appointed. The testimonial took the form of a handsome half-hunting gold keyless watch, on the case of which was engraved: "Presented by the officers and men of the Vauxhall Gas-Works to Charles Dru Drury, on his retirement from the position of Assistant-Engineer. Feb. 20, 1892." In making the presentation, Mr. Carpenter pointed out what an excellent lesson might be drawn from Mr. Drury's career, by young men such as many of his hearers; and he made reference to the late James Nasmyth's method of selection from his apprentices, by means of an examination of the seats of their trousers, rejecting those where any signs of wear or shininess were apparent. Mr. Drury, in reply, referred to his long association—first as pupil and then as assistant—to his chief, Mr. Carpenter; and he expressed his determination that if any works did get ahead of Vauxhall in its working, it would be those of Sunderland. He concluded with a kindly acknowledgment of the help he had always received from his fellow-officers and men in carrying out his duties; and he expressed his deep regret that the inevitable parting from so many friends had come at last. The meeting then gave three hearty cheers for Mr. Drury, and dispersed.

The Distribution of Power.—In the course of the discussion on the paper by Mr. Joseph Parry upon the supply of power by pressure from public water-mains (*ante*, p. 247), which referred principally to the example of Liverpool, the members of the Institution of Mechanical Engineers debated the question of the comparative cost and efficiency of hydraulic and gas motors, to which allusion had been made by the author. Mr. Jeremiah Head remarked that the paper showed that, when the work to be done is intermittent, the hydraulic system of distribution is of advantage; but when a fairly continuous demand is made upon the motor, the gas or the steam engine is to be preferred for reasons of economy. Mr. E. B. Marten confirmed what was said as to the advantages of hydraulic power for small and intermittent work; but he admitted that it cannot compete with other means of obtaining power for large requirements and constant working. There is, of course, a great advantage when the hydraulic head is obtained by gravitation. Mr. J. Platt testified to the superiority of gas-engines to hydraulic power for constant working; and he pointed out the waste of water that goes on when hydraulic machinery is employed for light loads. Sir J. N. Douglass expressed the opinion that Liverpool gas is too dear. But he confessed that the case is much worse in the United States; and to this circumstance he ascribed the greater extension of the electrical distribution of power in that country. He stated that, with oil at 6d. per gallon, oil-engines will give results equivalent to gas-engines with gas at 1s. 3d. per 1000 cubic feet. He went on to say that, since good oil for hydrocarbon motors can be bought in England for 4½d. per gallon, the cost of power from this source is about half that of gas-engine power at London prices. Very rapid strides have been made of late in the development of the oil-engine; and Sir J. Douglass is one of those who think this class of motor is coming to the front. With regard to electrically-distributed power, it appears, from the tariff prevailing in Liverpool, that the local Electric Supply Company charges after the rate of 5d. per horse power per hour, which puts this source of power out of the market—excepting, perhaps, for the requirements of dentists, &c.

NOTES.

Coke-Breeze Concrete.

Correspondence is still proceeding in the columns of the *Builder* upon the subject of coke-breeze concrete, which is regarded by many architects as a most valuable building material, and a powerful help towards the solution of the problem of "economical and yet substantial labourers' tenements in their own localities." One architect states that he has had some 1-inch yellow deal flooring nailed to 2 inches of coke-breeze concrete, on a bed of brick rubbish and Portland cement concrete gauged 6 to 1. The whole of the concrete was left for a month to dry thoroughly before the floor-boards were nailed down; and the work has stood perfectly for five years—the boards being as solid to walk upon as when they were laid. The boards were not, and ought not to be, tongued. Another architect advises that tongued boarding should not be laid directly upon a flat surface of concrete, for fear of dry rot; but he recommends that sleepers of the breeze concrete should be formed, keeping their surface not less than 1 inch above the general surface of the floor, upon which the boards should be nailed—provision being made for the admission and circulation of air. Particular attention should always be paid to the drying of the concrete before the flooring-boards are laid upon it. The same architect denies that breeze concrete will accumulate heat from flues and fireplaces; asserting that, after years of extensive experience with it, he finds this material "most fire-resisting and incombustible." It is admitted that breeze concrete is about 25 per cent. lighter than ballast concrete. It will satisfactorily encase iron girders if a thickness of at least 1 inch on the soffit is allowed; and it will then take plaster without the needless expense of battens and lathing. The Editor of the *Builder* remarks upon this communication that, with proper care, flooring-boards can be laid direct upon a concrete floor without dry rot supervening, and that the plan of laying the boards with a space between them and the concrete keeps up that system of inaccessible hollows in house building which it is highly desirable to get rid of on sanitary grounds.

Annealing in Coal Gas.

In a communication to the *Engineering and Mining Journal* of America, Mr. H. P. Jones describes a process of annealing metals under non-oxidizing conditions which appears to involve an interesting application of coal gas. It is remarked that the ordinary process of annealing iron and steel consists in bringing the metal to a good red heat, and then allowing it to cool gradually. While the metal is hot, its surface becomes oxidized; and although for many classes of work this scale of oxide is of no practical importance, yet in some instances it is very undesirable, and even necessitates the incurring of considerable expense for its removal. The process in question depends upon the principle of surrounding the metal, while in course of annealing, with an atmosphere of non-oxidizing gas. With this object, the metal is heated in a retort, the interior of which is placed in communication with a supply of coal gas, either taken directly from the main or stored in a gasholder, the gas being perfectly free to expand back into the main or holder—thus keeping the retort under a constant pressure. Although the process is only now disclosed, it has been in use for two years at a works at Hartford (Conn.), during which time several tons of metal have been annealed daily and turned out perfectly bright, at small expense. The retorts used were made of wrought-iron tubes, of sizes suitable to the articles to be treated, and the gas was that supplied by the local Gas Company. Moreover, all the tool steel used in the shop was annealed in the same way, and found to work better in consequence. Experiments have been made to ascertain whether the constituents of coal gas exercise any deleterious effect upon the metal at a red heat; and it has been determined, by direct comparison, that there is practically no difference between the behaviour of specimens treated with coal gas and pure nitrogen.

The Separation of Fresh Air from Dust.

Mr. T. Pridgin Teale, F.R.S., lately read a paper before the Society of Arts upon the ventilation of rooms, and preventing the admission of dust, which he seemed to regard as produced outside. He explained the intrusion of dust particles into cupboards, drawers, &c., as due to air currents produced by incessant variations of atmospheric temperature and pressure. He proposed to make all such receptacles dust-proof by lining the jambs of the doors, the chinks of drawers, &c., with cotton velvet. A model living-room was described, beginning with the fireplace, in the construction of which Mr. Teale's well-known suggestions are, of course, to be carried out. The admission of fresh air to the room would be by means of the "Harding diffuser," which delivers air, filtered through canvas screens, in a number of small jets near the ceiling. The patent for this arrangement has lapsed. Having thus secured a supply of air for the chimney, Mr. Teale proposes to make the windows air-tight by doing away with sashes and making most of the glass a fixture. The window is to be so divided that one-half or one-third shall open inwards on hinges; and all the panes are to be doubled—the inner glass not being puttied, but sprigged upon a cotton-velvet bearing, to keep the intermediate space clean. Mr. Teale's suggestions were received with a good deal of adverse criticism; Sir H. Trueman Wood remarking that the

carrying of them out would demand much better workmanship than could be expected in an ordinary house, and another critic pointing out that a great deal of dust arises inside rooms.

The Maintenance of Ropes.

The care of ropes forms the subject of an article in a recent number of the *Engineering Record*. It is remarked that American practice allows of a factor of safety of from 6 to 8 in working wire ropes; but large ropes should not be worked at more than one-tenth of their breaking strength. Careful maintenance is indispensable to the preservation of all rope. Hemp rope needs regular tallowing; while sisal rope should be kept continually damp. Wire rope, particularly of steel, should be paid regularly with a mixture of oil and grease, soft enough to work in between the strands, yet sufficiently stiff to stick on the outside of the rope, laid on hot with a brush. In America the practice is to use vegetable oils rather than animal grease; and where rope is to be exposed, it is not unusual to paint it at the manufactory, and pay it while in use with a mixture of linseed oil and pine tar. Some makers advise the use of a mixture of equal parts of linseed oil and Spanish brown, or lampblack. For wire ropes used under water or below ground, the old recipe of limed tar is recommended; sawdust or oatmeal being sometimes added. Wire ropes fail both from repeated bending and from abrasion; both of which must be duly regarded in proportioning a rope for any purpose.

Nitrogen in Pitch.

At the last meeting of the London Section of the Society of Chemical Industry, Mr. Watson Smith contributed some notes on the "Stability of Certain Organic Nitrogen Compounds occurring in Coal-Tar Pitch." His remarks were based on a very simple, but interesting experiment, which was repeated at the meeting. Some fragments of pitch were placed in the bulb of a tubulated retort, which was inclined in such a manner as to permit the ready egress of products of volatilization. Heat was then applied until the pitch was completely coked. The source of heat was removed, and the retort allowed to cool until it could be handled without inconvenience. On removing the stopper from the neck of the retort, strong fumes of ammonia issued, and were identified by the usual methods. The author assured the audience that no indication of the presence of ammonia could be obtained while the coke was hot; but that the fumes were observed only when it was nearly cold. A repetition of the phenomenon took place on re-heating and again allowing the coke to cool; and as there was no appreciable diminution in the quantity of ammonia evolved after each successive heating, Mr. Watson Smith had not been able to estimate the quantity obtainable from a given weight of pitch. No explanation of the experimental fact was tendered by the author, though he had proved, by attaching a series of drying-tubes to the mouth of the retort while cooling, that the moisture of the air did not play any part in the reaction. The subject was freely discussed; but no reasonable explanation was offered by any of the speakers. The occurrence of the same phenomenon when other organic bodies are coked was affirmed by two gentlemen; and a suggestion that the nitrogen of the air might be concerned in the formation of the ammonia was, curiously enough, not repudiated by the author as improbable. No information of a definite character was elicited as to the possibility of coked pitch furnishing a source of ammonia on a commercial scale; but Mr. Watson Smith was evidently not sanguine of its value for this purpose. It is regrettable that the observer did not work further on the subject before communicating his results to the Society. If, however, his paper should lead to other competent chemists studying the phenomenon, and to a speedy elucidation of its cause and value, its early presentation should be pardoned.

The London Water Bills.—Those of our readers who are interested in the London Water Question will probably be surprised at no indication being given, in our "Parliamentary Intelligence," of the existence of the two Bills promoted jointly by the Corporation of London and the County Council; the other Water and Gas Bills of the session having been fairly started on their way through the Houses. The reason is that the Bills in question were opposed on Standing Orders; and it has been arranged that the matter shall not be considered by the Examiners before the 25th inst.

Death of Dr. Dittmar.—We regret to record the death, on the 9th inst., of Dr. William Dittmar, F.R.S., Professor of Chemistry at Anderson's College, Glasgow, and Lecturer at the Glasgow and West of Scotland College. Professor Dittmar was born at Umstadt, near Darmstadt, in 1833, and studied at Heidelberg under Bunsen, who appointed him as one of his assistants. Shortly afterwards he came to England as an assistant to Sir Henry Roscoe, at Owens College, Manchester. From 1861 to 1869 he was chief assistant in the chemical laboratory of the Edinburgh University. In 1873 he went back to the Owens College as Assistant Lecturer, but returned to Scotland in 1874 as Professor of Chemistry at Anderson's College. Professor Dittmar published several chemical papers on original researches; and also contributed to Watts's "Dictionary of Chemistry" and Liebig's *Handwörterbuch*.

TECHNICAL RECORD.

ILLUMINATING FLAMES.

A Lecture delivered by Professor Vivian B. Lewes, F.I.C., F.C.S., at the London Institution, last Thursday.

Flame has always had an attraction for us which has been rivalled by few other natural phenomena; and whether we look back to the times when the old Fire Worshippers treated it as a deity, or take the present century and trace the work which has been done and the discussions which have been held as to its cause, and the actions which render it luminous or destroy its light-giving power, we are fain to admit that a subject which has drawn to it so much attention for upwards of twenty centuries must be a worthy object for research, until such time as we have mastered every detail that bears upon the subject. It is upon flame that we have, up to the present, always depended for artificial illumination; and whether that flame has been derived from the torch, the rushlight, candle, oil-lamp, or coal gas, it has played a part second to none in our domestic comfort; while with the birth and development of coal gas in the early years of this century, flame became an important commercial factor in the history of the country. It was not until the waning years of the last century that Lavoisier's historical researches upon combustion gave us the key to the action which leads to the formation of flame; and since that time its history has teemed with important researches, and still more important applications, which have to-day borne fruit in the improvements we see on every side in our methods of utilizing flame for both heating and illuminating purposes.

Flame, be it luminous or non-luminous, is produced by the combustion of gaseous matter; and a moment's consideration will render this clear to our minds. Take a piece of Wallsend or Silkstone coal, and note how it burns on the hearth—first swelling and giving out tarry vapours, which ignite and form jets of flame; and these, encircling the coal, carry on the action, and give us the bright mass of flame which renders our English hearth so cheery a companion. On the other hand, take the coke which is derived from this same coal by its destructive distillation in the gas-retort, and watch the clear coke fire as it burns. Here you have no flame of the kind given by the coal, but simply the glowing mass of fuel, with, at most, a small blue lambent flame playing over its surface.

What is it that has happened during the conversion of the coal into coke which made so great a difference in its method of combustion? If we analyze the coal and then the coke formed from it, we can at once trace the cause which has given us in the one case flame and in the other none:—

	Silkstone Coal.	Coke from Silkstone Coal.
Carbon	79'0	89'0
Hydrogen	5'2	1'0
Nitrogen	1'5	1'0
Sulphur	1'5	1'2
Moisture	4'0	1'2
Ash	2'8	5'2
Oxygen	6'0	1'4
	100'0	100'0

The conversion of the coal into coke has been accompanied by the elimination of hydrogen, which, partly free and partly in combination with carbon, has been driven off, and has formed the coal gas; and with the destruction of the constituents capable of forming gas, the property of burning with flame has disappeared. Again, take a piece of pine-wood, and ignite it. Its combustion will be marked by a large and luminous flame; while after conversion into charcoal, by elimination of its gas-producing constituents, it burns with a flameless combustion. From such experiments as these, we are forced to the conviction that flame is gas or vapour undergoing combustion; and inasmuch as combustion is chemical combination, we can define flame as being gaseous matter undergoing active chemical combination.

In all the earlier experiments with flame and with the other phenomena of combustion, it was only those substances which ordinarily burnt in air that were studied and experimented with—those bodies which would burn in air being called combustibles; while oxygen and air were looked upon as supporters of combustion. This conventional limitation of the processes of combustion still exists. A little reflection, however, shows us that such terms must be purely relative; as, if flame depends merely upon active chemical combination taking place between gases, it can only exist where both the combining gases are present, and it cannot matter which of them has the credit of being the combustible, as a jet of air or oxygen will burn just as well in an atmosphere of coal gas or hydrogen as the hydrogen or gas would in air.

It might be imagined that, having come to these conclusions with regard to flame, it would be a comparatively simple matter to solve the other problems connected with it; but, on studying the subject, it is at once found that the physical and chemical actions taking place are of the greatest complexity, and are in many cases governed by laws of which we know but little. In the propagation of flame, for instance, the combination of the inflammable constituents at the first moment of combustion

gives rise to a great increase in temperature, which in many cases is sufficient to check and alter the combination, and in some instances even to cause dissociation of the products formed in the earlier phases of combustion; so that the combination seems to take place in waves, and not evenly, as one might at first imagine, with the result that the maximum temperature of a flame is never so great as one would expect from calculations based on the heat of combustion of the gases and the specific heat of the products and residual nitrogen from the air. These points, together with the rate of propagation and burning of gases, have been the subject of historical researches by Bunsen, Déville, Berthelot, and others; but much still remains to be done before we arrive at any final conclusion on the subject.

By far the most interesting, and at the same time important, chapter in the history of flame, however, is the consideration of the causes which lead to the luminosity of those flames upon which we depend for most of our domestic lighting; and these offer so beautiful a field for both physical and chemical research, that they have attracted the attention of many observers, and form no inconsiderable addition to the chemical history of this century. In the year 1816, while engaged upon those celebrated researches which culminated in the discovery of the miner's safety-lamp, Sir Humphry Davy noticed certain facts which led him to work out and propound his theory of the causes which lead to luminosity in flame—a theory which is generally stated as being that the presence of solid particles in the flame is essential to its luminosity. This theory remained unquestioned until 1868, when Professor E. Frankland, in his celebrated communication to the Royal Society, showed that, although incandescent solid matter in a flame renders it luminous, luminosity is also in many cases produced when the flame contains very dense vapours at a sufficiently high temperature, and also that a non-luminous flame may be rendered luminous by increasing the pressure.

This gave rise to a storm of criticism; and the next few years drew forth a rich crop of papers on the subject. Professor Frankland not only showed that flames might be luminous without containing solid particles, but advanced the theory that the luminosity in the flame of a burning gaseous hydrocarbon was due to dense hydrocarbon vapours, and pointed out that the soot deposited upon any cool substance held in such a flame contained hydrogen. To this W. Stein replied, showing that the deposited soot contained less than 1 per cent. of hydrogen which was therefore probably only occluded by the carbon; and also that, if it had been present as a vapour in the flame, it ought, on being heated to the same temperature as the flame, to be once again volatile, which it undoubtedly is not. In the year 1874, Soret attempted to show that the cause of luminosity in flame really does depend upon the presence of solid particles, by focussing the sun's rays upon a luminous flame, and examining the reflected light by means of a Nicol prism; and rather later Burch pursued the same line of research, but employed the spectroscope for his examination of the reflected light. Their results point unmistakeably to the presence of solid particles; and at the present time I think there is very little doubt in anyone's mind that, as far as the flames of candles, oil, and gas are concerned, Sir Humphry Davy's theory is the correct one. Indeed, I am strongly of opinion that, although in certain points Davy went a little too far in his theory, had he been still among us we should have found that, in his own mind, he applied his theory more especially to the flames of our ordinary illuminants, as in his original memoir he speaks of "common flames," and distinctly says that "when in flames pure gaseous matter is burnt, the light is extremely feeble," and again, "the intensity of the light of flames depends principally upon the production and ignition of solid matter."

While this war of solid particles *versus* dense vapours was raging, Hilgard, Landolt, Blochmann, and Heumann were trying to trace the chemical actions taking place in various flames, and the causes which led to loss of luminosity when air was mixed with coal gas before combustion in the Bunsen burner. Heumann added the further proof to the "solid particle" theory of luminosity, that all flames which owe their luminosity to incandescent solid matter give definite shadows, while those in which luminosity is due to dense vapours, give none; and that candle, oil, and gas flames all cause well-defined shadows.

This brings the work done upon the cause of luminosity down to the present time. The accepted description of a luminous flame now is that it consists of several zones—an inner one, in which no combustion is taking place; a central one, in which, either by selective combustion or by direct decomposition by heat, carbon or very dense hydrocarbons are liberated, and, being heated to incandescence at the moment of production by the combustion of other gases present in the flame, give it luminosity; and an outer one, which consists of the products of combustion and atmospheric air heated to incandescence, and in which combustion is complete.

The work of Soret, Burch, and Heumann proves beyond doubt that our ordinary illuminating flames contain in the luminous zone particles of solid matter; and the only solid which could be present is carbon, either pure or containing the merest trace of hydrogen. The chief question now remaining to be solved, consequently, is the action taking place which leads to the formation of the solid particles in the luminous zone of the flame. During the last two years, I have devoted a very

considerable amount of time and attention to the study of this subject; and I think I have found the key to this important problem—important from a practical point of view, because, until it is thoroughly solved, all efforts to improve our illuminating gases, and the burners in which we consume them, can only be the outcome of experiments made without definite idea of the means to employ in order to obtain the results we desire.

Coal gas is a mixture of hydrocarbons with hydrogen and small quantities of carbon monoxide; and it also contains traces of carbon dioxide, nitrogen, and oxygen. The gas manager, however, does his utmost to eliminate the last three, which, if present in anything but the merest traces, would seriously injure the illuminating value of the gas. An analysis of the South Metropolitan Company's gas gives the following as its composition:—

Hydrogen	57·08
Hydrocarbons—	
Unsaturated (containing 0·035 p. c. of acetylene).	4·38
Saturated	33·99
Carbon monoxide	2·63
Carbon dioxide	0·79
Nitrogen	0·96
Oxygen	0·15
Bisulphide of carbon	0·02
	100·00

The unsaturated hydrocarbons consist of ethylene, benzene, propylene, butylene, and acetylene, and probably also traces of crotonylene and others; while the saturated hydrocarbons consist chiefly of methane, with traces of ethane, propane, and butane.

Analyses made by Landolt of gases withdrawn from various parts of a luminous coal-gas flame, and also a long series of analyses which I have made, show that, as the gas leaves the burner, the hydrogen is the first to be consumed; and that, in the passage up the non-luminous part of the flame, the carbon monoxide largely increases in quantity, while at the same time the methane rapidly decreases, and the unsaturated hydrocarbons seem to be the least affected. In the luminous zone the unsaturated hydrocarbons rapidly disappear; while the carbon monoxide formed in the inner zone, and also the residual hydrogen and methane, undergo combustion. Professor Smithells, in a paper read before the Chemical Society in December last,* also proved that, during the incomplete combustion taking place in the inner cone of a Bunsen flame, this same increase in the amount of carbon monoxide was to be observed. The fact that the decrease in quantity of the unsaturated hydrocarbons was but slow in the inner zone, and then took place with considerable rapidity in the luminous zone, favoured the theory that they were broken up by heat in that portion of the flame, and liberated the carbon, which by its incandescence gave the luminosity. But it does not seem to have occurred to anyone to try to determine whether the unsaturated hydrocarbons at the top of the non-luminous zone were of the same description as those in the coal gas.

It is a matter of common observation that the checked combustion of a luminous flame at once gives rise to the escape of acetylene, and also that, if a Bunsen burner catches light at the bottom, large quantities of acetylene are formed, of which the presence is at once detected by its distinctive and pungent odour. These facts suggested the idea that, in the inner cone of the flame, acetylene might be formed by decomposition of the original hydrocarbons; and experiment at once showed this to be the case. Of the unsaturated hydrocarbons present in coal gas, 0·8 per cent. consist of acetylene; while at the top of the non-luminous zone of a flat flame produced from the same gas, between 80 and 90 per cent. of unsaturated hydrocarbons present consist of acetylene; and in all the other luminous flames experimented with, the same action was found to take place.

On taking the most important hydrocarbons present in the coal gas, mixing them with about 20 per cent. of air, and passing them through a tube heated to the temperature existing near the top of the inner non-luminous zone, the following results were obtained: Methane gave rise to unsaturated hydrocarbons, acetylene, and carbon monoxide; ethylene gave acetylene and carbon monoxide; hydrogen charged with benzene vapour gave the same; and ethane gave unsaturated hydrocarbons, acetylene, and carbon monoxide. These experiments clearly show that, in the inner non-luminous zone of the flame, the heat generated by combustion of the hydrogen of the coal gas in the presence of the small proportion of air drawn into the flame at this point, causes the conversion of the hydrocarbons present in the gas into acetylene and carbon monoxide.

Acetylene is a clear colourless gas, with a strong and disagreeable odour. It consists of 24 parts by weight of carbon, combined with 2 parts by weight of hydrogen. It is one of those bodies which, during their formation, take in heat instead of giving it out; and it is therefore called an "endothermic" compound. Such substances are especially liable to decomposition, as this is accompanied by a rise in temperature instead of, as is the case with most decompositions, an absorption of heat. Acetylene is decomposed at a bright red heat into carbon and hydrogen, together with traces of tarry matter as well as ethylene; while Berthelot has shown it to be so unstable that it can be broken up into carbon and hydrogen by detonating a percussion cap in it.

These important points being established, it is necessary to ascertain if the temperature existing in the various parts of a flame give any clue to the actions going on within them. The beautiful platinum and platinum-rhodium thermo-couple devised by M. Le Chatelier, and introduced to us by Mr. W. Chandler Roberts-Austen, gives a means of measuring the temperatures of flames with an ease and comparative accuracy which was never before hoped for. I made a small thermo-couple of platinum and 10 per cent. of rhodium, platinum wire, using it as thin as possible to reduce errors from loss of heat by conduction, and keeping the wires of considerable length to prevent any chance of rise of temperature introducing conflicting currents at the connections with the galvanometer wires. A reflecting galvanometer was employed, and sufficient resistance was introduced into the circuit to keep the spot of light upon the scale at the highest temperature of the flame; and the scale was then graduated for temperature by taking water at 0° and 100° C., and checking the higher temperature by the fusing-points of the chlorides of the alkalis and alkaline earths, as determined by Dr. Carnelly.

With this arrangement I was able to map out the temperatures existing in the flat flame in which I had traced out the changes taking place in the constituents of the gas; and I found that the temperature rapidly rose from 500° C. half an inch above the burner, to a little over 1200° C. at the commencement of the luminous zone—the luminous edges having a temperature of 1216° C.; and these temperatures were further increased in the luminous zone until near the top of the flame 1368° C. was reached. This at once gives us the secret of the luminosity. From the mouth of the jet and up to a temperature of 1000° to 1200° C., we have the formation of acetylene from the original hydrocarbons; but the moment the requisite temperature is reached by the combustion of the hydrogen and the carbon monoxide, the acetylene decomposes, with a further rise of temperature, and the carbon heated to incandescence radiates heat and light.

If a luminous flame be cooled, its luminosity is at once diminished, and may be destroyed; while, as the propagation of flame requires a certain temperature, a further cooling will extinguish it. In the outer edge of a flame, the rapid inrush of air sucked into the flame so lowers the temperature that a thin envelope is rendered non-luminous, the actions checked, and traces of the gas allowed to escape unconsumed by the extinction of the extreme limit of the flame; and delicate analysis shows that every luminous flame burning freely in air gives off distinct traces of carbon monoxide, acetylene, and even such highly-inflammable gases as methane and hydrogen.

Ever since the structure of flame has been noted and discussed, it has been accepted as a fact beyond dispute that the outer almost invisible zone which is interposed between the air and the luminous zone of the flame, is the area of complete combustion, and that here the unburnt remnants of the flame gases, meeting the air, freely take up oxygen, and are converted into the comparatively harmless products of combustion, carbon dioxide and water vapour, which only need partial removal by any hap-hazard process of ventilation to keep the air of a room fit to support animal life. The facts I have brought before you show that this is not the case; and they fully explain why gas is so oppressive in a badly-ventilated apartment.

It has always been the custom to speak of flame as built up of zones; and although there are no sharp lines of demarcation, in the actions taking place, which would warrant this, still three distinct portions are visible to the eye. If we divide the luminous flame into zones, it would be perhaps best looked upon as consisting of three, viz.—

- (1) The inner zone, in which the temperature rises from a comparatively low point at the mouth of the burner to about 1000° C., at the apex of the zone. In this portion of the flame, the constituents of the gas undergo various decompositions and interactions, which culminate in the conversion of the heavier hydrocarbons into acetylene—carbon monoxide being also produced; and these, with the products of combustion and residual hydrogen, pass into the next phase of action.
- (2) The luminous zone, in which the temperature ranges from 1000° C. up to a little over 1300° C. Here the acetylene formed in the inner zone becomes decomposed by heat, with liberation of carbon, which at the moment of production is heated to incandescence by the combustion of the carbon monoxide and hydrogen, and gives luminosity to the flame.
- (3) The extreme outer zone, in which, combustion being nearly completed, the cooling and diluting influence of the entering air renders a thin layer of the flame non-luminous, and finally extinguishes it. With ordinary coal gas, this results in the escape of traces of hydrogen, methane, carbon monoxide, and acetylene; while with a very rich gas unconsumed carbon also escapes.

This description of a luminous flame is of necessity far from complete, as it leaves out of consideration the interactions which lead to the formation of acetylene, and also the decompositions going on in the various parts of the flame between the products of combustion and the flame gases; but I think it marks a considerable advance in our knowledge of the main

* See ante, p. 68.

actions which lead to luminosity—the other interactions being at best subsidiary to it.

Having obtained a clear idea of the causes which lead to luminosity in flame, we are enabled for the first time to clearly understand the actions taking place in the atmospheric or Bunsen burner, the invention of which revolutionized our methods of heating by gas, and made coal gas one of the most important of our domestic fuels.

When it was first found that the admixture of a certain proportion of air with coal gas before combustion caused it to burn with a non-luminous flame, it was at once accepted, as an explanation of the phenomenon, that the extra oxygen so led into the inner cone of the flame, by causing complete combustion in the central zone, burnt up the carbon before it could be heated to incandescence, and so destroyed its light-giving power. Some years later, however, Knapp and others showed that, by mingling inert diluents, such as nitrogen, carbon dioxide, or even steam, with the gas before combustion, non-luminosity could be produced. It was then recognized that the diluting and cooling action of the nitrogen in air played an important part; and some observers held that it was this, and not the oxygen, which was the cause of non-luminosity.

On measuring the amount of air and of nitrogen respectively able to render a Bunsen flame non-luminous, they are found to be practically the same, while the quantity of oxygen present in the air used, when passed into the gas by itself, still gives a very luminous flame. This certainly looks as if it were the nitrogen that was doing the work. If this were so, the temperature of the flame rendered non-luminous by nitrogen should be the same as that of the flame rendered non-luminous by air; but, on testing these, the fallacy of such a supposition is at once exposed. This will be seen by the following table:—

Part of Flame.	Temperatures existing in a Bunsen Flame rendered Non-Luminous by—	
	Nitrogen.	Air.
$\frac{1}{4}$ inch above burner	30° C. ..	54° C.
$1\frac{1}{2}$ inches above burner.	111° ..	175°
Tip of inner cone	444° ..	1090°
Centre of inner cone	999° ..	1533°
Tip of outer cone	1151° ..	1175°

These temperatures clearly show that a very considerable amount of combustion is due to the oxygen of the air, and make it perfectly manifest that both the oxygen and the nitrogen are acting in bringing about the loss of luminosity.

While working at these points, I found that if mixtures of nitrogen and oxygen, poorer in oxygen than air, were employed, it was practically only the nitrogen which acted—the diluting effect being so strong that the oxygen was prevented from taking any active part. With air, both act; while with mixtures richer in oxygen than air, the oxygen alone acts—the nitrogen being apparently unable to exercise any retarding influence. The same result is obtained if excess of air is mixed with the gas before combustion. If the quantity of air reaches a point at which the proportion of oxygen in the air is to the gas as 0.5 : 1, then the diluting influence of the nitrogen is lost, and the appearance of the flame becomes entirely altered. The normal Bunsen flame burns with a lilac-coloured inner and blue outer zone; but the moment the quantity of air admitted reaches the ratio mentioned, the flame becomes short and fierce, and the inner zone changes to a greenish colour—the highest temperature in the flame at the same time increasing by nearly 100° C. Experiments show that the nitrogen acts in the normal Bunsen flame by so diluting and protecting the hydrocarbons that a far higher temperature is needed for their decomposition; and this action gives time for the oxygen of the air to consume them without liberation of carbon, and hence without luminosity.

In conclusion, I think that we may express the actions which lead to the loss of luminosity in the normal Bunsen flame in the following way:—

- (1) The chemical activity of the oxygen introduced in the air, which, by burning up the molecules of hydrocarbons before, in their diluted condition, they undergo decomposition, causes loss of luminosity.
- (2) The diluting action of the nitrogen of the air, which, by increasing the temperature necessary to bring about the partial decomposition of the hydrocarbons, prevents formation of acetylene, and in this way will, by itself, cause non-luminosity; and in the normal Bunsen flame it acts by doing this until destruction of the hydrocarbons by oxidation has taken place.
- (3) The cooling influence of the air introduced, which is able to add to the general result, although the cooling is less than the increase in temperature brought about by the oxidation due to the oxygen in the air.

The Use of Liquid Fuel for Heating and Lighting Purposes.—The *Financial News* understands that a Syndicate is in course of formation for the purpose of acquiring several valuable patents in connection with the use of liquid fuel for heating and lighting purposes. The processes to be employed are quite new; and they have, it is stated, been tested at Glasgow and elsewhere, where they have been found completely satisfactory.

REGISTER OF PATENTS.

Valve Gearing of Gas-Engines.—Boulton, A. J.; communicated from the Berliner Maschinenbau-Aktien-Gesellschaft, of Berlin. No. 383; Jan. 8, 1891. [8d.]

This invention relates to the employment in gas and other like engines of a reciprocating bell-crank lever, adapted to be turned upon its pivot by means of a pawl or tappet at each stroke of the slide; its angle of oscillation being limited by a stop, so that, when its arm is allowed freely to descend, it thereby actuates the inlet for the gas supply. It also includes, in valve gear for gas-engines, the combination with the bell-crank lever and tappet of an adjustable balance weight or spring, whereby the movement of the arm may be properly timed so as to control the speed of the engine.

Conveying Combustible Gas to Boilers, Kilns, Furnaces, &c.—Rylands, D., and Potter, R., of Stairfoot, near Barnsley. No. 764; Jan. 15, 1891. [8d.]

This invention has for its object the "securing of a better and more even combustion of the gases used in gas-fired boilers, kilns, furnaces, &c., together with greater economy in fuel and more durable construction than hitherto." To this end, the gas as made in the producer is passed into a flue made of fire-brick or other suitable material. Into this flue, there is introduced or suspended a tube, made of wrought iron or other suitable substance, through which air is made to travel to the point of combustion, while the hot gases from the producer are conveyed in the outer flue—thereby heating the inner tube and the air which is being passed through it. At the points where it is required to ignite the gas, short branch-flues are arranged, to convey the gas and hot air under or through the boilers or into the kiln. These branch-flues are connected to a combined igniting port made in three compartments; the centre compartment being for hot air, the second for gas, and the outer for the air—thus securing a thorough admixture of the particles of combustion. The branch pipes and flues are, of course, all fitted with suitable valves for regulating and controlling the supply of gas and hot air.

Gas Cooking Appliances.—Darwin, H., and Guthrie, J., of Glasgow. No. 767; Jan. 15, 1891. [8d.]

This invention relating to gas cooking appliances has for its objects: To increase the utility of a gas grill; to reduce the consumption of gas therein; to simplify the conversion of a deflecting gas grill into a boiling appliance; to prevent the accidental fouling of burners in gas cooking appliances; to adapt the ribs or bars of a gas hob for being quickly and thoroughly heated; and to increase the heat arresting and refracting power of the grill deflecting-plates.

The grilling mechanism (when it consists of three parallel tube burners, placed horizontally between deflecting-panels) is made with a lever movement for oscillating the two outer tube burners, and enabling their lighted jets to be turned beneath the deflecting-panels for grilling, or above them for boiling purposes, alternately as required; and when the outside burners are turned up from their grilling positions to those required for boiling, the supply of gas is simultaneously cut off from the middle burner by the same lever movement. Also when the two outside burners are revolved into their grilling positions, the supply of gas is, by the same lever movement, restored to the middle burner.

Gas-Engine Piston-Rings.—Wertenbruch, F., of Nottingham. No. 3682; Feb. 28, 1891. [8d.]

This invention relates mainly to the moveable piston rings or valves of gas-engines, having automatic action to close passages leading to a hollow trunk or a chamber in which the explosions take place, so as to act against a larger piston; the chamber or hollow trunk serving also as the receiving and compression chamber. For this purpose the patentee prefers to make the trunk connecting the two pistons hollow; and by passages at the upper part to make communication with the space in the larger diameter cylinder. The bottom of the trunk is smaller in diameter than the cylinder in which it works, and is encircled by a ring, piston, or valve, which fits the cylinder. This has free play, within certain limits, to open passages through which the mixture has to pass and become compressed, and also to close the passages for the ignition and working or power stroke. The piston-rings proper may be of wire coiled and faced up.

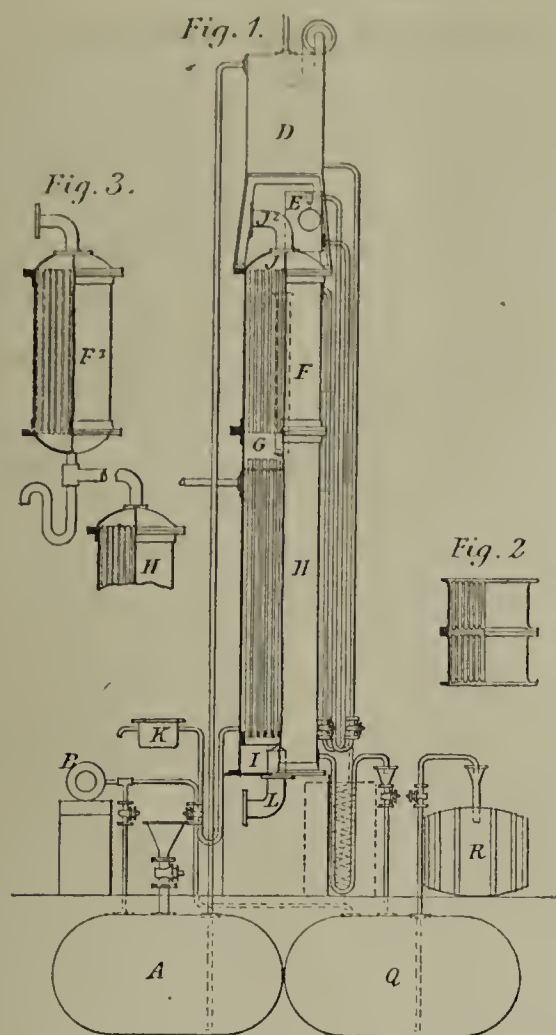
Carburetted Gas or Air.—Lennard, F., of East Greenwich. No. 3716; March 4, 1891. [8d.]

This invention has for its object to provide apparatus by means of which gas or air can be carburetted or impregnated with matter with which it is desired to treat it; the apparatus being applicable generally in cases where it is desired to distil, or evaporate off the volatile constituents of liquids.

In this apparatus as constructed for the purpose, the liquid to be evaporated, distilled, or concentrated is passed through tubes in such a manner that it is very efficiently subjected to the action of heat applied by steam or otherwise. The gas or air, after being carburetted or impregnated, or the vapours from the liquid being evaporated, distilled, or concentrated, are preferably passed upwards through another tubular arrangement, to effect the preheating of the liquid to be subjected to the action of heat in the tubes.

Fig. 1 shows in elevation (partly in section) an apparatus constructed according to this invention.

A is a storage vessel for petroleum, naphtha, or other liquid. It has a funnel, by which it is filled, fitted with a stop-cock, which is closed when the vessel is filled. By means of a pump B, pressure is exerted upon the liquid in the vessel, so that it is forced up into the tank D, from which it passes into a receiving tank E; the inlet of the pipe into the tank being provided with a ball-cock, for keeping a proper level of the liquid therein. The liquid then passes into the top part of the upper column F, in which it becomes preheated by the hot vapours escaping from the lower column H; and then the liquid overflows and travels down into a space G, into which project the upper ends of tubes



passing through the lower column H. The lower ends of these tubes communicate with the space I below the lower column; the plates through which the tubes pass separating the main part of the interior of the lower column H from the spaces G and I above and below. The top and bottom plates of the upper column F separate the interior of this column from the space G below, and the space J above it. Tubes pass through these plates, so as to form a communication from the space G to the space J. The liquid which passes from the pipe through the perforated lower end thereof, rises in the space G until it overflows at the tops of the tubes of the lower column, so that, as the liquid runs in thin sheets (or films) down the interiors of the tubes, volatile matters are driven off; the driving off of the required product being effected by the heat applied to the exteriors of the tubes. This heating may be done by steam admitted into the column H; the water of condensation passing away by the steam-trap K.

If air or gas is to be carburetted, it is admitted, under pressure, by the pipe L projecting into the space I, as shown; and on rising through the tubes, it comes into contact with the descending films of liquid passing down the internal sides of the tubes. The air or gas thus takes up the volatile products which are given off from the liquid, which is heated not only by the heating agent in the lower column H outside the tubes, but also (before the matter enters the space G) by the escaping hot carburetted gases or vapours which pass up through the interiors of the tubes into the space J above it, and thence by an outlet-pipe J² to the place of utilization or storage.

In evaporating, distilling, or concentrating, the heating effect of the steam on the column H may be supplemented or replaced by the heat of hot air or gas admitted through the pipe L. The pipes by which the liquid passes to and from the tanks preferably descend (as shown) to a low level, and then rise again, so as to enable regulating-cocks thereon to be brought into convenient position for manipulation.

In order that the liquid may be further preheated before it enters the column F, the arrangement shown in dotted lines may be used; the lower end of the pipe being carried down and attached, at its lower end, to a closed vessel, from which the upward continuation of the pipe ascends to the tank E, so that the liquid passes through the vessel on its way from the descending to the ascending part of the pipe.

The supply of liquid from the tanks is regulated so that it passes into the tubes of the lower column in sufficient quantity to form only thin films passing down the interiors of the tubes. To ensure that the liquid is properly subjected to the action of the heating agent, or air or gas, the patentee makes the lower column of a number of sections, each with tubes, and with spaces between the sections; the tubes rising into these spaces, and being set alternately in different vertical planes, so that any liquid which flows down (say) the mid-part of a tube, will pass down a tube below it in contact therewith. This is shown with regard to two sections in fig. 2. The heating agent may be supplied to the sections, outside the tubes, either separately to each section, or so as to pass from section to section. In the arrangement shown in fig. 1, any liquid resulting from condensation in the tubes will pass down the tubes; but if it be desired to retain the result of such condensation separately, the top of the column H is closed in, as shown in fig. 3, and the vapours are led from the column H into the tubular condenser F²—the liquid resulting from condensation in this condenser being obtained separately, and drawn off by a syphon. The liquid to be treated may, of course, be preheated, if desired, by being used as the condensing agent in the condenser F². Similarly, the vapours from the condenser F² may be passed into other condensers, to obtain further fractions.

Making Gas and a Product therefrom.—Dyson, W., of Oldcoates, Notts. No. 3862; March 4, 1891. [4d.]

This invention, says the patentee, relates to "improvements in the manufacture of coal gas, such as is used for lighting and other purposes; and in the production of a composition or material during such gas manufacture which forms a valuable tillage."

In carrying out his idea, the patentee proposed to "cause the crude or unpurified gas, during the process of manufacture, to pass through purifying tanks or chambers filled with peat-moss, in place of the usual water-tanks. The gas, while forcing its way through the fibres of the moss, parts with the ammonia that is being carried along with it; and the process of extraction or separation of the ammonia is effected in a more complete and perfect manner than by water. The peat-moss having performed its duty and become charged with ammonia separated from the gas in its passage through it, is then treated with sulphuric acid, thereby fixing the ammonia. A high-class tillage or manure, being a very valuable product, is then produced."

The claims for the "invention" are: (1) In the manufacture of coal gas, causing the crude gas to pass through an enclosed mass of peat-moss, instead of through water, to more effectually separate the ammonia therefrom. (2) The production of a material for tillage purposes, consisting of peat-moss charged with ammonia, by passing the crude gas during the manufacture of carburetted hydrogen gas (or ordinary coal gas) through an enclosed mass of peat-moss and fixed by a treatment of sulphuric acid.

Sulphate of Ammonia Plant.—Marriott, C., of Redcar. No. 4730; March 17, 1891. [8d.]

This invention in sulphate plant relates to means whereby the salt is continuously "fished" or removed from the saturator by self-acting means.

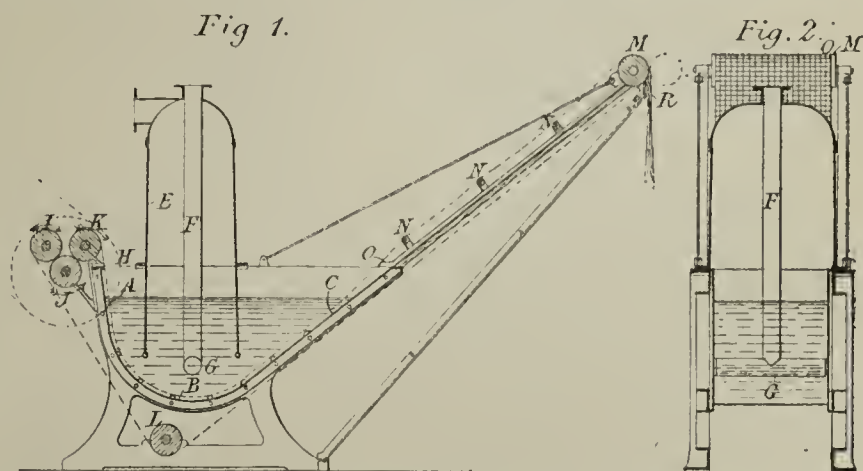


Fig. 1 is a longitudinal, and fig. 2 a transverse section of the saturator, the body of which has a vertical or nearly vertical back A, a radial bottom B, an inclined front, and a bell E in which the waste gases collect. Through the centre of the bell, in a vertical position, is the ammoniacal gas or saturator pipe F, terminating at the bottom in a perforated T-pipe G, the T end being a short distance above the bottom, and immediately over the radial part B; a space H being left between the outside of the bell and the back of the vessel. At the back of the saturator are three or more driving or drawing rollers I J K; and underneath and outside the vessel a carrying roller L. In front of the apparatus, in line with the inclined front, and at any convenient distance, is another carrying roller M; and at suitable intervals down the inclined part are other small rollers N, all working in bearings in the framework. Over the rollers is an endless apron O (the full width of the inside of the vessel), made of wire gauze of suitable mesh; the apron being of such length that it passes over and under the driving or drawing rollers, down the vertical or nearly vertical back, along the radial bottom, under the T-pipe and bell, up the inclined front, over the roller at the top, and back under the roller L, underneath the vessel, and again to the driving or drawing rollers I J K, which are driven from any convenient source, and thus give the apron a travelling motion.

The action of the apparatus is as follows: The saturator being charged with acid to a suitable depth, and the ammoniacal gas being put in communication, the salt as it is formed is deposited on the travelling apron, and is continuously carried on it or "fished" out of the vessel up the inclined front; being drained in its passage of any surplus liquor, which flows back into the saturator—the acid being kept at one constant level by any well-known means. Underneath the roller M, at the top of the inclined front, and in contact, or nearly so, with the endless apron, is a stationary knife or scraper R, to remove the salt from it, to fall into any convenient place; or a stationary or revolving brush may, when desired, be used for the same purpose.

Manufacture of Gas.—Kitson, A., of Philadelphia, U.S.A. No. 17,557; Oct. 14, 1891. [8d.]

The subject matter of this patent has of late received a considerable amount of attention in our columns—see the article, on "Fuel Gas: Its Production and Distribution," commenced in the JOURNAL for Jan. 19 (p. 112). The invention relates to an improved gas generating furnace, adapted more particularly for generating fuel gas for domestic heating and cooking and for manufacturing purposes.

One object of the invention is to provide for more certainly passing steam and air down through the body of heated fuel, and conducting the resulting gases away centrally through the moveable grate or hearth. Other objects of the invention are: To provide an improved construction and arrangement of the mechanism for imparting to the grate or hearth which supports the coal a rotary and a vertical up-and-down motion, for removing ash and cinder at the peripheral opening, and for causing the coal to properly feed downwardly, and prevent it from caking in case bituminous or soft coal is used; to provide in connection with the moveable hearth or grate, a circle of dependent vertical bars, suitably spaced for permitting the escape of dust and ashes when the hearth is lowered below the fuel chamber, but serving to retain the fuel on the hearth so that the fire may be properly cleaned without waste of the incandescent fuel; to provide for dumping ash and cinder from the ash-pit into the water-seal chamber, thereby preventing the escape of gaseous products during such operation, and also preventing dust and ashes from flying about in the generator-room; to provide for cooling the iron division-plate between the fuel chamber and ash-pit, and utilizing the heat radiated from the grate and ash-pit for

heating air which is supplied to the fuel chamber through the steam-injector; to provide an effective arrangement of air-heating flues in the wall of the generator and connecting injectors for forcing hot air either up or down and into the top or bottom of the generator; and, lastly, to obtain a uniform volume of steam at a perfectly steady pressure for forcing air, by means of an injector, into the fuel chamber, or for other purposes.

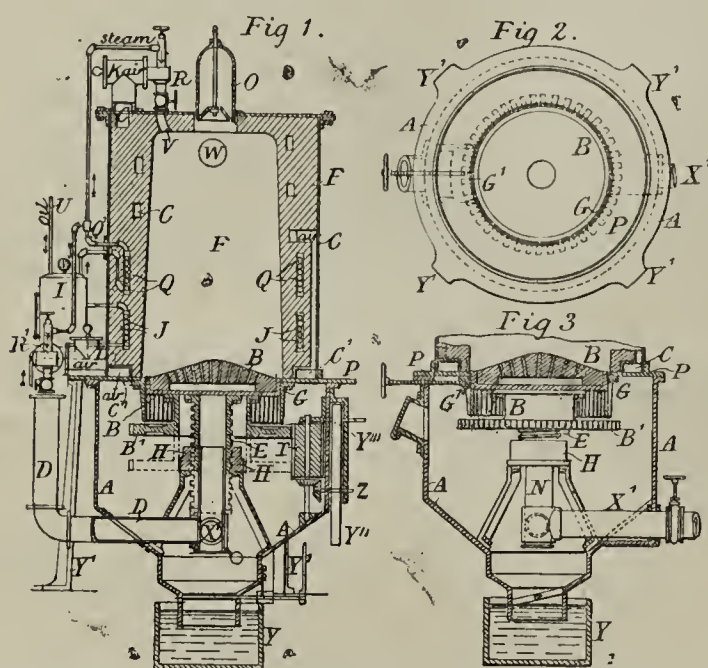


Fig. 1 is a vertical section of the generator; fig. 2, a horizontal section above the hearth; and fig. 3, a vertical section of the base of the generator taken at right angles to fig. 1.

The walls of the furnace *F* are constructed of fire-brick, and enclosed in an iron jacket in the usual manner. The fuel chamber is provided at the bottom with an annular iron plate *P*, supported upon the iron columns *Y*¹. The iron ash chamber *A*, and circle of vertical grate bars *G* are also bolted to the annular plate, and suspended therefrom. The ash chamber is provided at the bottom with a downwardly extending passage or opening furnished with a valve having a handle for the removal of ashes. It also has a door for giving access to the interior for cleaning or inspecting the gearing and other mechanism connected with the grate or hearth. Below the valved passage is placed a vessel *Y* to contain water, into which vessel the passage dips, so as to form a gas-tight seal. The ash is dumped into the vessel *Y*, preventing its escape into the room containing the generator.

The grate or hearth is provided with means for giving it both a rotary and a vertical up-and-down motion; and it has a central passage way through it connected (by pipes passing through the ash-pit) with the gas-escape pipe and with a supply-pipe for the air and steam. There is also an opening between the periphery of the hearth and the wall of the furnace for the removal of ash and cinder; thus permitting them to be shaken out while gas is being passed off through the central opening and the pipe leading therefrom through the ash-pit. The hearth is preferably made of iron, having a turned up circumferential flange, and filled in or covered over with fire-brick, as shown. It is provided centrally with an opening, and above the opening with ports. The grate or hearth is connected to, or supported centrally by, the short hollow screw-shaft *E*, having a central opening mounted in the collar or hub *H*, which is internally screw-threaded and supported by the legs. The screw-threads upon the shaft are large and strong, so as to withstand the pressure of the body of coal resting upon the hearth. To the under side of the hearth, there is bolted a large annular hub, carrying at its lower end the large toothed gear-wheel *B*¹, arranged to mesh with the long pinion *T* (mounted on a shaft), by means of which the hearth is rotated and raised or lowered. The shaft is journalled top and bottom, and has secured to it a bevelled gear-wheel, meshing with the bevelled gear, and secured to the inner end of the horizontal shaft *Z*, which is provided at its outer end with a gear-wheel *Y*³, with which there meshes a pinion *Y*³. By means of this mechanism, the hearth is readily rotated and raised or lowered, according to the direction in which the gearing is turned. The object of these two motions is to thoroughly shake up the fuel, and to provide for more effectively using bituminous or soft coal in the generator.

It will be understood that as the hearth *B*, and the toothed wheel *B*¹, are turned in one direction, the screw-shaft *E* will be traversed upward through the hub *H*; and if turned in the other direction, will be traversed downward through the hub, so as to raise and lower the hearth. The hollow screw-shaft *E* fitting in the hub is simple in construction and positive in action; so that the hearth cannot stick when it is desired to move it either up or down. A short vertical pipe *N*, having two elbows or branches at its lower end, projects into the passage of the screw-shaft *E*, fitting loosely therein, so that the shaft may be readily turned around it.

At the base of the fuel chamber *F*, there is secured to the under side of the annular plate *P*, the circular grate *G*, surrounding the vertically moveable hearth *B*, and having dependent bars suitably spaced apart to permit the escape of ashes when the hearth is lowered, but serving to retain the incandescent fuel. A section or segment *G*¹, of the grate is made moveable, and has loosely connected with it the end of a screw-shaft, so as to form a swivel joint. Guide ways, properly flanged or grooved, are secured to the under side of the plate *P*, for supporting the segment *G*¹, and permitting it to be slid out and in by means of a screw. For the purpose of removing clinker from the hearth and fuel chamber, the segment *G*¹ is drawn out by the screw, leaving an opening through which the clinker may be raked or shaken out by the moveable hearth. After the fire has been cleaned, the segment is again secured in its place adjacent to the hearth. The water-circulating and steam-generating coils *J* are preferably arranged in a channel formed in the brick lining at or near the base of the fuel chamber *F*, and are enclosed in such channel by suitable tiles.

The patentee also arranges in the furnace walls a coil *Q* for superheating steam; and both sets of coils *J* and *Q* are connected by means of an intermediate reservoir *I*, at the side of the generator, and adapted to contain the feed water supplied to the coil *J*, and the steam generated in such coil and supplied to the superheating coil *Q*. The outlet end of the coil *Q* is connected with the upper injector *R*, and by a branch-pipe with the lower injector *R*¹. The air-supply box *K*, provided with a removeable lid or slide, connects with the upper injector, and also with a hot-air flue *C*, at the top of the furnace. The lower injector connects with an air-supply box *L*, having a removeable lid or slide, and connecting with the lower end of the hot-air flue *C*, or annular box *C*¹. The lower injector opens into the supply-pipe *D*, connecting with the interior of the fuel chamber through the central opening in the hearth. The hot-air flue *C* is formed spirally in the brickwork of the furnace, and may be lined with metal or formed of metallic tubing, if desired. An annular air-box *C*¹ is preferably placed adjacent to the plate *P*, above the ash-pit for the circulation of air, which keeps the plate and hearth sufficiently cool, while the excess of heat is utilized for heating the air which is supplied to the injectors. The box *C*¹ connects with the air-heating flues *C*, as shown in fig. 1.

The upper injector is connected with the top of the furnace by an inlet passage *V*. When the furnace is in operation, and the steam is supplied to the injectors under suitable pressure, air is admitted into the top of the flue *C*, in which case it will flow downward, and be heated in its passage through the flue, and will then flow through the box *L* to the injector *R*¹, for supplying the base of the fuel chamber. In case it is desired to supply air to the top of the furnace, the injector *R* is put in operation; and the lid of the box *L* being removed, air is admitted into the box *C*¹ and the lower end of the flue *C*, so that it is heated by passing up through the flue and finally escapes through the box *K*, injector *R*, and supply-passage *V*, into the top of the furnace. The gas take-off pipe *W* leads from the top of the furnace to a chimney (not shown); and a pipe provided with a valve may lead from the pipe *W* to the holder, or the place where the gas is to be burned.

The fuel-supply hopper *O* is connected at the top of the furnace, and is provided with a valve for admitting fuel as required. The bottom of the fuel chamber is made of greater diameter than its upper portion; so that, when the hearth *P* is lowered, the entire weight of the fuel exerts its full pressure downward, unchecked by friction, against the side walls of the furnace. This provides for readily cleaning the fire; and in case bituminous coal is used, any bridge or arch formed in the upper portion of the fuel is readily broken. After the hearth has been lowered, it is then raised to its normal position; thereby compacting the fuel into a body of uniform density, and preventing the formation of blow holes or cavities, and securing more uniform action of the air and steam on the fuel, resulting in a better production of gas. In order to better mix a fresh charge of coal with the body of incandescent fuel in the furnace, the hearth may be lowered by turning the toothed wheel *B*¹ in the right direction (after first having introduced a fresh charge of coal), and then again rapidly turning and raising the hearth. The fresh fuel thus becomes mixed with the incandescent coal, and forms a compact body.

APPLICATIONS FOR LETTERS PATENT.

- 1879.—BARKER, T. B., and ROLLASON, E., "Gas-bags for gas-engines." Feb. 1.
 1909.—LIVESEY, G. T., "Preventing the freezing of water in the cups or lutes of gasholders, and for other similar purposes." Feb. 1.
 1958.—COULTAS, W., SIDDELL, T., and SMITH, J. L., "Combined boiler and gas-producer for the generation of steam and production of gas, whether used in combination or for separate purposes." Feb. 2.
 2005.—CATTELL, C. F., "Gas-generators." Feb. 2.
 2047.—PRICE, J., jun., "Pipe joints." Feb. 2.
 2065.—WRIGHT, F. G., "Liquid meter." Feb. 3.
 2073.—WILSON, W. H., "Manufacture of illuminating gas." Feb. 3.
 2181.—ATKINSON, J., "Self-starting apparatus for gas and other internal combustion motors." Feb. 4.
 2204.—SMITH, W. E., "Burning liquid hydrocarbons for heating and lighting purposes, and apparatus therefor." Feb. 4.
 2207.—SMETHURST, W., and WADE, J., "Mixing inflammable gas or vapour with air, and utilizing such mixture." Feb. 4.
 2334.—JONES, G. H., "Gas-igniter." Feb. 6.
 2363.—INGHAM, W. P., and Crowe, E., "Gas-fired recuperative kilns." Feb. 8.
 2455.—MAJOR, J. L., "Lamps for oil, gas, or vapour, and appliances connected therewith for burning common oils." Feb. 9.
 2728.—ABEL, C. D., "Gas or oil motor engines." A communication from the Gas-Motoren-Fabrik Deutz. Feb. 11.
 2864.—LEE, T. W., "Appliances for use in connection with burners for burning an explosive mixture of gases." Feb. 13.

Increased Storage for the Brussels Gas-Works.—According to the Brussels correspondent of *Industries*, tenders are shortly to be invited for supplying two gasholders to the Brussels Gas-Works. These holders are each to have a capacity of 35,000 cubic metres, or about 1½ million cubic feet, and are said to be the largest in Belgium.

The Gas Question at Bideford.—At the meeting of the Bideford Town Council yesterday week, the Mayor (Mr. R. Dymond) reported that a meeting of ratepayers was held on the previous Thursday, at which a resolution was passed approving of the action begun by the Council, and of their efforts to purchase the undertaking of the Gas Company, and requesting them to continue their negotiations upon such terms as may be considered fair and reasonable. The adoption of the report having been moved and seconded, a little discussion ensued, in the course of which Mr. Squire proposed, in order to show the Company that the Council were serious in their negotiations, that a cheque be drawn for £100, and paid to the Company, and if the Council failed to purchase, the money be forfeited. Mr. Braddick, in seconding this proposition, said he desired the Council to go further, and fix the price—say, £9500—which they were prepared to pay for the works. The motion was carried, two members only voting for Mr. Squire's proposition.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

Progress of Gas Consumption in Denmark.

SIR,—You were good enough in a former number of the JOURNAL to notice the extraordinary increase in the business of the Danish Gas Company during the last 10 years, which increase was as follows:—

Lighting gas	105 per cent.
Cooking gas	318 „
Motive power gas	540 „

We have now before us the accounts for the year ending Dec. 31, 1891; and the following remarkable increases have again taken place during the past year:—

Aalborg	14.3 per cent.
Assens	10.4 „
Flensburg (Germany)	12.4 „
Odense	17.0 „
Randers	22.7 „
Veile	16.0 „
Viborg	8.2 „
Copenhagen (Frederiksberg)	40.0 „
Average total	20.0 „

We have another town, Elsinore; and this has shown no progress, for the simple fact that, pending negotiations with the town for a renewal of the concession, no efforts have been made to push the consumption. This will now be changed; and, sleepy as the place is, I think we shall be able to galvanize it into "cooking gas" activity when we take it in hand, and it is the fact of stirring a torpid town into activity, that gives us great satisfaction.

When last in England, many of my friends often asked me how we manage to obtain such steadily-maintained good results; and I answered them shortly as follows:—

Devote all your energies to the sale of "cooking gas," by selling it at the lowest possible price, to give you a margin of profit. It is what you have to depend upon for your livelihood in the future.

Fix independent "cooking gas" meters in the kitchens. It is of the utmost importance that the "good house mother" knows exactly what is being used daily or weekly.

Maintain permanent exhibitions of the best apparatus in each of your towns; and give practical exhibitions of gas cookery weekly, and these on a liberal scale. Our demonstration meat bill for one town alone amounted to between £50 and £60 last year. Employ intelligent womenkind as assistants in the exhibition. The ironmonger's assistant young man is of no use.

Hire out good and reliable stoves on easy terms; and make the fixing of these light and easy for the householder, by fixing services gratis, right up to the stove itself.

Never lose sight of your stoves, but employ female inspectors of good address and a knowledge of gas cookery, who as occasion requires visit houses where gas-stoves are employed, inquiring of the housewife as to its well-doing, and giving practical aid if the stove shows backslidings in the way of refusing to do duty. Women like to be talked to (I mean sometimes) by women, and do not like mankind prying about their kitchens. The gas company's inspector of the common or "garden" type is not liked.

To increase the consumption of lighting gas and check the inroads of electricity, and what in small towns is much worse—the demon petroleum, let out on easy terms first-class high-power lamps, such as the Siemens or Schülke. (We have now over 2000 of these lamps out on hire.) Keep one or two inspectors—practical men, not of the collector type—whose sole duty it is to nightly visit shops and other places where the lamps are fixed, and to see that they are maintained in proper working order, and to personally adjust the lamps from time to time according to variation in pressure or illuminating power. The Siemens lamps are very sensitive in this respect.

Great care must be exercised in selecting the right description of lamps to let on hire. Otherwise a great waste of capital will ensue; and the consumer once set against the high-power system, it will be a matter of difficulty to induce him to try it again.

We have now experienced a three years' trial of the system, and have not had a single lamp returned owing to dissatisfaction on the part of the consumer.

In conclusion, gas men must look on their gas-works as a commercial concern, standing on its own base, to cater for the needs of the public, and not as an Act-of-Parliament-concession-bolstered-up concern.

The days when we considered it an act of gracious condescension to supply a consumer are no more. We have now to hunt up business, and induce the consumer to deal with us, and not to go to the rival firm of Messrs. Electro, Aquagas, Kerosine, and Co., who are only too anxious to "catch on."

Danish Gas Company, Copenhagen, Feb. 18, 1892. F. D. MARSHALL.

Statutory Evidence as to the Quality of Samples of Gas Supplied by the Metropolitan Companies.

SIR,—My attention has quite recently been directed to the circumstance that a letter by Mr. George Livesey, which appeared on the 24th of March last year in the JOURNAL, contains an erroneous statement on a matter of fundamental importance in the administration of the testing clauses of the Gas Act, concerning which any misapprehension is particularly undesirable. I beg accordingly to trouble you with a brief indication of some of the more important facts of the case.

There are twenty-three "testing-places" in the Metropolis, provided with gas-testing apparatus and materials, under the control of the municipal authorities. A "competent and impartial person" is appointed to each testing-place by one or other of these authorities, for the purpose of ascertaining daily the illuminating power, purity, &c., of the gas delivered by the Company at his testing-place, and of making daily reports of the results of his testings. The illuminating power, as reported each day by a Gas Examiner, is the average of

from 30 to 40 photometric observations duly corrected for temperature and pressure, &c. These observations extend over at least three hours, but frequently over a considerably longer time.

Various regulations have been laid down by Act of Parliament for the guidance of the Gas Examiners, and further regulations, as well as apparatus and materials to be employed in the testings, mode of manipulation and of carrying out and calculating the necessary corrections for changes of temperature and pressure, are issued from time to time under the authority of the Special Act by the Gas Referees.

Each Gas Company is, moreover, authorized to inspect the books in which the examiners of their gas record the particulars of their observations and calculations. Each Company may also, on demand, be represented by an officer at a testing-place, so as to see whether the gas examiner deviates in any particular from the precise regulations laid down for his guidance. Whenever a Company, on appeal to the Chief Gas Examiner against a gas examiner's report of illuminating power, proves that a reported test was made in a manner distinctly differing in any particular from that laid down by the Act or by the Referees, such test is disallowed as not being a statutory test, and the report of it is quashed. In like manner, a statutory report showing defective gas is quashed on appeal upon proof by the Company that the defect was occasioned by an unavoidable cause or accident.

It will be seen from this brief outline that great pains have been taken to establish a trustworthy and uniform system of testing daily samples of gas as supplied by the Companies. Each of these tests shows simply the average quality of the particular samples of gas which were used by the gas examiner.

The Special Act accordingly lays down, in the most authoritative manner, that each statutory test is to be taken as affording conclusive evidence of the quality of the gas officially tested at a particular place on a particular day. The Gaslight and Coke and other Gas Companies' Acts Amendment Act, 1880, clause 80, is thus worded: "The average of all the testings at any testing-place on each day of the illuminating power of the gas supplied by the Company at such testing-place shall be deemed to represent the illuminating power of such gas on that day at such testing-place." Each Company is liable to a forfeiture if, on any day, the gas supplied by the Company, at any testing-place, is of less illuminating power than it ought to be under the Special Act.

The various proceedings which arise under the testing clauses and forfeiture clauses are conducted in strict obedience to the regulation which fixes what shall be deemed to be the illuminating power of the gas at the testing-place on the day of the test.

Mr. Livesey's letter has reference to the official report of a statutory test of the illuminating power of gas supplied by the South Metropolitan Gas Company. The report was such as is expressly declared by the Act to be final and conclusive; and it proved that the gas was of defective illuminating power to the extent of 7-10ths of a candle—having only 15.3 candles illuminating power instead of 16 candles, as required by the Act. Mr. Livesey declared himself satisfied that there was no defect in the gas; which is tantamount to saying that the gas had an illuminating power of at least 16 candles.

Mr. Livesey then proceeded to urge as a grievance that, in the hearings of appeals, the statutory tests are taken as conclusive evidence of the illuminating power in question. His words are: "No matter what evidence may be produced to show that the gas was up to the standard, if the official tester has taken his tests in the prescribed manner, the Chief Examiner assumes that the official test is correct, and disallows the appeal." In more explicit terms the statement might run thus: When the Gas Examiner has taken his test in the statutory manner, the Chief Gas Examiner deems such test to represent the illuminating power of the gas delivered by the Company at that testing-place on that day, no matter how much he is pressed to do otherwise; and dismisses the appeal against the test. These facts tell their own tale.

ALEX. W. WILLIAMSON.

Feb. 20, 1892.

Smokeless London.

SIR,—For the last year or two gas coke appears to have been a drug in the London market; and I am of opinion that the cause is not far to seek. It is almost impossible to use gas coke for domestic purposes in an ordinary London fire-grate with either comfort or economy; and in its present condition, it may fairly be classed with anthracite as "an invention of the Evil One."

Cannot the gas companies supply a better article, even at an increased price? Those who would prefer the use of coke to coal (and their name is legion) would, if they could obtain a bright, cheerful, and lasting fire from it, be glad to pay any reasonable price for a fuel which would meet the above conditions, and at the same time be practically smokeless. Is it not a fact that by destructive distillation in the retorts, the coal is sweated to such an extent that the resultant coke has "the very pith and marrow taken out of it;" and that it is of very little use for burning in an ordinary grate? Gas companies cannot expect to "eat their cake and have it;" and if they insist upon extracting the largest possible amount of gas from the coal, it is impossible that they can at the same time obtain a first-class coke suitable for household purposes. Assuming that they would be content with a yield of about 8000 cubic feet of gas per ton of coal, of a high illuminating power—say 20 candles, instead of 10,000 cubic feet of 16-candle gas, would not the decrease in quantity be fully met by the increase in quality of both gas and coke?

From my point of view, the latter is the more important of the two.

C. A.

London, Feb. 22, 1892.

Newport (Mon.) Gas-Works Benefit Society.—The annual gathering of the members of this Society took place on Monday last week. There were about 150 employees present. Mr. Thomas Canning, Assoc. M. Inst. C. E., Engineer and General Manager of the Newport Gas Company, presided; and Mr. J. Whitfield, the Secretary of the Society, occupied the vice-chair. The report and balance-sheet presented showed that the Society is in a sound condition. Several toasts—among them being "The Benefit Society"—were duly honoured; and a pleasant evening was spent.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress was made with Bills last week :—

Standing Orders complied with : Airdrie and Coatbridge Water Bill ; Ashton-under-Lyne, Stalybridge, and Dukinfield District Water Bill ; Barrow-in-Furness Corporation Water Bill ; Barry and Cadoxton Gas and Water Bill ; Birmingham Corporation Water Bill ; Blackburn Corporation Bill ; Blackpool Improvement Bill ; Bournemouth Improvement Bill ; Bradford Corporation Water Bill ; Bristol Gas Bill ; Brynmawr and Abertillery Gas and Water Bill ; Cleator Moor Local Board (Gas) Bill ; East Grinstead Gas and Water Bill ; Exmouth and District Water Bill ; Glasgow Corporation Water Bill ; Ilkley Local Board Bill ; Ipswich Corporation Bill ; Kilmarnock Corporation Water Bill ; Lanarkshire (Middle Ward) District Water Bill ; Leeds Corporation Water Bill ; Liverpool United Gas Bill ; London County Council (General Powers) Bill ; London County Council (Subways) Bill ; Middlesbrough Corporation Bill ; Mold Water Bill ; Newcastle-upon-Tyne Improvement Bill ; Newport Corporation Bill ; North Shields Water Bill ; Ormskirk Gas Bill ; Oxford Gas Bill ; Pontypool Gas and Water Bill ; Pontypridd Water Bill ; Rhyl Improvement Bill ; Rhymney Valley Gas and Water Bill ; St. Pancras Vestry Bill ; Southborough Local Board (Gas) Bill ; Southend Gas Bill ; Stamford Gas Bill ; Sunderland and South Shields Water Bill ; Swansea Corporation Water Bill ; Swinton and Pendlebury Local Board Bill ; Tredegar Local Board Water Bill ; Uttoxeter Water Bill ; Western Valleys (Mon.) Water (Gas Purchase) Bill.

Standing Orders not complied with : Llanbradach District and Aber Valley Water.

Bills presented and read the first time : Ashton-under-Lyne, Stalybridge and Dukinfield District Water Bill ; Barrow-in-Furness Corporation Water Bill ; Bradford Corporation Water Bill ; Glasgow Corporation Water Bill ; Ipswich Corporation Bill ; Kilmarnock Corporation Water Bill ; Llanbradach District and Aber Valley Water Bill ; Newport Corporation Bill ; Rhymney Valley Gas and Water Bill ; Southborough Local Board (Gas) Bill ; Swansea Corporation Water Bill ; Swinton and Pendlebury Local Board Bill ; Tredegar Local Board Water Bill ; Uttoxeter Water Bill.

Bills presented, read the first time, and referred to the Examiners : Bristol Gas Bill ; Cleator Moor Local Board Gas Bill ; Liverpool United Gas Bill ; North Shields Water Bill ; Oxford Gas Bill ; Pontypridd Water Bill ; Western Valleys (Mon.) Water (Gas Purchase) Bill.

HOUSE OF COMMONS.

Monday, Feb. 15.

The petitions were presented for the following Bills, which were ordered to be brought in :—

*Airdrie and Coatbridge Water Bill, by Mr. Baird and Mr. Sinclair.
*Barry and Cadoxton Gas and Water Bill, by Mr. A. Williams and Mr. A. Thomas.

Birmingham Corporation Water Bill, by the Right Hon. H. Mathews, Mr. Chamberlain, Mr. H. H. Fowler, Mr. Kenrick, and Mr. Powell-Williams.

Blackburn Corporation Bill, by Mr. Coddington and Mr. Hornby.
Blackpool Improvement Bill, by Sir M. W. Ridley, General Feilden, and Mr. J. Maden.

Bournemouth Improvement Bill, by Sir H. Davey, Mr. Jeffreys, Mr. Pitt-Lewis, and Mr. Young.

*Brynmawr and Abertillery Gas and Water Bill, by Mr. F. Morgan and Mr. Warmington.

*East Grinstead Gas and Water Bill, by Mr. A. Gathorne-Hardy and Colonel Malcolm.

*Exmouth and District Water Bill, by Sir J. Kennaway and Sir S. Northcote.

Ilkley Water Bill, by Mr. Shaw Lefevre and Mr. Barran.

Lanarkshire (Middle Ward District) Water Bill, by Mr. D. Crawford and Mr. Philipps.

Leeds Corporation Bill, by Mr. Jackson, Sir L. Playfair, Mr. H. Gladstone, Mr. G. Balfour, and Mr. Gane.

London County Council (General Powers) Bill, by Sir J. Lubbock, Colonel Hughes, Mr. J. Stuart, Mr. Lawson, and Colonel H. Vincent.

London County Council (Subways) Bill, by Colonel Hughes, Mr. J. Stuart, and Earl Compton.

Middlesbrough Corporation Bill, by Mr. Fell Pease and Mr. I. Wilson.

*Mold Water Bill, by Mr. J. Roberts and Mr. S. Smith.

Newcastle-upon-Tyne Improvement Bill, by Mr. J. Morley and Mr. Craig.

*Ormskirk Gas Bill, by Mr. Forwood and Mr. Curzon.

*Pontypool Gas and Water Bill, by Mr. F. Morgan and Mr. A. Thomas.

*Rhyl District Water Bill, by Mr. West and Mr. J. Roberts.

Rhyl Improvement Commissioners Bill, by Mr. J. Roberts and Mr. S. Smith.

St. Pancras Vestry Bill, by Sir J. Goldsmid and Mr. Lawson.

*Southend Gas, by Mr. Warmington, Mr. Halley Stewart, and Mr. Rentoul.

*Stamford Gas Bill, by Lord Burghley and Mr. Finch.

*Sunderland and South Shields Water Bill, by Mr. Storey and Mr. Gourley.

On Tuesday and Wednesday all the above-named Bills were presented and read the first time ; those marked * being referred to the Examiners, and the remainder being ordered for second reading.

Petitions against the following Bills were presented during last week :—

Birmingham Corporation Water Bill, from the Conservators of the Wye Fishery District.

Pontypool Gas and Water Bill, from John Williams (for the insertion of a clause).

Southend Gas, from the Southend Local Board.

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Wednesday, Feb. 17.

(Before Lords Justices LINDLEY and KAY.)

Andrew and Co. v. Crossley and Co.—Crossley and Co. v. Andrew and Co.

This was an appeal from a decision of Mr. Justice Chitty in certain actions brought by the above-named parties (the well-known gas-engine makers), in which important questions were raised as to the procedure under the Patents Acts. The points raised were fully set out in the JOURNAL when the matter was before his Lordship early last month (see *ante*, p. 116) ; the principal one being as to the operation of an order, made under section 18 of the Act of 1883, giving leave to amend the specification of a patent. It was held that the amended specification was admissible, on the ground that the proceedings for amendment terminated with the leave to amend. This was a decision in favour of Messrs. Crossley and Co. ; and against it Messrs. Andrew and Co. appealed.

Mr. HOPKINSON, Q.C., and Mr. J. C. GRAHAM appeared for the appellants ; the ATTORNEY-GENERAL (Sir R. E. Webster, Q.C., M.P.) and Mr. W. N. LAWSON represented the respondents, but were not called upon.

Lord Justice LINDLEY said the appeal was from a decision which was in effect that the action for the infringement of the patent under the amended specification could not be maintained. The form of the question stated for the decision of Mr. Justice Chitty was not quite accurate. The action being for the infringement of the specification as amended, it was difficult to see how that specification could be excluded. But the real question was, whether the action could be maintained. The action was brought upon a specification which the statement of claim alleged to have been duly amended ; and it was commenced before the specification had been actually amended. What was the difficulty ? Before the writ was issued, the patentees had applied for, and had obtained (on June 9, 1890) leave to amend their specification, upon the condition that they should not bring any action for any infringement committed before Jan. 1, 1884. From the evidence, his Lordship understood that this condition was then and there assented to by the patentees. The amendment was then made in every sense except that the document was not actually altered. The terms of the proposed amendment had been stated by the patentees ; its exact terms were accurately known by the Patent Office ; and nothing remained to be done but to enter the alteration on the register. This was the position of affairs when the action was begun. What was the objection to the action ? Reliance was placed upon a minute criticism of sub-section 10 of section 18 of the Act. No doubt, as Mr. Hopkinson had said, the patent was one and indivisible, and therefore an action was pending for the infringement of the patent. But, looking at the previous provisions of section 18, his Lordship could not see how any of them applied to such a case as the present, except sub-section 9. He thought the obvious meaning of sub-section 10 was this : When you are applying for leave to amend your specification, and have not got it, you shall not bring any action for infringement of your patent. But sub-section 10 did not apply when leave to amend had been actually obtained. There was nothing in the Act requiring the patentee to give a written acceptance of the condition imposed. After the leave to amend had been granted, nothing more remained to be done by the patentees. The only possible difficulty was in the suggestion that the patentees were in some way infringing section 19. But in the present case the plaintiffs did not require the leave of the Court to amend, for they had leave already. The whole argument turned on this—it asked the Court to construe sub-section 10 as applying to an action brought for the infringement of a patent the specification of which had been amended, instead of an action for the infringement of a patent the specification of which had not been amended. The appeal must be dismissed.

Lord Justice KAY entirely agreed. He said that in his opinion the action was properly brought, and everything necessary to be done by the patentees for the amendment of the specification had been previously done. Nothing was said in section 18 about the making of the actual amendment. If leave to amend had been applied for, and had been granted subject to a condition, and the condition had been assented to by the applicant before the action was begun, there was nothing in section 18 which prevented an action for infringement being then commenced on the amended specification. Was there a single thing which was required to be done by section 18 which was left undone when this action was brought ? Not a single one. Sub-section 10 could not have the least reference to a case like the present, in which everything which section 18 contemplated had been completed before the action was brought. The argument had proceeded upon an entire misapprehension of section 18. There was nothing in the Act which required a written acceptance of the condition imposed by the Comptroller. All that remained to be done was the registration of the amendment at the Patent Office, as required by section 23. The patentees had nothing to do with that. It was the duty of the Patent Office to make the registration. Section 19 provided for a perfectly different state of things. Its meaning was this : You cannot bring an action upon a patent, and then obtain an amendment of the specification without the leave of the Court. To such a case, section 18 had no application. But there was nothing in section 18 which said an action could not be brought upon an amended specification when leave to

amend it had been obtained, and everything which had to be done by the patentee to procure the amendment had been done, and nothing remained to be done but by the Patent Office. It had been stated that it was the practice of the Patent Office, after leave to amend a specification had been given, and before the amendment had been actually made on the register, to issue certified copies of the original unamended specification, without any note upon them of the fact that leave to amend had been given. There was nothing in the Act which required the Patent Office to do that. If this was the practice of the office, it was a very bad one; and the sooner it was altered the better. But this practice could not alter the Act, or make the action wrongly begun. In his Lordship's opinion it was rightly begun; and he did not see that any evil could result from this construction of the Act.

The appeal was therefore dismissed.

COUNTY OF LONDON ASSESSMENT SESSIONS.

Sessions House, Clerkenwell, E.C.—Thursday, Feb. 11.

(Before Sir P. H. EDLIN, Q.C., Chairman, and a Bench of Magistrates.)

Judgment in The Gaslight and Coke Company's Assessment Appeals.

Explanatory Note by the Chairman.

The following note, explanatory of the judgment delivered in the above-named appeals, given in the JOURNAL last week (p. 299), was issued by Sir Peter Edlin to-day:—

It will doubtless have been understood, from what was said after judgment had been delivered at the sitting on Monday last, that, in ascribing a *separate* rateable value of £250,000 to the stations and indirectly-productive works, we had adopted Mr. Ryde's separate valuation of those works, and that we did so in complete accordance with the written particulars thereof appended to his evidence. Now, it will have been observed that that valuation was arrived at *after* allowance made for rates; and, therefore, it will not be subject to any further deduction. But with regard to the other portion of the works, the assigned rateable value of which we said would be subject to certain deductions in respect of rates, the intended meaning would have been more precisely expressed had we said *corrections*. We differed materially from Mr. Ryde, as well as from the other professional witnesses; and it may be desirable that, having made this emendation, we should add a few words in order to remove any possible ambiguity. The "landlord's share" of this portion (I quote the words of the judgment), or the specified rateable value of it—viz., £370,500—would, of course, be irrespective of rates, which, in assessing property of this description, have to be deducted before we reach the lettable or rateable value; and in the estimate specified, they had been taken generally at 5s. 2d. in the pound, and deducted accordingly. The same amount—viz., £155,864—was deducted for rates by *each* of the valuers examined; that sum having been the amount actually paid in the account year. But upon the now altered total assessment, we calculate that the Company would be entitled to a somewhat larger deduction; and the difference [hence arising would necessitate the "correction" referred to, and would, of course, have to be apportioned, not only according to the value allocated, but, as I expressed it in the judgment, according to the poundage actually levied in each parish respectively. The necessary corrections for this purpose will require the aid of a skilled accountant.

Friday, Feb. 19.

On resuming the proceedings to-day,

Mr. LITTLER said that he desired to present certain matters to the Court. A "substituted" document had been sent to the parties, altering the views which were expressed by the Court in the first instance.

The CHAIRMAN said he could hardly concede that; and must at once meet it with a direct negative. It was not a "substituted" judgment, but an explanation of what might be ambiguous in the judgment as delivered by the Court. It was sent in order to remove any ambiguity. If the judgment was looked at, and compared with the synoptical table, they would find that there was no substitution. He complained that the matter was brought on without notice, and he consequently had not his papers with him—the questions having been postponed by general consent till the following Friday. If, however, there was any preliminary point to which Mr. Littler desired to call his attention, he would be happy to consider it; but when he made use of the expression "substituted" judgment, he at once met it with a direct negative. The emendation or correction, as it might be called, of an ambiguous word, was not necessarily inconsistent. But, on the contrary, it was quite consistent with the judgment originally delivered; and Mr. Littler had himself told him that his clients thought there was an ambiguity which had better be removed.

Mr. LITTLER said that the only ambiguity in his view was that with regard to the unproductive mains.

The SOLICITOR-GENERAL said he should very much like to know what it was that Mr. Littler proposed to do, or what motion he desired to make. They had been brought to the Court by a letter from the Solicitors to The Gaslight and Coke Company; and he hoped that his Lordship would allow Mr. Littler to mention the matter, so that he might see whether or not it was a motion he was going to make.

The CHAIRMAN said that it was agreed that he might be consulted *in camera* in regard to any question which might arise; and in that consultation the substance of the explanatory note was most clearly stated by him. If, however, his judgment had been carefully read in the first instance as it was delivered in Court, in conjunction with the synoptical table, the explanatory note would not have been necessary; but to clear up any ambiguity, he added that note, because he understood that Mr. Littler's clients thought that the word "deduction" or "reduction" might have been misapprehended.

Mr. LITTLER said that, with regard to the main question of the £370,000, he had no authority from his clients to assent to any such alteration as that.

The CHAIRMAN: How do you mean "consent to any such alteration?" The Court has to deliver its judgment.

Mr. LITTLER: Then I ask that the judgment as delivered may stand.

The CHAIRMAN: The Court has to deliver its judgment; and, if it is

ambiguous, it is for the Court to put the proper construction upon what it intended.

Mr. LITTLER said that, must be done in the first place in open Court by the Court; but he said it was not ambiguous in the slightest degree.

The CHAIRMAN: I hope it is not now.

Mr. LITTLER said that one parish had acted upon the original judgment in the sense in which he understood it, and had sent them in particulars on that basis.

The CHAIRMAN said that, if the parish in question acted upon its view, and because of ambiguity it took a view contrary to that which the Court intended, it was for the Court to put the construction that it intended upon its judgment.

Mr. LITTLER said he was sure his Lordship would appreciate the importance of this matter. It made a difference of £130,000 a year to The Gaslight and Coke Company; and if the correction stood, it would have the effect that the Company would be actually paying a sixtieth of the whole rates of London.

The SOLICITOR-GENERAL: Why not?

The CHAIRMAN said that the Court had had to deal with very wide differences, involving upon one point of view a positive liability to rates exceeding the amount which was agreed upon of £150,000 a year. The Court had had to deal with the materials before it, with a most anxious desire to do justice between the parties; and it had come to the conclusion which was very clearly expressed in the printed copy of the judgment. He admitted that the expression "subject to deduction for rates," was somewhat ambiguous, but they must observe that if they increased the rateable value of the appellants' property, why then they would be entitled to a larger deduction for rates than was included in the sum which was, by universal consent, agreed to by all sides. Therefore he was perfectly correct in saying that, in arriving at that sum, they must not overlook the fact that the appellants would be entitled to a larger reduction than that—subject therefore to the reduction consequent upon the finding of that sum.

Mr. LITTLER protested that they had come to any such conclusion; and he repeated that he must respectfully ask, on behalf of his clients, that the judgment should stand.

The CHAIRMAN: How can it stand?

Mr. LITTLER: Stand as originally delivered in open Court.

The CHAIRMAN: Certainly; but subject to an interpretation upon it which would be contrary to the interpretation which the Court intended, and to which we all agreed.

Mr. POLAND said that there was no judgment until his Lordship had decided what was the gross rateable value in each parish.

The CHAIRMAN: No, of course there is not.

Mr. LITTLER said that it now worked out pretty nearly to the same effect as if the Company had not appealed.

The CHAIRMAN said he could not help the effect. Mr. Littler would have been the first to blame him if he had framed his judgment upon the hypothesis, and anticipated the conclusion that the sum of £155,864 would be all the deduction necessary for rates. He did not do so. He showed clearly that the Company would be entitled to a larger deduction for rates; and the expression should have been the "correction" of the amount, and not the expression used, which he quite agreed might have led people to suppose that the £155,000 had not been already deducted. Now they had the explanation.

Mr. LITTLER said that of necessity the amount would be larger. It would have been much better if it had not been mentioned in the judgment at all.

The CHAIRMAN said he must be permitted to frame his own judgment, and to express it in such words as he thought would be necessary and requisite for expressing the opinion of the Court.

Mr. LITTLER said that it seemed to him that "correction" was an entirely different word from "deduction."

The CHAIRMAN said he could not put it clearer than he had. How could they deduct the proper amount for rates until they knew what were the rates in the several parishes—130 parishes in all. In some they were as much as 6s., and in others less than 5s.; and the deduction for rates must necessarily be, as he put it, according to the poundage in different parishes.

Mr. LITTLER remarked that all he could say was that they would have the satisfaction of going all through the figures again with the supplemental rate—that was all.

The SOLICITOR-GENERAL said that not only was he not aware that certain figures had been sent to the appellants by one of the parishes, based upon an interpretation similar to Mr. Littler's, but until late on the previous night he was not aware that his Lordship had given any explanatory memorandum. He had read the judgment as originally delivered by the Court, and carefully considered it; and in his belief that judgment, when carefully examined, sufficiently established the conclusion at which his Lordship had arrived, and at which he understood his Lordship to arrive, and with which he (the Solicitor-General) was entirely satisfied.

Mr. CASTLE called attention to the printed reports of the proceedings, and contended that they did not bear the construction which his Lordship put upon them.

The CHAIRMAN said he differed from Mr. Castle entirely. If the matter were candidly considered in conjunction with the appellants' own figures, it would be impossible to come to any other conclusion; and the fact that the stations and unproductive portion of the property had been separately assessed, clearly showed that there must have been a deduction for rates in respect to that amount. Otherwise they would have to specify a different figure with regard to that portion of the property.

Mr. CASTLE said that, if his Lordship remembered, the reason given why the apportionment should take place before the rates were deducted, was because there were different rates in each parish. Therefore as to the £370,000 which they had to distribute, they must first agree as to what portion of the £155,000 of rates was added before they distributed it at all. They could not distribute the £370,000; but they must distribute some other sum which must be the £370,000 *plus* an aliquot proportion of the £155,000.

The CHAIRMAN said that would be subject to deduction before it was distributed; and that deduction would be the difference between the rate in respect of the present assessment and the amount of rates

in each parish—the difference to be ascertained by comparing what was the former assessment and what was the present assessment, and making a larger deduction for rates accordingly and according to the specific rate in each parish.

Mr. CASTLE: You cannot distribute it in that way.

The CHAIRMAN: Oh, yes, we can.

Mr. CASTLE said that in some parishes the rates were 5s., and in others 4s.; so that they could not apply it in that direction. Therefore the £370,000 must have added to it some further sum, and that must be the difference for the whole of the rates.

The CHAIRMAN said that Mr. Castle was altogether in error in saying that it could not be done. It might be a difficult calculation; but with the aid of an accountant it could be made, and made upon the data which were furnished. If they considered that the receipts in each parish had to be compared with the total gross receipts of the Company, then there would come a deduction in respect of what might be called the general expenses—namely, the unproductive works. Then there was the residue or remainder; and that remainder had to be distributed in a like ratio. When they ascertained in the account year (which was a different year from that upon which the calculation was first based) what the receipts were in each parish, they would then have to consider what proportion they bore to the general receipts after these receipts had been subjected to the deduction spoken of. Then, when they got that ratio, they would have to apply it to the remaining sum for distribution.

Mr. DANCKWERTS, following on the same side as Mr. Littler and Mr. Castle, said that it was a serious matter for his clients; and therefore he desired to say something in addition to what his leaders had stated. It was obvious, if they looked at the synoptical table, that that was founded upon a different basis altogether as regards the respondents' witnesses and as regards those who appeared for the appellants. The respondents' witnesses had all of them added £200,000 odd for the increased price of gas.

The CHAIRMAN: No, not all of them.

Mr. DANCKWERTS: All of them, without exception.

The CHAIRMAN: Not in respect to those figures which we have taken for our assessment.

Mr. DANCKWERTS: Every man of them has done so. Every man has added 3d. for the increased price of gas, and that accounts for £200,000 of the difference between them.

The SOLICITOR-GENERAL: Mr. Jones added something in respect of that.

Mr. DANCKWERTS: I beg your pardon; you are utterly mistaken.

The CHAIRMAN: I think not, Mr. Danckwerts.

Mr. DANCKWERTS said it was obvious that it was only in those cases that there could be a deduction by way of correction where the rateable value had been increased; and his Lordship would find that all the witnesses who had decreased the rateable value as compared with the account year had added a correction by way of rates.

The CHAIRMAN said he quite followed that. The three valuers called on behalf of the appellants put the sum at which they alleged the property should be valued at a less amount than that at which it stood at the last quinquennium. Then necessarily they had to add an amount for rates, because they would not be entitled to so large a reduction as they had formerly; but the others, if they were valuers putting up the assessment, had, of course, to take that into account.

Mr. DANCKWERTS: Are we to understand, then, that the Court did intend to put up the assessment because of the 3d.? That is the point.

The CHAIRMAN: I am much obliged to you for putting a categorical question. I answer it by saying that I leave you to consider the judgment, and to answer the question according to the judgment.

Mr. DANCKWERTS said his Lordship would pardon him, but this was an important matter. It had occupied the Court for seventeen days during more than six months, and enormous costs had been incurred. There had been talks of supplemental lists; and unless they understood that the Court had given due weight to that addition of 3d. to the price of gas, it might be that they would have to come again this year or next year, and fight the whole matter over again before the Court.

The CHAIRMAN: You want an encouraging word from me to induce you to appeal again.

Mr. DANCKWERTS said they merely wanted something from the Court which should be equivalent to finality, and put a stop to this enormous expense. He would like an answer to the question he had put. The next point he had to make was that, on the sixteenth day of the hearing, the Court called them all solemnly together and put certain questions to them, and made certain bargains with them, which the appellants understood and which they accepted only in the way in which they understood it. The way in which they understood that bargain was this—

The SOLICITOR-GENERAL: A bargain!

Mr. DANCKWERTS: Yes, and with you too, Mr. Solicitor.

The SOLICITOR-GENERAL: My Lord, I never made a bargain with the Court in my life.

Mr. DANCKWERTS said it was agreed that the Court should deliver judgment upon a certain basis. He called that a bargain. It was plain Saxon-English, and it was the right word. That bargain was this—that the Court should name a sum for the total of the directly-productive works; that this total should be allocated among the parishes; and that the rates in each parish should be deducted therefrom, according to what they really were in each parish.

The CHAIRMAN said Mr. Danckwerts was putting an interpretation upon what he said entirely foreign to his intention; and, if it were carefully considered, an interpretation that would be absolutely inconsistent with a judicial dealing with the case. He could not fix the rateable value in either of the parishes until he knew what the rates were in the account year. He had pointed out that the Company were entitled to a deduction for rates. The rates were not deducted in ordinary cases. In the case of house property, they were left to be paid by the tenant after the rateable value was fixed; but they had in this case to consider what would be the charge upon the Company for the rates they would have to pay. This introduced necessarily some little complication into the statement of the figures, and into the accounts. He could not undertake to ascertain from each parish what was the amount of its rates in the account year, and then work out the

necessary sums for the purpose of showing what would be the specific rateable value in each parish, and what would be the total when they came to be added together. How could he do that?

Mr. DANCKWERTS said that to his mind it did not present any difficulties, and also that was the way in which they understood the arrangement that was made on the sixteenth day.

The CHAIRMAN remarked that if he said anything which might have produced a misapprehension, he apologized. They made no bargain, and he could not accept that word.

Mr. DANCKWERTS said that then he failed to see what conceivable object could have been accomplished by calling the parties together.

The CHAIRMAN said the object of the interview was that he wished to find what was the proper proportion of division for the gross receipts. He found a general accord with the principle.

Mr. DANCKWERTS said that so far as one man could know the mind of another, he knew the respondents understood the matter in the way in which the appellants understood it. He did not say that this was the case with all the respondents; but it was so with those with whom they had communicated. At the outset, an agreement was made that his Lordship, in the first instance, should determine the value of the whole; that this should be the judgment of the Court; that the parties should subsequently apportion it among the parishes in the usual way; and that if any difficulties arose they should come before the Court. Under the statute, his Lordship was bound to deliver judgment in open Court; that judgment was delivered in open Court on the seventeenth day; and the appellants claimed by that, and could not accept any subsequent modification by private circular.

The CHAIRMAN said that, if the parties were represented, he would now read his judgment.

Mr. DANCKWERTS said that the Court was not composed as it was on the day that the judgment was delivered; they had the judgment of the Court on the seventeenth day, and they could not accept anything else.

The CHAIRMAN: You have the judgment as delivered, with the explanatory note.

Mr. DANCKWERTS: I cannot accept that note. It makes a difference to us of an enormous sum. We cannot accept anything except the judgment of the Court as it was constituted on the seventeenth day.

The SOLICITOR-GENERAL applied for the costs of the day's proceedings against the appellants.

The CHAIRMAN said he did not think he should make any such order at present. The question of costs would be one that they would have to consider, and he was much exercised as to what the Court would do in the matter. The appellants, now that they had had an opportunity of studying the judgment, were not so well satisfied with it as they appeared to be when it was delivered, and they had set forth certain reasons, and they would have him think that the judgment was not open to the ambiguity which he admitted that it was. But he had dealt with that; and he thought he had succeeded conclusively in showing that, when the facts came to be looked at according to their own synoptical table, a frank and candid mind construing the judgment would have seen that it bore no other interpretation than that which it must bear with the explanatory note which he had added. With regard to the costs, let both sides understand that the Court had to look at the figures that were presented on behalf of the respondents as well as on behalf of the appellants. He would instance one case which he was very sorry to observe—the parish of Islington. In that parish there was a claim, in rough figures, of £45,000 rateable value; and the appellants insisted that they ought to be rated at £12,000 rateable and £14,000 gross value. Look at the wide difference which the Court had to consider, and at the embarrassment caused by those widely conflicting opinions, and the difficulty of the task imposed upon it. The Court, however, did not shrink from the task; and he personally devoted hours and days, when he had not been sitting in that Court, to the consideration of the facts in the case. If he had gone wrong, all he could say was that he deeply regretted it; but he had applied his mind most conscientiously to the matter, and he abided by, and should abide by, the judgment as it had been explained by himself.

Electric Lighting for Dublin.—The electric lighting undertaking of the Dublin Corporation has now progressed very nearly to completion. The main building is in Fleet Street, and will be finished in about a fortnight. It consists of engine-rooms and offices, testing-rooms, and a storage room, and will shelter three 300-horse power engines for private lighting, and three 60-horse power engines for public lighting. Two of the private lighting engines can work 5000 incandescent lamps of 16-candle power; and there will be one spare engine in case of accidents or emergencies. The public lighting engines can supply 120 arc lamps, with one engine in reserve. The foundations are ready for the engines and dynamos; and the wires are laid in the principal streets in the portion of the city which the Corporation has selected to be first lighted. The Electrical Engineering Company of Ireland are carrying out the work; and Messrs. Hammond and Co., of London, are supplying the electrical appliances.

The Gas Question at Eccles.—On Monday last week, a special meeting of the Eccles Local Board was held to consider the petition prepared by the Board's Parliamentary Agent for presentation to Parliament against the Swinton Gas Bill. The petition contained a general clause declaring that the promotion of the Bill would injuriously affect the interests of the Board's district, and requesting the alteration of various clauses, so that (1) Swinton should not have the power to impose a differential rate on gas consumers in the Eccles district; (2) that the illuminating power of the gas to be supplied by Swinton should be 18 instead of 14 candles; (3) that the Eccles Local Board should have the control of their lamplighters; and (4) that a clause be inserted in the Bill enabling the whole of the out-districts affected by the clause in the Salford Act to form a joint authority, or that section 48 of the Bill be so altered as to enable Eccles to purchase only such portion of the gas undertaking as is situate within its own districts, or those portions of the out-districts—Irlam, Cadishead, and South Barton—which are supplied by the gas-mains running through Eccles. The petition was approved; there being only one dissident.

MISCELLANEOUS NEWS.

SOUTH METROPOLITAN GAS COMPANY.

The Ordinary Half-Yearly General Meeting of this Company was held on Wednesday last, at the Bridge House Hotel, London Bridge—Mr. GEORGE LIVESEY in the chair.

The SECRETARY (Mr. Frank Bush) having read the notice convening the meeting, and also the minutes of the previous meeting, the report of the Directors, with the accounts for the six months ending Dec. 31 last (given in the JOURNAL for the 9th inst.), was taken as read.

The CHAIRMAN, in moving the adoption of the report and accounts, observed that several questions were raised in the report upon which, he thought, an explanation was due to the shareholders. Beginning with the first paragraph, reference was made to the coke, on which the Directors stated that there had been a very serious falling off in the receipts—a falling off amounting to £32,500 in the half year. He thought the proprietors were entitled to know how and why this had happened. He might say that, as to quantity, coke was not produced at all uniformly throughout the year. They made about thrice as much in the three or four winter months as in the summer months. In the winter the supply exceeded the demand; while in the summer the demand exceeded the supply. Consequently, they were obliged to store a large quantity every winter, in order to meet the summer demand, and thus avoid disappointing their customers as well as prevent a great fluctuation in price. In 1890 the stock which had accumulated in the previous winter was not sufficient, and they ran out of coke. Its price therefore rose very materially; and the cement manufacturers, who had been obtaining their coke by contract at about 6d. per cwt., had to pay as much as 9d. per cwt. for contracts made that year. This was a very serious matter for them, because coke was the heaviest item of their expenditure; and the result had been that the cement trade had fallen to pieces very much indeed. It was, in fact, now in a very unprosperous condition, partly owing, he presumed, to the great advance in the price of coke. The increase in the cost of coal, therefore, which was reflected in coke, had acted detrimentally to the cement trade, which was a most important one in this country; and no doubt it had been detrimental also to other trades. Seeing that they had not enough stock in the summer of 1890, they accumulated a large quantity in the succeeding winter; but in the summer of 1891 they were quite unable to sell any appreciable amount of it. Prices fell off very materially; and the cement contracts had to be made at very much like the old figure. He thought this was a sufficient explanation of the great falling off in the receipts from coke. The Directors could not get rid of their stock, so in the fall of last year they determined that they would not allow it to accumulate any further; and it would be found, in the statement referring to the residual products, that in the six months covered by the period under review, they scarcely increased their stock of coke at all. They reduced the price in order to sell all they made; and he contended that in so doing they had acted wisely and of necessity. It would have been the extreme of folly to have kept up the price, and so increased the stock: for this would have made their difficulties all the greater. The JOURNAL OF GAS LIGHTING and Money had referred to a sentence in the paragraph from which he had quoted, in which the Directors stated that the reduced price of coke might be expected to benefit gas undertakings by helping to bring down the price of coal. He desired to make it perfectly clear that they had not reduced the price of coke for the purpose of lowering the price of coal. It would not only have been folly, but it would also have been wrong, to waste their money in any such attempt. It had, however, occurred to them, seeing that coke had returned to its original value, and that coal still remained very high, that, if the former were sold at its present low price, it must, to some extent, at any rate, affect the price of coal. They had therefore said that it might not be altogether such a great disadvantage to them that coke was so cheap; and this accounted for the following sentence in their report: "Coke being now a far cheaper fuel than coal, the sale, at low prices, of the large quantities for disposal all over the country may be expected to benefit gas undertakings by helping to bring down the price of coal." He repeated, however, that the Directors had reduced the price of coke because they could not help themselves. The price of coal was, as the proprietors were all aware, a most serious matter to them. When he told them that last year 52 per cent. of the Company's total expenditure was upon coal, they would see what a serious matter was a rise in its price. Coal was a little cheaper now; but seeing that only two months ago it was 50 per cent. more, free on board in the Tyne, than it was two or three years previously, it was plain that its high price must very seriously affect them; and the drop in coke had also affected them very seriously also. With these items, however, he had done with all that was unsatisfactory. In all other particulars, what they had to say to the proprietors was, in the opinion of the Directors, of a most satisfactory character. He found that the increase of their business was going on at a greater rate than before. For instance, in the five years from 1881 to 1886 they increased 25 per cent.; while in the five years from 1886 to 1891 they increased 29 per cent. Altogether, since 1880, the increase in their business amounted to nearly 300,000 tons of coal a year. In 1880 they used 387,000 tons; and in 1891 they used 682,000 tons. With regard to the increase in the consumption of gas, comparing last half year with the corresponding period of the previous year, there was practically no increase—at any rate, it was less than 1 per cent.; but then they were comparing a mild season with a totally exceptional one. The half year ended December, 1890, was such as they had never known—at any rate, for the last 30 or 40 years; and to obtain a fair comparison, they must go back some time. He could not compare the past half year with the December half of 1889, because then there was a disturbing influence. At that time they were in the midst of the strike, which affected their consumption; and therefore it was necessary to go back to 1888. On doing so he found that, comparing the December half of 1891 with the same period of 1888, the increase in the consumption had been 13½ per cent., or rather more than 4½ per cent. per annum. He thought this was satisfactory. The next item in the report contained a reference to the Company's

officers and foremen; and he was bound to say that, as had always been the case, they were devoted to the interests of the undertaking. The proprietors were very much indebted to them for the earnest devotion with which they served the Company; and he thought he might say that the good feeling which existed between the Directors and the officers was thoroughly reciprocal. As he had given the meeting the proportion of the expenditure upon coal, he might say that salaries represented about 5 per cent. of the Company's total expenditure. In connection with the officers, they had within the last half year started a superannuation or pension fund—the officers and the Company contributing an equal amount—to provide a retiring allowance on the officers attaining a certain age, without their having to come before the Board, and then having each case dealt with on its merits. He believed that this would work to the satisfaction of the officers as well as to that of the Directors. He next came to a very important matter—the question of the workmen. The Directors said in their report: "Of the workmen of all classes, it can truly be said of the great majority that never has the work been done better, or in a more cheerful spirit, particularly by the stokers, than during the week of fog at Christmas." He might say, in reference to that week, that the Company had considerable difficulty in supplying their consumers; but their worst day was on the Tuesday. In consequence of the thorough manner in which all their people put their shoulders to the wheel, by the Wednesday and Thursday they were gaining on the fog; and their Engineer had informed them that, if the fog had lasted eight days, they would have been quite masters of it. Walking through the retort-house with their foreman on the Wednesday, he asked him how the men were doing. Their foreman was not one to say that the men were doing well if they were not; but he replied that they were doing as well as could be wished. He (the Chairman) then asked whether the men were working the retorts a little harder; and the reply was: "Yes, and without being asked to do so. They are putting an extra quantity of coal into the retorts without the foremen asking them to do it." Now, that was a return to the old state of things which used to exist between employers and workmen; and the men had acted as stated without any expectation of getting extra pay, and, indeed, without getting it, for when there was too much gas the work was eased somewhat, and in times of pressure it was expected that the servants of the Company, from the Directors downwards, would put in some extra exertion, as was done during the fog in question. The Directors considered this the most important question affecting the interests of the Company—that their men should work on terms satisfactory to themselves and to their employers, and that they should work in a cheerful, happy, contented spirit. It was the object of the Directors to do everything that was fair and just—for it was justice, and not charity, that workpeople wanted—to promote this state of feeling; and he thought they were fairly succeeding. For workmen's wages they paid last year something like £300,000, which was 35 per cent. of their total expenditure; so that any abnormal increase in wages or reduction of work would, as the proprietors could see, very seriously affect them. With reference to the question of labour and capital, he held in his hand the annual report of the Labour Association for Promoting Co-operative Production. This was an Association of working men; and in their report he found this sentence: "Already, in some industries, and before long in others, it appears likely that organized labour and organized capital will stand face to face in a position alternating between that of armed peace and open war. But, like two hostile though neighbouring nations, each is essential to the welfare of the other; and the question arises, with ever-growing importance, 'How will their interests best be harmonized?'" He thought this was a very pregnant sentence; and it expressed what was very much the truth—that they were approaching, if they had not arrived at it in many cases, a state of armed peace or open war between capital and labour. What they had to do was to harmonize these two apparently conflicting interests; and he felt that in their own case they had found the system of profit-sharing which they had adopted had tended materially in this direction. At any rate, they were anxious to make their workmen feel that their interests were bound up with those of the Company; and it seemed to him that the way in which their employees did their work was tolerable evidence that they were responding in a right and proper spirit to the efforts which were being made. The proprietors would probably have noticed during the past week the strike of the coal porters. A statement was made that the Union men working at the South Metropolitan Company's wharves had refused to unload the barges. They had been very much surprised at this; and the Secretary wrote to the Editor of the paper a letter on the subject, which, with the usual fairness of the press to the Company, was inserted. The Secretary stated that there were two mistakes in the report. The first was that the Directors were not aware that any members of the Coal Porters' Union were employed by the Company; and, in the second place, that no man had refused to work at any of their stations. The Coal Porters' Union struck on two occasions without giving the Company any notice at all. In the dock strike, all the coal porters stopped work in sympathy with the dockers. There was no grievance or complaint on the part of the coal porters themselves; but all the work of the Company at their wharves was stopped in the strike of August, 1889. Then, in the stokers' strike in December of last year, the coal porters turned out in the same way. Mr. Michael Henry, their Secretary, said to him (the Chairman): "Unless you give way to your stokers, not an ounce of coal shall be received into your works from to-morrow." And the coal porters came out again without notice. The Company then got free from this state of things; and they intended to keep free. The result had been that, while other companies had recently had their coal supplies partially stopped, the South Metropolitan Company had gone on without a hitch. The proprietors might have noticed a case of *Higgins v. Ward*, which had been recently reported in the papers.* Ward, the Assistant Secretary of the Gas Workers' Union, made a charge against one of the Company's men. According to the evidence, Ward said about Higgins, who was employed at the East Greenwich works, that he "would stand about and rob any hard-working man of his week's wages, or his

* See ante, p. 117.

watch and chain if he were lucky enough to have one; and he knew the cells in Strangeways Gaol better than the retorts in gas-works. He had often been convicted; and on one occasion, when he had been taken into custody, upwards of 40 pawntickets were found on him relating to stolen watches and chains which he could not account for." It had been stated that the Directors had asked Higgins to explain this matter; but this was not the case. The fact was that the man came to them, and said that it was a very serious state of things for him; that he lived in the immediate neighbourhood where the statement was made; and that he had since then been pointed at as the Manchester thief. He (the Chairman) told Higgins they would do all they could to protect him; that he might go to the Company's Solicitor; and that an action for slander should be proceeded with if he was prepared to go on with it. This Higgins had done. Workmen were often charged with want of pluck in such matters; but he had not found this to be the case where they were properly supported. The Directors paid the cost of the action, with the result that the Judge (Mr. Justice Denman) stated that "he could not say that this was not a very serious slander, as systematic dishonesty of a very low character was charged against the plaintiff." The defendant would not apologize; and a verdict of £200 was given against him. But here the law was in fault. The man snapped his fingers at the verdict, and said that neither the Company nor anyone connected with them should have a brass farthing out of him. Inquiries had been made about him; and it had been stated that the whole of his goods were not worth a pound. A poor man could therefore be slandered, as Higgins had been, and there was no remedy. However, the action which had been taken had to some extent stopped Mr. Ward from making his speeches. This same man last summer said to Mr. Tysoe, the Manager of the Company's East Greenwich works: "We will have all your Company's men in the Union again before next winter; and then we shall have another strike," which, of course, was an empty threat; but after this, who could blame the Directors for saying that they would not employ men belonging to the Union? They refused to do so both in their own interests, and in that of the workmen themselves. Turning to the accounts, the Chairman said that the item of "repair, maintenance, and renewal of mains and service-pipes" was high as compared with what it was last year. Last summer they were laying or relaying a large quantity of old mains; and as they could not charge this expenditure to capital, it had to come into the revenue account. This had swollen the item; and another cause for swelling it was that a considerable length of large main had been found to be leaky. It was laid in a road that was not secure, and a settlement had taken place, causing very heavy expense—amounting to about £20 a week for some months—in searching for leaks. This and the relaying of old mains accounted to a great extent for the increase in the item of repairs and renewals. With reference to stoves and meters, the question had been raised as to what the Directors did in the matter. The answer was that they treated them both alike. When an old meter was worn out, they bought a new one, and paid for it out of revenue, so as to keep their capital intact; and when an old stove was worn out, they also bought a new one, and paid for it out of revenue, so as to keep their capital intact. Thus they maintained their meters and stoves at their original capital value. They did not write off anything for depreciation; but they did what was the same thing—they restored out of revenue all the wear and tear. The next point in the report was an important one, relating to capital; and here he thought the shareholders had a right to ask for full information. The Directors were year by year asking the proprietors and the public for more capital. During the last ten years they had raised something over £900,000 of capital; and the shareholders might well ask what had become of it. Whether or not they had expended the capital advantageously was the question that concerned the proprietors and the public. They would want to raise additional capital; and if they could convince the shareholders and the public that the capital so raised was being wisely and advantageously expended, they would find no difficulty in obtaining it in the future as they had done in the past. This £900,000, on which the average charge for interest was a trifle over 4 per cent., had been spent on the erection of new works and plant for making and distributing the gas from the greater part of the extra 300,000 tons of coal a year above referred to. He found in the last five years the capital expenditure had been equal to £3 3s. per extra ton of coal used. This certainly was a low figure. In the previous five years, it was equal to £4 10s. 6d. per ton; but then they were buying land. During the past ten years, the expenditure worked out at £3 14s. 3d. per extra ton of coal. The shareholders might ask him how he knew that this was right. He did not know how to explain it exactly; but he thought he might take corresponding cases. In the previous decade, there were two large London Gas Companies, each about as large as theirs, who were building new works; and he found in those cases that, in the eleven years from 1869 to 1880 they expended at the rate of £9 15s. 9d. per ton on their new business, against the South Metropolitan Company's £3 14s. 3d. This, he thought, spoke for itself; and the result of their working was that they had reduced their capital from £5 11s. 7d. per ton in 1879 to £4 10s. 9d. at present. They were now raising capital. They were obliged to issue debenture stock and "C" stock in certain proportions; and the rate at which they were getting capital now was about £4 16s. 6d. per cent. They were trying to raise it at the lowest possible rate, in order to make the burden of interest as light as possible. With regard to the effect of the sliding scale on the price of gas, he desired to say a few words. A good deal of complaint was made about the increase in the price, though he could not say that there was much about their own Company. They advanced their price by 3d. per 1000 cubic feet from last September. What, however, was the case in the coal famine of 1873-4-5? At that time the Company were selling gas at 3s., and they did not put up the charge at all, but they fell back on their reserves—their undertaking was then one-eighth its present size—to the extent of £15,000. At the present period of pressure, owing to the high price of coal, they had used their reserves to the extent of £300,000; showing that this period was very much harder, and that the difficulties were very much greater, than they were in 1873-4-5. In fact, if the Company had been able to do as well this time as they did then, they would have taken only £120,000, instead of £300,000, from their reserves. n 1873-4-5,

coke, tar, and ammonia realized very high prices; and in this way they recovered a great deal of the additional cost of coal. He was stating this in order to show that the present was a much harder period for gas companies to pass through than the previous one. What, however, was the result of the sliding scale? Some gas companies in the earlier period raised their price from 3s. 9d. to 5s., or 1s. 3d. per 1000 cubic feet; whereas this time the greatest increase that had taken place was only 7d. He thought they might fairly contend that the small advance in price now was due to the action of the sliding scale, which was not in existence in 1873-4-5. The sliding scale made it the interest of gas companies to keep down their price, and to avoid raising it as much as ever they possibly could. He contended therefore that it had been the cause of preventing the charge for gas from being put up to anything like the extent that it was advanced some sixteen or seventeen years ago. The only other question to which he had to refer was that of the dividend; and in connection with this subject, he desired to repeat the statement that a very large proportion of the Company's shareholders were not getting 13 per cent., although this was the dividend declared. About 30 per cent. of the proprietors—some 1150 of them in all—had purchased their stock under the auction clauses; and they were only receiving about 5 per cent., or a fraction over. It was therefore a misnomer to call it 13 per cent. in their case. The Directors had very anxiously thought over the question of dividend. They were drawing about £17,000 from their reserve fund; and they considered whether or not it would be wise to reduce the dividend. But the fact that so large a proportion of the shareholders had bought their stock by auction was felt to be a very serious objection to any reduction, particularly as the Directors thought they saw their way to "pull through" now without decreasing the dividend any further—at any rate, they hoped so. They felt that they had a thoroughly sound business, which was increasing and prospering; and so long as their business went on increasing and prospering as it had done and was doing, they might be certain that temporary periods of depression, temporary periods of bad times, or temporary periods of high prices would pass away, and that they would recover their original prosperity, and be able to meet the proprietors, declare the same dividend, and sell gas at the same low price, and, they would hope, lower than ever before. He did not think the shareholders had the slightest ground for fear as to the stability of their property. If their business were declining, and they did not see their way to hold their own, if they were on bad terms with their workmen, if coals were going to remain at their present high prices, and if coke was going to be sold permanently at low prices, they might have despondent feelings. But seeing that coal was coming down, and that the business of the Company was growing at a greater rate than it was ten years ago, the shareholders were right in thinking they had a solid property; and they would do well to keep their stock.

Captain T. B. HEATHORN, in seconding the motion, observed that the Chairman's remarks were the echo of the opinion of every Director present.

Mr. LOTT said that what the Chairman had stated was quite correct—that a large proportion of the shareholders were really only receiving about 5 per cent. on their investment in the Company; and he asked whether a plan could not be devised by which, for every £100 of "A" stock, £300 of stock might be issued. The dividend would then be the same, though appearing to be so much less.

Mr. FOSTER stated that, like everyone else, he had been greatly incommoded during the past few weeks, in going through the City, by the works in progress for starting the electric light. He asked if the Chairman could inform him what he would have to pay for an equal quantity of light by electricity if, with gas at 2s. 6d. per 1000 cubic feet, his gas bill, including repairs, cost him £50 a year. He was sure all the shareholders congratulated the Directors on their very excellent report.

Mr. FIELD asked whether any electrical plant was being laid in the Company's district. Their success had, he said, been achieved by cheap gas; and he hoped the Directors would reduce the price as soon as possible, and not wait until they could make a reduction of 3d. per 1000 cubic feet before lowering it.

The CHAIRMAN, in reply, stated that they were aware of the disadvantages of declaring a dividend of 13 per cent. when so many proprietors received only about 5 per cent., or a fraction beyond; but there were many difficulties in making any alteration. In the first place, it would very largely increase the nominal capital of the Company. The Bristol Gas Company obtained power from Parliament last session to reduce their 10 per cent. capital to 5 per cent., by doubling the amount of the capital, the greater part of which, however, was auction capital. In the case of the South Metropolitan Company, only a part of the capital was in this category. If any means could be devised by which they could put the rate of dividend on a more just footing nominally, the Directors would be quite prepared to adopt it; but they would not go to Parliament for this object. They were safe from applying to Parliament now for a considerable number of years. They could raise about £1,400,000 more capital without legislative sanction; and they intended to keep clear of Parliament, the County Council, and "all those people," as long as possible. Mr. Rice had handed him a slip of paper containing this question: "In the event of a proposal from the County Council to acquire the gas undertakings, what would be the position of the shareholders?" The first thing was to show that the public would be better served by the Company than by the Council; and he had no fear on this point. Then, if the Council wished to buy them up, they must pay the Company the recognized price; and he did not at all think that Parliament would compel them to sell their property at less than its proper value so long as they did their duty by the consumers, as they had been doing, and intended to do. As to the price of gas, they were anxious to lower it again; and they would not wait until they could bring it down 3d. before they made a reduction. As soon as possible, they would reduce it by 1d., then by another 1d., and so on. The proprietors were aware that the Company's greatest strength was in selling gas at the lowest possible figure. With regard to the electric light, the other day Professor Forbes said, at the Society of Arts, that it was nonsense to talk about electric

light being nearly as cheap as gas; its cost was equivalent to double the price of gas at 3s. per 1000 feet. Other estimates had put the cost of the electric light at three times that of gas. In answer, therefore, to Mr. Foster, if his gas came to £50 a year, it would cost him, by the lowest estimate, according to a responsible electrician, more than £100 to have the same amount of electric light; and he (the Chairman) himself believed that it would cost Mr. Foster £150. This was the Company's safeguard. Theirs was a poor district, and people were not likely to pay £2 for what they could get for £1. He did not know that any electric light plant was being laid in their district, though one or two private houses supplied themselves by means of gas-engines and there was a semi-public installation at Brixton. There was a large electric lighting station at Deptford for supplying the City and the West-end; but he did not think that it was working very satisfactorily.

Mr. FOSTER: I think we may also say that a good many of our customers prefer the heat which they get from gas, and which they could not get from the electric light?

The CHAIRMAN: Yes.

The resolution was then put, and carried unanimously.

The DEPUTY-CHAIRMAN (Mr. John Mews) then proposed, and Mr. SIMPSON ROSTRON seconded, the following resolution: "That a dividend at the rate of 13 per cent. per annum be now declared, and that such dividend, with the exception of the sum of £500, be apportioned amongst the three classes of stock, as prescribed by the Scheme of Amalgamation, 1880; and that the warrants be transmitted to the registered addresses of the proprietors by post."

The resolution was unanimously agreed to; and the retiring Directors and Auditor were subsequently re-elected.

Cordial votes of thanks were afterwards passed to the Chairman and Directors, and also to the Engineer, the Secretary, and the staff.

The CHIEF ENGINEER (Mr. Frank Livesey), in replying for his department, observed that had it not been for the low price of coke the Company would have had a very good half year indeed. They had never gone into new schemes rashly, but they were carefully and cautiously trying all the latest systems of carbonizing, in order that, without spending money recklessly, they might find out and adopt the best. If the value of coke, and the purposes for which it could be used, were more widely known, he was sure it would be more generally employed. They could at the present time deliver coke to any manufacturer on the river at about 7s. per chaldron; and they could also deliver it now in any part of their district at about 9s. or 10s. per chaldron.

A SHAREHOLDER inquired if this included coke for household use.

The CHAIRMAN: Certainly. We break the coke especially for household purposes for a penny per cwt. extra.

The proceedings then terminated.

BRENTFORD GAS COMPANY.

The Half-Yearly Meeting of this Company was held last Friday, at the Charing Cross Hotel—Mr. HOWARD C. WARD in the chair.

The SECRETARY (Mr. W. Croxford) read the notice convening the meeting; and the Directors' report and the accounts (which were summarized in last week's number) were taken as read.

The CHAIRMAN, in moving the adoption of the report and accounts, said that the former contained a little more than it usually did. The first paragraph, after that dealing with the dividend, referred to the inclined retorts which they had been erecting at Brentford and Southall; and he believed their Engineer (Mr. Frank Morris) would tell them that they were working in a most satisfactory and efficient manner, that he had perfect confidence in them, and that they would be of very great service in the future, not only to the Brentford Company, but to all gas companies throughout the kingdom. The retorts worked very easily and economically. In point of labour, the saving by them was considerable; but this was not shown in the accounts for the past half year, because they formed rather a small proportion of the total number of retorts in use, and they had not been at work for any length of time, except experimentally. What was very important, too, was that the men preferred working the inclined retorts to the horizontal ones; and, besides, being very easily operated, any set of men could work them if the regular hands were to enter upon one of those damaging strikes which had been so rife in the country during the past few years. They had now 154 inclined retorts set; and, having been satisfactory, the Directors had arranged for 84 more to be put up. In connection with this subject, he might say that these retorts had been erected to replace a large number of the old horizontal ones, which were originally paid for out of capital; and as the latter were destroyed, it was only fair to charge the new retorts against wear and tear. If the shareholders turned to the revenue account, they would see that the item of repairs and maintenance of works and plant, &c. (which was £7516 in the December half of 1890), had increased to £12,019 in the past six months. This was an increase not absolutely of cent. per cent. for wear and tear, but approaching it; and he wished the shareholders to understand that it was due to the exceptional charge for the establishment of the system of inclined retorts, and that the increase was nearly equal to the deficit of the profit required to pay the dividend for the half year. They had also been busily engaged in the erection of the new holder at the Southall works; but the wet autumn had delayed its completion, and they now hoped to get it finished by the end of March. With regard to the question of residual products, all of them had fallen in value during the half year, especially coke. As to the reason of this, a good many people differed. But he saw that their friend, Mr. Livesey (whose opinion always deserved attention), said that the price of coal and fuel was too high, and that this had depressed the cement trade. The disturbance of business in South America, in the Argentine Republic, and the want of progress there, had crippled the cement trade in a great degree, and had made it unnecessary to export cement there, where it was very largely used. He (the Chairman) hoped this state of things would pass away, and that the cement trade would again develop, so that coke would return to its former value.

Referring next to the appeals which the Directors had made against the new assessments, the Chairman said they had not yet been heard; and he would not therefore say anything about them, except that they had charged the rates and taxes for the half year according to the new assessment, and the item amounted to about £1193 more than in the corresponding period of 1890. Of course, if they obtained a reduction upon the assessment (he supposed they would, and he believed Mr. Monier-Williams would tell them so too), that would be an asset to the good. The matter was not yet determined; and if they could settle it out of Court, the Directors would be happy to do so, instead of going through the expensive litigation which was involved in getting a case of this kind decided. The business of the Company, the Chairman proceeded to remark, continued to grow in a very healthy manner. The meter and stove rental had increased in a higher proportion than in previous half years; and things were looking tolerably rosy. Dealing next with the accounts, he said that they had expended out of capital during the half year £23,485. This was mostly spent on the new gas-holder, which would put the Company in a good position for a considerable time, and the Directors hoped it would enable them to do away with Sunday labour. Having spent this money, it made the total capital expenditure £788,678; and as the receipts on capital account amounted to £789,699, they were reduced to a balance in hand of £1021 to carry on the business. This explained the paragraph in the report, which stated that the Directors were about to issue a further £30,000 of the 1881 stock. Respecting the revenue account, the receipts for gas, meter, and stove rental had increased by £2545; but, on the other hand, they had to pay considerably more for coal. In the December half of 1890, they were working upon old and favourable contracts. But then the price of coal advanced; and they had been obliged to make other contracts, which had increased the cost, including labour, by 8d. per ton, and this, on the amount of coal they used, made a considerable difference. The total of this increase in the half year had been £3760, which was more than the addition they had obtained on the gas and meter rental. The coal had not only been dearer, but it had not been so good. Whether it was by reason of the troubles the coal owners had had with the miners in the north or through the wet season, he could not say, but the coal had been delivered in a very wet and dirty condition; and although their men worked in very good spirit, it was impossible for them to produce as much gas from coal of this description as from dry and clean material. It would be seen that the carbonizing wages were about £1060 more than in the corresponding period of 1890; and there was a very singular thing about this—that in the half year just ended, they had 27 weeks' wages to pay instead of 26, and a week's carbonizing wages amounted to about £1000. The whole result of the working during the half year, was this—that, compared with the six months ending Dec. 31, 1890, there had been a diminution in the profits of between £13,000 and £14,000. The amount required for dividend was £31,462, towards which they had £25,500; showing a deficit of £5962, which the extra wear and tear and the additional week's wages nearly balanced. He hoped that during the present six months the Company would see better times. They would, of course, have the partial charge for the new inclined retorts which they were substituting for the old ones. As a matter of interest to those who went into the working minutely, he stated, in conclusion, that the capital per ton of coal carbonized amounted to £6 16s.; coal had cost about 8d. per ton more than in the second half of 1890; the carbonizing wages were 2d. per ton more; the repairs and depreciation of plant, 1s. 5d. per ton more; and rates and taxes, 4d. per ton more.

Mr. J. ORWELL PHILLIPS seconded the motion.

The CHAIRMAN, in reply to questions put by Mr. Montague, Mr. J. Rokeby Price, and Mr. J. H. Meyers, said that the price charged to the consumers was now 3s. per 1000 cubic feet. Their initial price was 3s. 9d.; so that, under the sliding scale, they were entitled to the 12½ per cent. dividend recommended in the report. The Directors would as early as possible, reduce the price. As to the production of gas per ton of coal, the average was 10,002 cubic feet; and the quantity sold, 9874 cubic feet. These figures compared favourably with those of the London Companies. Regarding the question of manufacturing gas from oil, he said that he believed it would be of very great use in cases of emergency; but it was still a matter of experiment. One patent process was being tried at the Company's works; but not at their expense. They told the people who were making the experiment that, if they could show good results, the Company would buy the plant; but until they did that, they would not take it.

The motion was then carried.

On the proposition of the CHAIRMAN, seconded by Mr. PHILLIPS, the dividends recommended were declared—viz., at the rate of 5 per cent. per annum on the 5 per cent. preference stock, of 12½ per cent. on the consolidated stock, and of 9½ per cent. on the new 1881 stock, all subject to income-tax.

Resolutions were then passed, re-electing the retiring Directors (Mr. H. C. Ward, Mr. Ulick J. Burke, and Mr. J. S. Neville) and the Auditors (Mr. J. W. Field and Mr. Monier-Williams), and thanking the Chairman and Directors, the Secretary, the Engineer, and the other officers of the Company for their services during the half year.

The proceedings then terminated.

Rushden and Higham Ferrers District Gas Company, Limited.

—A Company has been formed to acquire the undertakings of the Rushden Gas and Coke Company, Limited, and the Higham Ferrers Gas and Coke Company, Limited, and to carry on and extend them in all their branches. The capital is £10,000, in 2000 shares of £5 each. Our readers will remember that these two undertakings have been in process of amalgamation for some time; but the union could only be effected by the liquidation of the old Companies and the formation of a new one to take over the concerns. This has now been done. Mr. J. T. Lewis, of Wellingborough, has been appointed Consulting Engineer to the new Company; and, under his supervision, fresh works, fitted with the most modern appliances, will be constructed in a position suitable for the supply of both Rushden and Higham Ferrers, and every effort will be made to have them available by next winter.

LIVERPOOL UNITED GASLIGHT COMPANY.

The Half-Yearly Meeting of this Company was held last Tuesday—Mr. E. LAWRENCE in the chair.

In their report, the Directors recommended the declaration of a dividend for the half year ending Dec. 31 last of 5 per cent. on the ordinary consolidated stock, and of $3\frac{1}{2}$ per cent. on the 7 per cent. stock issued prior to July 1 last.

The CHAIRMAN, in moving the adoption of the report, said that the Company had no difficulty in recommending the dividends mentioned, as the accounts made up to Dec. 31 showed a very satisfactory result. Speaking of the position of the Company, he said they had passed over the pinching time of the year—that period of winter when the consumption of gas was highest—without any of the difficulties that attended them in the previous winter. It was quite true that, for two or three days about Christmas, the demand made by the public upon their resources was greater than their producing powers; but with the large stock of gas in hand in the holders, they had no trouble in supplying the public with all their requirements, although they were great, without reducing the pressure usually given. They were spared all those complications which arose in the previous winter from the long-continued frosts and excessive fogs that interfered with railway arrangements, &c.; and the working of the concern this winter had proceeded smoothly. He might mention that the production of gas during the last eleven weeks had been, on the average, upwards of 100 million cubic feet per week—a record that had never been known before in the annals of the Company. This showed that, in spite of high prices and the competition of electricity, the consumption of gas was steadily increasing. From the 1st of July to the present time, the actual consumption was nearly $2\frac{3}{4}$ per cent. in excess of what it was in the previous year. He thought this was satisfactory to the shareholders, as showing that, whatever might be the competition (and they did not ignore it) of the electric light, the demand for gas still continued, and enabled the proprietors to feel every confidence in the value of the stock of the Company. It was to the interest of the Directors that the price of gas should be as low as possible; and it was with the greatest possible regret that they felt compelled to raise it on the 1st of July last. With regard to the future, no doubt the shareholders would be aware that there had been a decline to some extent during the last six months in the price of coal; but whether this would affect the price of gas coal as much as steam coal, he did not know. He was sorry to see that there was a combination of workmen to reduce the output of coal; and if they were successful, he was afraid the reduction in the price of gas would have to be relegated to the distant future, though nothing would give the Directors greater pleasure than to announce a decrease at an early date. He referred with regret to the illness of their Engineer (Mr. William King), who had gone abroad to recruit his health.

Mr. H. B. GILMOUR seconded the motion, which was passed.

The dividends having been declared,

A Special Meeting of the shareholders was held for the purpose of considering a resolution to the effect that, in pursuance of the Company's Act of 1886, such an amount of stock be created as may be necessary to raise the sum of £280,533, being the balance of the capital authorized by that Act, and that the stock be sold in the manner most advantageous to the Company.

The CHAIRMAN moved the resolution; and, in answer to questions, he said that the stock would be sold by auction as the money might be required. As to the necessity of raising the capital, he stated that it was required in order to proceed with the works at Linacre. It had been the policy of the Directors to keep down the capital. But they now felt it their duty to the public, seeing that they had had nearly a deadlock last winter, to raise it; and if they did not, the consequence would probably be something more serious than the expenditure of capital.

The resolution was passed; and afterwards sanction was given to the promotion of a short Bill in Parliament, to enable the Company to utilize a strip of land lately purchased for the enlargement of the gasholders at the Athol Street works.

The proceedings terminated with a vote of thanks to the Chairman.

BRISTOL GAS COMPANY.

The report which the Directors of the Bristol Gas Company will lay before the shareholders at their half-yearly general meeting next Friday cannot be objected to on the ground of length, as it consists of only four paragraphs. The story told is simply that there has been a steady increase in the consumption of gas, and that it has been necessary to make enlargements and extensions in order to provide for future demands. The maximum dividend, at the rate of 5 per cent. per annum (subject to deduction of income-tax), on the nominal capital of the Company entitled thereto, will be recommended. The accounts by which the report is accompanied show that a sum of £90,983 was received for gas consumed in the ordinary way, and £12,290 for that used in the public lamps and supplied under contract. As compared with the latter half of 1890, these figures exhibit advances of £6966 and £891. The residuals yielded £26,745, as against £26,550; and the total receipts for the half year were £132,263, as against £123,941 in 1890. The expenditure on the manufacture of gas was £89,126, as against £77,948; coal going up from £47,129 to £52,245, and wages from £15,369 to £16,931. The outlay on the repair and maintenance of works and plant rose from £11,351 to £14,996; and the total expenditure, from £93,331 to £106,720. The balance carried to the profit and loss account is £25,542; whereas at the close of 1890 it was £30,609. This account shows that the sum available for division is £29,896; and if the dividend recommended should be declared, £22,212 of it will be absorbed—leaving £7684 to go forward. The quantity of coal carbonized in the period covered by the accounts was 72,037 tons; of cannel, 12,744 tons. The gas made was 790,768,000 cubic feet, as compared with 779,221,000 cubic feet in the latter half of 1890. Of the former quantity, all is accounted for but 67,278,348 cubic feet; of the

latter, all but 79,435,042 cubic feet. The residuals produced are estimated as follows: Ordinary coke, 46,384 tons; cannel coke, 8315 tons; breeze, 5967 tons; tar, 867,267 gallons; ammoniacal liquor, 2,003,704 gallons. In connection with the working of the Company, it may be mentioned that there was a large expenditure on capital account in the past half year; the total at June 30 last (£782,142) being brought up to £801,819, leaving a balance of only £4608. The outlay consisted of £14,605 on buildings, plant, &c.; £2682 on mains and services; £1233 on meters and stoves (less £376 for depreciation of the latter); and £1531 on parliamentary expenses. In the course of the half year the capital was increased by the issue of £20,000 of new debenture stock, which produced, with premiums, £20,748. A similar amount of debenture stock was submitted to public auction last Wednesday, and realized £20,668.

NEWCASTLE AND GATESHEAD GAS COMPANY.

The Annual Meeting of this Company was held last Wednesday—Mr. W. B. WILKINSON in the chair.

The Directors' report (the principal portions of which were noticed in the JOURNAL last week) having been taken as read,

The CHAIRMAN, in moving the adoption of the report, said the capital expenditure for the year had been £33,515, which was principally spent in extending their works. This had been raised by the issue of debenture stock at $3\frac{1}{2}$ per cent. They were limited in the issue of this stock to one-quarter of the paid-up capital; and, therefore, they could not issue any more until they created and sold more ordinary stock, which they would ask the proprietors to give them permission to do at the close of the meeting. The receipts for the year had been £219,383, against £211,443 for the previous year, or an increase of £7940. This increase would have been larger by about £3500 had they not lowered the price of gas in the last quarter from 2s. to 1s. 10d. per 1000 cubic feet. The expenditure had been £175,779; being £25,132 more than in the previous twelve months. About £21,000 of this was due to the increased price of coal. They had made more favourable coal contracts for the present year, and hoped to continue the reduced price throughout the year. The consumers would benefit by the reduction in the fifteen months to the extent of £15,000; while the shareholders would only get £2750 by the reduction. To pay $9\frac{1}{2}$ per cent. dividend for the year, they took the undivided profit in 1890 (£6611), and an additional sum of £4493 from the undivided profits of previous years. They could well afford to do this, and hoped it would meet with the shareholders' approval. They had added to renewals £4411 properly chargeable. One of the items was for a new locomotive to replace one worn out, and another one had had very extensive repairs, and had been made equal to new. They contemplated also a renewal fund and creating a reserve fund. The reserve would be invested in Government or other securities; and the interest accruing would be added from time to time, and additions made from profits, until it reached 8 per cent. of the paid-up capital. This would be available to meet extraordinary expenses. Speaking of the progress of the business, he said that in about 20 years they had doubled it. In 1873, the average price of coals was 16s. per ton; and some were bought as high as 25s. per ton. The total receipts for that year were £115,526; and the half-year's dividend was only £3050—a very great contrast with the present dividend of nearly £25,000 for the half year. There had been used during the past year about 175,000 tons of coal, which had produced 1,894,000,000 cubic feet of gas, 105,000 tons of coke, 1,575,000 gallons or 8000 tons of tar, and 1323 tons of sulphate of ammonia. He did not wish unduly to magnify their position; but their property was a valuable one, and remained an excellent investment. They had made considerable extensions to mains during the year for the purpose of improving the supply, and intended to do considerably more in the near future. Eleven miles of pipes had been laid in the course of the year, making a total of 511 miles in all. The number of public lamps had been increased to about 8000. At their last annual meeting, it was stated that they would probably have to extend the works at Redheugh. They were desirous to put this off as long as possible; but the increasing demand for gas warned them that it was not safe to sail too near the wind. So they decided first of all to increase the storage, so as to be able to store about a full day's make in winter. They had in hand a holder capable of containing 3,000,000 cubic feet, the cost of which would be about £29,000. Their production at present was about 10,000,000 feet per day. They had storage room for only 6,750,000 feet; but when they had their new holder in use, which they hoped would be next winter, they would be able to store 9,750,000 feet; and they would then be in a proper position in regard to storage. They were also erecting some new retorts, which would be brought into use next winter. They had reduced the leakage during the year by about 20,000,000 feet, and hoped to get it further reduced during the present year. When the cost of wages and coals went up, the necessity came upon them to economize in every possible way, without losing in efficiency. The result of their endeavours was extremely satisfactory; and, by alterations now in progress, they hoped to save several thousands of pounds during the year. This would be principally in the means of getting steam to work their exhaust-engines, and in an improved method of producing sulphate of ammonia. Their position generally compared well with that of other companies. The price of gas in London was 3s. 1d. per 1000 cubic feet, and in Newcastle it was 1s. 7 $\frac{1}{2}$ d. net; while in regard to quality, they compared favourably with the London gas. He was not aware that gas had been sold anywhere before at 1s. 7 $\frac{1}{2}$ d. net; and they hoped ultimately to get it down to 1s. 6d. When that time came, they would have to be content, and try to increase the purity and illuminating power by adding vapourized oil, or by some other contrivance. Some inquiries had already been made with this view; but they intended to proceed cautiously. They had 1290 cooking stoves out on hire; and there were in use about 130 gas-engines, consuming probably 130,000,000 cubic feet of gas a year. He concluded by moving that the report be adopted, and that a dividend of £4 12s. 6d. per cent. be declared for the half year ended Dec. 31 last.

Mr. E. LEADBITTER seconded the motion.

Dr. MACAULAY wished to draw their attention to a new gas, which he thought would greatly improve the quality of the coal gas at present used. He had heard during the past year frequent complaints as to the deficiency in the illuminating power of the Newcastle gas. The new gas was hydro-oxygen gas. It was manufactured from crude oils, which were refined during the process of manufacture. By the use of this gas, 15-candle coal gas could be increased to 20 candles at a cost of 3d.; while the additional cost of coal gas to give the same power would be 8d.

The motion was carried.

The retiring Directors and Auditors were re-elected; and this concluded the business of the ordinary meeting.

A Special Meeting was then held, and the Chairman moved the following resolution: "That under the power of the Newcastle-upon-Tyne and Gateshead Gas Act, 1879, and of the Acts incorporated therewith, the existing capital of the Newcastle-upon-Tyne and Gateshead Gas Company be now increased by the creation of £50,000 of new consolidated stock, part of the additional capital authorized by the above-mentioned Act, which stock shall for all purposes form and be part of the general capital of the Company."

Mr. LEADBITTER seconded the resolution; and it was agreed to.

The CHAIRMAN observed that in the course of a few weeks the new stock would be sold by auction. They had not decided yet how much would be offered; but it would be probably £15,000 or £20,000.

A vote of thanks to the Chairman terminated the meeting.

TOTTENHAM AND EDMONTON GAS COMPANY.

The Half-Yearly Report and Accounts.

The report of the Directors of the above Company, with the accounts for the six months ending Dec. 31 last, has been issued, in view of the half-yearly general meeting of shareholders next Saturday. In their report, the Directors state that, in the period to which it refers, there was a further increase in the quantity of gas sold—equal, as compared with the corresponding half of 1890, to 5,079,000 cubic feet; or 3·289 per cent. They remark that this is the more satisfactory as the latter portion of the past year was not nearly so cold and dark as the period with which it is compared. It may be reasonably presumed that this additional consumption of gas has been for culinary purposes, seeing that 173 stoves have been added to the number in use by the Company's customers; being a gain of 63·60 per cent. as compared with the second half of 1890, and bringing up the total to 445. The Directors allude to the lowness of the price of all the residual products made for sale, which reduces the amount brought to credit, although the quantities of coke, tar, and sulphate of ammonia produced have been greater. But, at its present figure, coke is so cheap a fuel relatively to coal, that the Directors do not fear any considerable reduction in its market value. The continued high price of the raw material of gas manufacture is alluded to. The Directors state that the purchases made have been at lower prices; but the large quantity of coal in stock at the commencement of the half year, and the running contracts at old rates, have kept the charge high. The gratifying statement is made, however, that the current six months will show an improvement in this respect. It is scarcely necessary to add that the works and plant, which are under the supervision of Mr. W. H. H. Broadberry, have been maintained in a condition of thorough efficiency. The accounts accompanying the report show that the expenditure of £25,297 produced a revenue of £32,121; leaving a balance of £6824 to go to the profit and loss account. Of the total revenue, a sum of £24,976 was for the supply of gas; meter and stove rental returned £595; and residuals, £6464. On the other side of the revenue account, the most important item is that of coals, which cost the Company £13,445; the other manufacturing charges (wages figuring for £3166) bringing this amount up to £19,731. The expenses of distribution were £1587; and those of management, £1451. Rent, rates, and taxes came to £1687; and other items (of minor importance) make up the above-mentioned total expenditure. The statements as to the working show that 14,487 tons of coal and 686 tons of cannel were carbonized. The treatment of this bulk of raw material resulted in the production (in addition to 159,497,000 cubic feet of gas actually sold) of 9255 tons 2 cwt. of coke, 1726 chaldrons of breeze, 170,230 gallons of tar, and 465,696 gallons of ammoniacal liquor worked up into sulphate. The business of the past half year resulted, as already stated, in a profit of £6824; but the amount available for division is £7412. Out of this the Directors recommend the payment of the following dividends (less income-tax): 11½ per cent. per annum on the "A" stock, and 8½ per cent. per annum on the "B" and "C" stocks. This will leave a balance of £1148 to be carried forward. The payment of these dividends will reduce the undivided balance by only £157. The Directors consider it is a matter for congratulation that, though most of the items of manufacture, especially coal and wages, have been greatly increased, it has not been found necessary to raise the price of gas or reduce the rate of dividend.

The Electric Lighting Question at Coventry.—A report by the Electric Lighting Committee, which was first presented to the Coventry City Council on Nov. 9 last, but was deferred to allow the members an opportunity of considering it, was again before them at their meeting on the 2nd inst. The report was prepared by Mr. A. B. Holmes; and it was thus summarized: "(1) That having regard to local circumstances, the Corporation would do wisely to keep the electric lighting of the city in their own hands. (2) That no advantage is to be gained by delay in commencing operations. (3) That a low-tension direct-current system should be adopted, and that the sum of £32,000 would cover the necessary expenditure." There was a short discussion on the subject, in the course of which the Town Clerk stated that the Council were not compelled to take action before June next year. From their remarks, the members did not appear to be in any hurry to proceed in the matter; and they resolved to defer the consideration of the report for six months, and then, if thought desirable, for a further similar period.

PROVINCIAL GAS AND WATER COMPANIES.

The following paragraphs contain the principal features of the financial statements and reports of the proceedings at meetings of the various Provincial Gas and Water Companies referred to:—

Gas Companies.

The report of the Directors of the Barnsley Gas Company, which was noticed in the last issue of the JOURNAL, was submitted at the meeting of the shareholders yesterday week. The Chairman (Mr. E. G. Lancaster), in moving the adoption of the report, said, acting on the principle they always adopted, he would first refer to the unpleasant side of the balance-sheet. In two years the cost of coal had increased by £2272. In the year 1889, they paid an advance over the previous year of 1s. 4d. per ton. In the following year, there was a further increase of 1s. 4½d. per ton; and in the past year, a still further increase of 1s. 4½d. per ton was imposed—making the advance for the three years 4s. 1d. per ton, or an increase of 60 per cent. over 1888. With figures like these, it was not to be wondered at that companies increased the price of gas in large centres of consumption such as London—3d. in the case of the South Metropolitan Company, and 7d. in that of The Gaslight and Coke Company; Leeds, Halifax, and Liverpool, 4d.; Boston, 5d.; and Bristol, 8d. In fact, throughout England the exception was where there was a company which had not increased the price. During the year they had an increase of £1600 for repairs. The cost of the manufacture and distribution of gas was £16,225, against £12,831 in the preceding year, which showed an excess of £3493 in expenditure. They had obtained a new railway engine at a cost of £800; something like £200 had been expended on the extension of sidings, and about £500 had been laid out on retorts. To these items had to be added £1208 extra for coal, and £200 for new meters. Altogether these figures amounted to about £3000, which caused the difference. Then with regard to the pleasant side of the balance-sheet, they had sold something like 10 million cubic feet of gas more, which produced £1290. Their total make of gas was 131,500,000 cubic feet; and they had sold 115,500,000 cubic feet. There was an increase of £400 in the sales of coke, &c. With regard to the dividend, they proposed, by withdrawing £1226 from the reserve fund, to pay the usual dividend. Mr. Cooper seconded the motion, which was carried unanimously.

According to the report of the Directors of the Bath Gaslight Company, the working in the half year ending Dec. 31 last was, on the whole, satisfactory. Less coal was carbonized than in the corresponding period of 1890, and the consumption of gas was rather less; but this was owing to the mildness of the season. The report further states that the stoking machinery which was erected in 1889-90 has given satisfaction, and the Directors are now extending its use, hoping for further good results. The total revenue for the half year was £33,198, of which £25,835 was produced by gas, £483 by meter-rental, £219 by stove-rental, £6379 by residual products, and the remainder was made up of small items. The expenditure amounted to £27,429; leaving a balance of profit of £5769. The disposable balance at the profit and loss account is £9719; and the Directors recommend the declaration of maximum dividends.

At the half-yearly meeting of the Brighton and Hove General Gas Company to be held on the 4th prox., the Directors will report a small increase in the sale of gas, but a considerable fall in the value of residual products, in the six months ending Dec. 31 last, as compared with the corresponding half of the year 1890. An increased expenditure is shown in the revenue account, principally due to an advance in the price of coal. The total receipts in the half year amounted to £81,577, as compared with £82,204 in the corresponding period of 1890; the expenditure, to £62,452, as against £57,684. The balance carried to the profit and loss account is £19,125, as compared with £24,520. The amount available for division is £38,205; and the Directors recommend that dividends at the following rates should be declared: 11½ per cent. per annum upon the original shares, 8½ per cent. per annum upon the "A" ordinary shares, and 6 per cent. per annum on the "B" preference shares. With regard to the works, the new retort-house commenced last year has been completed, and part of it brought into use; and the construction of the remainder of the third section of the works is in progress. The quantity of coal and cannel carbonized in the past half year was 43,455 tons; the residual products being 54,061 chaldrons of coke, 443 chaldrons of breeze, 406,187 gallons of tar, and 963,761 gallons of ammoniacal liquor. The quantity of gas sent out for private consumption was 421,525,000 cubic feet, all of which, with the exception of about 11 millions, was sold at 2s. 9d. per 1000 cubic feet; and 33,120,839 cubic feet were employed in the public lighting or were sold under contracts.

The report which was submitted at the recent half-yearly meeting of the Chesterfield Gas and Water Company stated that the net profit for the six months was £3999. From the revenue account it appeared that the income from water had been £3578; from gas, £5036; and from residual products, £804—a total of £9418. The expenditure on water had been £1224, and for gas £3771—making a total of £4995, and leaving £4423 to be carried to net revenue account. After paying interest on mortgages and prepaid calls, and adding the balance from the previous half year, there was a sum available for division of £5691. The Directors recommended the payment of a dividend at the rate of 5 per cent. per annum, which would absorb £3907, and leave £1785 to be carried forward. The Chairman (Mr. R. T. Gratton) moved the adoption of the report and accounts; and it was carried.

The Colchester Gas Company held their half-yearly general meeting last Friday, when the Directors reported a steady increase in the consumption of gas, and, as a consequence, referred to the necessity for enlarging the mains in certain places. Various improvements were carried out in the works during last year; one being the extension of the coal-store, which allows all the coal to be placed under cover. In connection with this, two hydraulic lifts have been erected, whereby the coal can be run to any part of the store. The receipts for gas in the six months ending December last amounted to £8668; the total revenue being £11,139. The expenditure was £9009; £4903 being for coal, about £1100 for salaries and wages, and £1968 for repairs and

maintenance. The balance was £2130. The Company have unfortunately sustained a loss by the failure of their bankers; but this did not prevent the payment of the usual dividend.

The ordinary general meeting of the Ipswich Gas Company was held in the Board-room at their new offices, briefly described in the JOURNAL last week, on Monday, the 15th inst.—Mr. Sterling Westhorpe presiding. The report of the Directors, of which an abstract has been already given (*ante*, p. 301), having been presented, the Chairman moved its adoption; calling attention, in doing so, to the fact that there had been a large increase in the manufacture of gas, and stating that the expenditure, especially in regard to repairs and maintenance of works and plant, had been very judicious. The outlay for the renewal of mains and service-pipes would, he remarked, be followed by a further reduction in leakage, which had within the past few years been brought down to the extent of one-third. Mr. Biddell seconded the motion. Dr. W. A. Elliston expressed the hope that the price of gas would not be raised, as suggested in the report, unless there were decided reasons for doing so. There had been a large increase in the use of gas for heating purposes; and this depended greatly upon its being sold at a moderate price. The Chairman replied that it was not proposed to increase the price of gas; but if coal should continue at its present figure, and residuals go down as they were threatening to do, the Directors would have to consider the matter. Mr. Talbot also hoped the Directors would not see any reason to raise the price of gas; and he referred to the competition of the electric light and crystal oil—the latter being, in his opinion, a much superior light. Mr. D. Ford Goddard said he trusted the shareholders would not be alarmed in regard to the suggestion in reference to raising the price of gas. If they took any trouble to ascertain what other gas companies had been doing in England, they would find that the Ipswich Company had been exceedingly fortunate in not having increased their price up to the present. They had been sufficiently economical and prosperous to avoid doing so; but they could not control the price of coal. It would not, in his opinion, make very much difference to the consumption of gas in Ipswich whether the price was 2s. 10d. or 3s. per 1000 cubic feet. With regard to the electric light, he did not think the shareholders need fear raising the price of gas 2d. The Electric Light Company in Ipswich supplied a few choice customers; but they did not do a trade which was likely to produce any bad debts. Of the two Provisional Orders applied for, permission had been asked to withdraw one; and this did not look as if they were very eager to bring the electric light to Ipswich. When they did propose to supply it, it was for a limited area or for a favoured circle. Crystal oil, he agreed, was a severer competitor than the electric light. Mr. Biddell thought an increase of 2d. would hardly be felt; and unless the shareholders were prepared to take less dividend, the Directors would, he feared, have to put up the price a little. They had given the consumers a wonderfully good time during the past three years; comparing Ipswich with other towns in the kingdom. The report was adopted. It was then decided to follow up the interim dividend by dividends of 13s. per share on the "A," 10s. 6d. per share on the "B," and 10s. per share on the "C" shares; making the three dividends for the year 11½, 9, and 8½ per cent. respectively. The retiring Directors were next re-elected; and it was decided not to appoint anyone to fill a vacancy which had occurred—it being in contemplation to eventually reduce the number from nine to six. The retiring Auditor was then re-appointed; and the proceedings closed with votes of thanks to the Chairman and Directors, and to the Secretary and Engineer (Mr. J. T. Jolliffe).

The accounts of the Leominster Gas Company for the past year show a net profit of £588, from which the Directors recommend a dividend at the rate of 10 per cent. per annum on the original shares, and 7 per cent. per annum on the "B" shares. The increase in the consumption of gas was, the report states, at the rate of over 4 per cent. During the year a new and more powerful exhauster was put in; the washer-scrubber was renewed with wooden bundles; a tar extractor was purchased; and some of the retorts were renewed. These renewals and improvements, and the increase in the cost of coal, diminished the profit of the year. There is, however, no reason to suppose that it will be necessary to raise the price of gas.

The half-yearly general meeting of the Newport (Mon.) Gas Company took place on Monday last week, under the presidency of Mr. E. J. Phillips. In their report, the Directors recommended the payment of the maximum dividends—viz., 5 per cent. on the "A" stock, 3¾ per cent. on the "B" stock, 3½ per cent. on the "C" stock, and 2½ per cent. on the debenture stock—for the past half year. In moving the adoption of the report, the Chairman remarked that, in order to pay the usual dividends, they would have to take £862 18s. 6d. from the profit and loss account. That was satisfactory in this respect—that twelve months ago, in order to pay the full dividends, they had to draw £1303. The Directors were desirous of supplying the very best gas at the lowest figure; and there was no necessity now for any advance in the price. They hoped there would soon be so great an increase in the consumption of gas in the town as would enable them to pay the maximum dividends without drawing from the profit and loss account. The illuminating power of the Newport gas had been kept, during the whole of 1891, one candle power above the standard required by the Act of Parliament; and this meant an extra outlay of £1300 to the Company. They expected to spend out of capital during the next 12 or 15 months about £25,000 in the erection of a new gasholder and tank, and the provision of new mains (under the supervision of Mr. T. Canning, Assoc. M. Inst. C. E., the Company's Engineer). The report was adopted; and the dividends recommended were declared. The proceedings closed with the customary votes of thanks to the Directors and officers.

To-day the shareholders of the Reading Gas Company will have before them, at their half-yearly general meeting, the report of the Directors and the accounts for the six months ending Dec. 31, 1891. The payment of full dividends on all the stocks and shares of the Company will be recommended; the profit and loss account showing that the Directors are justified in this course. In their report, they congratulate the shareholders upon the continued success of the Company; and, in proof of the excellent results obtained by the improved system of working adopted during the past three years, they refer to the figures contained in the last parliamentary returns relating to gas

undertakings, which show that these results exceed those of any other gas company—a fact which the Directors acknowledge to be largely due to the able efforts of their Engineer and Manager (Mr. E. Baker, Assoc. M. Inst. C. E.). During the past six months, the Directors have had under consideration the subject of electric lighting; many persons in the town (which has already a supply by an electric lighting company) having expressed the opinion that the Gas Company, or some authority emanating therefrom, and worked in conjunction therewith, might undertake it. With the knowledge they have obtained, however, the Directors feel that at present it would be unwise, and might be deemed misleading, if, before it has been ascertained beyond a doubt that the employment of capital for the purpose mentioned will achieve some degree of commercial success, they were to take steps to place themselves in a position to ask the shareholders and the public to invest their money in such an undertaking. At the same time, they will continue to watch the whole question very closely. Turning to the accounts, the receipts for gas in the second half of last year amounted to £20,597; residuals produced £6741; and the total income was £27,364, as compared with £26,450 in the corresponding half of 1890. The expenditure was £21,750, against £21,413. There were carbonized 12,890 tons of coal, which produced as residuals 12,890 chaldrons of coke, 148,650 gallons of tar, and sufficient ammoniacal liquor to yield 120 tons of sulphate of ammonia. About 129½ million cubic feet of gas were sold to consumers within and beyond the borough; and 9½ millions were supplied for public lighting and under contracts.

The annual general meeting of the Redhill Gas Company was held last Thursday, when the Directors were in a position to show a balance of £4455 on the past year's working. Out of this they placed £200 to the reserve fund and £64 to the renewal fund; leaving £4191 available for division. They recommended a dividend of 10 per cent., less income-tax; and as 4½ per cent. was paid in September, there will be a balance of 5½ per cent. to come to the proprietors on the 1st prox. Last year was in many ways an anxious one for the Directors; and the state of the labour market, the high price of coal, and the fluctuations in the value of residuals taxed the skill of the Board and the Manager (Mr. C. Read). The total receipts amounted to £13,848; the expenditure, to £9393—leaving the above-mentioned balance of £4455. There were 5821 tons of coal and cannel carbonized; the residuals being: Coke, 4872 chaldrons; breeze, 849 chaldrons; tar, 64,855 gallons; ammoniacal liquor, 174,000 gallons, the bulk of which was worked up into sulphate of ammonia. The report was adopted; and the dividend recommended therein was declared.

The half-yearly meeting of the Wakefield Gas Company was held yesterday week. The report showed that the balance available for dividend was £7192, out of which the Directors recommended the payment of dividends at the rate of 11½ per cent. per annum on the old shares, 9 per cent. on the £5 "B" fifths, and 8½ per cent. on the new £10 shares. In moving the adoption of the report and accounts, Dr. Statter, who presided, said that although they had used less coal they had made more gas during the half year. The average production had been 10,000 cubic feet per ton of coal, which was more than had ever been made by the Company since its formation seventy years ago. The total receipts had been £18,408, and the expenditure £12,385; leaving a balance of £6023 to be carried forward. The sale of gas had brought in £421 more; but £401 had been lost on the residuals. The total income had been £36 more than a year ago; and the expenditure, £864 less. The Directors had decided to reduce the price of gas 2d. per 1000 cubic feet from Jan. 1, which they estimated would cost about £1600 a year; so that the surplus on the half year would just meet the reduction. The report and balance-sheet were adopted.

At the ordinary general meeting of the Wellingborough Gas Company, Limited, held yesterday, the Directors reported that the Company's business during the six months ending Dec. 31 last had been satisfactory. The receipts amounted to £5168; and the expenditure was £3765—leaving a balance of £1403. The quantity of coal carbonized was 2609 tons; the gas made, 27,018,000 cubic feet, or 10,355 cubic feet per ton. Of the total make, 25,838,300 cubic feet were accounted for; 25,597,200 cubic feet being sold—equal to 9903 and 9811 cubic feet per ton respectively. The loss was 4.36 per cent. Of coke there was produced for sale 9 cwt. 2 qrs. 20 lbs. per ton of coal carbonized. The other products were: Tar, 37,366 gallons; ammoniacal liquor, 70,545 gallons; sulphate made 17 tons 15 cwt. The usual dividend of 5½ per cent. was recommended.

The report of the Directors of the Weymouth Consumers' Gas Company for the half year ending Dec. 31 last, noticed in the JOURNAL for the 9th inst., was presented at the general meeting of shareholders held on the following Thursday, under the presidency of Mr. Alderman Thomas. In moving its adoption, the Chairman remarked that the statutory dividend recommended therein had not been obtained without great care on the part of those who had taken the direction of the Company's affairs. The present year had had a rather depressing influence upon their residual products; and the sale of coke had been considerably diminished in consequence of the mild weather. Sulphate of ammonia, too, which realized a large profit a few years ago, was now nearly 100 per cent. lower than formerly. This he attributed in a great degree to the depressed state of agriculture; farmers being unable to use artificial manures so freely as they did when things were more prosperous. He hoped things would take a turn, and that residual products would again be a large item in the receipts of the Company; thus enabling them to maintain the statutory dividends which they had for so long a time been able to declare. Last year, as the shareholders would remember, was most severe, and there was a very large output of gas for both fires and lighting. The present one had been much milder, and there had not been a great demand for gas as compared with this time last year. Notwithstanding this, however, it was gratifying to be able to state that there had been a steady increase in consumption, amounting to something approaching 750,000 cubic feet during the year. Mr. R. W. Reynolds seconded the motion, and it was carried. The retiring Directors and Auditor having been re-elected, a vote of thanks was accorded to the Chairman; a similar compliment being paid to Mr. J. Lowe (the Secretary and Manager), and the other officials of the Company, for the efficient manner in which they had discharged their duties.

The half-yearly balance-sheet of the Yeadon and Guiseley Gas

Company shows that the revenue from the sale of gas and meter-rents is £4133; from the sale of coke, tar, and liquor, £1254; and from bonus and interest, rents, &c., £154—making the total receipts on the revenue account £5541. On the expenditure side, £3162 has been spent in gas manufacture, £410 in repairs, and £674 in rates, taxes, management expenses, &c.; the total expenditure amounting to £4276, and leaving a balance of £1265 available for division. The Directors recommend the payment of the usual dividends of 10 per cent. per annum on the consolidated stock (£11,725), and 7 per cent. on the new shares (£17,600).

Water Companies.

The revenue account of the Liskeard Water Company for the past year showed a balance amounting to £1044. After the payment of an interim dividend, and maintenance, interest, and rents, a disposable balance remained of £516, out of which the Directors recommended a dividend at the rate of 9 per cent. per annum, free of income-tax. The report and accounts were adopted at the recent meeting of the shareholders.

The business of the Newcastle and Gateshead Water Company continues to expand in a satisfactory manner. The Directors' report for the past year states that there has been an increase in the revenue of £3317. After paying all working expenses, interest on debenture stock and loans, and after deducting the interim dividend paid in August last, and adding the net revenue on the year to the balance brought forward, there remains a sum of £46,370, which the Directors recommend to be appropriated as follows: To the payment of the dividend on the preference stock (£6541); to the payment of a dividend at the rate of 10 per cent. per annum for the half year on the old ordinary stock, making, with the interim dividend paid in August last, 9 per cent. for the year (£19,419); to the payment of a dividend at the rate of 7 per cent. per annum for the half year on the stock under the Act of 1876, making, with the interim dividend, £6 6s. per cent. for the year (£11,200)—leaving £9210 to be carried forward. The quantity of water now in store is 3016 million gallons, out of an available storage capacity of 3060 million gallons; so that the Company are in an excellent position to meet the demand for water during the present year. The gravitation works on the River Rede, the new filter-beds at Whittle Dean, and the line of the 30-inch pipes to Newcastle in connection therewith, the Directors remark, are all making satisfactory progress. To meet the expenditure on these and other works, it became necessary during the year to sell by auction a first instalment of £50,000 of the 5 per cent. preference stock created under the Act of 1889. In order that the Directors may issue the capital authorized to be raised on mortgage under the Acts of 1889 and 1890 in the form of debenture stock, the sanction of the shareholders has first to be obtained; and a special meeting has been called, immediately after the termination of the ordinary meeting, to be held on the 29th inst., for the purpose of passing the necessary resolutions.

At the meeting of the Woking Water and Gas Company to-day, the Directors will submit their report for the past half year and the accounts for the entire year. In the report, the shareholders are informed that the total expenditure to date on capital account has been £67,584. The revenue for the past year amounts to £4312, and the expenditure to £1758—leaving a balance to be carried to profit and loss account of £2554. The sum available for division is £1291, out of which the Directors recommend the payment of a dividend at the rate of 4 per cent. per annum for the half year, less income-tax, absorbing £1076; and, after writing a further sum of £100 off preliminary expenses, a balance of £115 will be left to be carried forward. The Directors regard with much satisfaction the increase in the revenue during the year, which enables them to recommend the payment of a dividend at the rate of 4 per cent. It is also mentioned in the report that the authorities of Frimley and Farnborough have been in correspondence with the Company in reference to a supply of water to their districts; and the Directors hope to come to some arrangement on favourable terms to the Company.

CAGLIARI GAS AND WATER COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Tuesday, at the London Offices, No. 3, Lothbury—Mr. JOHN AIRD, M.P., in the chair.

The SECRETARY (Mr. W. B. Peat) read the notice convening the meeting; and it was agreed to take as read the Directors' report and the accounts, an epitome of which was given in the JOURNAL last week (p. 298).

The CHAIRMAN, in moving the adoption of the report, said it was very gratifying to him and his colleagues that he was able to state that the Company were progressing very satisfactorily. The works were in a complete condition; and what they highly valued was the fact that they were working in unison and good-feeling with the authorities of the city which they had supplied with gas and water for the past 25 years. With regard to the water supply, during last year they had proceeded in the most satisfactory manner. The reservoirs, the filter-beds, and the mains had given them no trouble; and the private supplies had materially increased. They had laid in the course of the year 60 new services, producing an additional income of £327. Only recently the Syndic of Cagliari completed an analysis of the water which had been taken during the year; and, at a meeting of the Town Council, he had expressed the opinion that the water was of excellent quality. As to the expenses connected with the water supply, they were less last year than on any previous occasion; and at the same time the Board had continued to take those steps which they believed to be necessary in such undertakings as this—viz., not only to see that the reservoirs and filters were in proper order, but to deal every year with a mile of the main running from the reservoirs to the city, and have it thoroughly cleansed and kept free from extraneous matter. Passing on to the gas supply, he said perhaps it would be interesting to the shareholders to know that their Manager (Mr. Simmelkjör) had thought it desirable to meet—even in their comparatively small works—the difficulties which otherwise would have arisen in the

labour market. By adopting machinery, he had materially lessened the cost of manufacture; and, in fact, they were assured, by his report, that during the past year he had, by the saving effected, returned to the Company the whole cost of the machinery. As to the general working, the illuminating power of the gas had been well maintained; 120 additional lights had been added; and the increase in the consumption of gas had been no less than 15 per cent. during the year. An effort had been made to introduce electric lighting into the Opera House at Cagliari; but after having spent a great deal of money, the authorities had thought it desirable to abandon that mode of lighting, and to welcome back the gas supply. The receipts for gas in the year had been increased by £1050, less £250 for the additional coal required. They had been making great efforts to push the use of gas-stoves, and to arrange for the sale and more rapid delivery of coke. To aid them in this matter, the post office authorities had, at the wish of the Manager, readily consented to pass letters on immediately when a supply was required; and this enabled deliveries to be made within six hours of their despatch. In Mr. Simmelkjör's report, he concluded thus: That our propaganda has been active and successful is proved by the accounts—viz., the coals cost us £2790 in round numbers, while the sale of the products rendered £2470; so that we get nearly 88 per cent. back of the cost of the coals from our residuals." This result, the Chairman thought, was the best possible proof he could offer to the shareholders of the successful working of the Company; and it might not be without some good purpose if these somewhat remarkable figures were circulated for the benefit, not only of other companies abroad, but of many at home. Before he left the subject of the gas supply, he might also mention that the unaccounted-for gas was only 4½ per cent. for the year. There was one other matter to which he wished to refer. The Directors had, in accordance with the wish of Mr. Simmelkjör, arranged with him that in the future he should give them the advantage of some of his time in London; and this would enable him to escape from Cagliari during the extremely hot weather. The Board believed this arrangement would be beneficial to the Company, and that it was necessary for Mr. Simmelkjör's health; for they could not forget how, during the past 25 years, he had laboured earnestly and continuously in the interests of the Company in Cagliari. They had, in consequence, thought it desirable to appoint Mr. Craig as his assistant; and this determination they had communicated to the Prefect of Cagliari, who had replied to the effect that he was quite sure Mr. Craig would carry on and maintain, in the transaction of business, that correctness and courtesy which so much distinguished Cavalier Simmelkjör, and promising not to neglect any opportunity, when in his power, of affording him his assistance. It was extremely gratifying to the Board that they should receive such testimony regarding their Manager, and to know that they might rely upon the support of the authorities of Cagliari in the future. In conclusion, the Chairman also testified to the admirable manner in which Mr. Peat performed his secretarial duties.

Mr. F. WIGAN seconded the motion.

Mr. NUGENT observed that last year there were two reserve funds—the special and the general—amounting together to £6400; and although it was stated in the report that a further £1000 had been transferred to reserve, there only appeared in the present accounts a sum of £6091.

The CHAIRMAN replied that last year a question regarding the sinking funds was raised by a shareholder, who thought (and the Directors agreed with him) that it was scarcely necessary to maintain the special reserve. The Board had, therefore, considered it desirable to transfer a certain amount of the special reserve to the sinking fund, which it would be seen had been increased, and to amalgamate the two reserve funds. The total figures in the present accounts under these two heads were £15,983; while last year the three funds only amounted to £13,477. The Company, he added, had now nearly £15,000 invested in 5 per cent. Italian stock; and close upon £4000 in The Gaslight and Coke Company's 4½ per cent. stock.

The motion was then carried.

The CHAIRMAN next proposed a resolution confirming the payment, in August last, of an interim dividend at the rate of 6 per cent. per annum, and declaring a dividend at the rate of 8 per cent. per annum for the half year ending December, and a bonus of 5s. per share.

Mr. WIGAN seconded the proposition, which was agreed to.

Mr. NUGENT then moved the re-election of the retiring Directors (Messrs. F. Wigan and J. Aird).

Mr. F. W. BLUNT seconded the motion, which was carried.

The Auditors (Messrs. H. Bishop and E. O. Coe) having been re-appointed, the proceedings terminated.

Barnet District Gas and Water Company.—The half-yearly general meeting of this Company is to be held next Friday, when the accounts which will be submitted for the six months ending Dec. 31 last will show a balance of £14,026 to the credit of the net revenue account. Out of this the Directors will recommend the declaration of a dividend (less income-tax) at the rate of 8 per cent. per annum on the "A" and "C" stock, 7 per cent. per annum on the "B" stock, and £5 12s. per cent. per annum on the "D" capital (water) shares. The Directors state that the Company's business continues to increase. The total gas revenue in the past half year was £8876; the receipts for water being £7438. The expenditure in the production of gas was £6298; in the supply of water, £2758.

Illegally Cutting Off a Gas Supply.—At the Barry Dock Police Court last Thursday week, Mr. I. T. Dando, of Cadoxton, summoned the Barry and Cadoxton Gas and Water Company for illegally cutting off his supply of gas. The statement made by Mr. A. Jackson, who appeared for the complainant, was to the effect that on Dec. 14, although all the gas bills due had been paid, the Company cut off his gas supply, and took away the meter, notwithstanding the fact that prosecutor showed the gas official the receipts. Mr. Hancock, for the Company, admitted that they had made an error, but said that an ample apology had been sent to Mr. Dando. The Bench said the action of the Company was a most extraordinary one; and they would have to pay £1 and costs.

THE BOARD OF TRADE REPORT ON THE GAS, &c., BILLS AND ORDERS OF THE PRESENT SESSION.

The Board of Trade report on the applications for Gas, Electric Lighting, and Water Bills and Provisional Orders for the present session has been issued. It shows that the number of Bills relating to the supply of gas is 19—all for England. Eight of these Bills also contain provisions in regard to the supply of water, while one has clauses referring to electric lighting. The capital proposed to be raised is £804,750—£247,000 by shares and £557,750 by loans. There are 24 Bills relating to the supply of water; four of them being Scotch. The total capital asked for is £8,643,150—£443,000 by shares and £8,200,150 by loans. Provisional Orders to the number of 15 have been applied for in respect of gas and water, and 32 in regard to electric lighting schemes. The capital proposed to be raised under these orders is: For gas supply, £132,500; for water, £160,000; for electric lighting, £1,211,103. As compared with last year, the number of Gas Bills has increased by three; that of Water Bills by two—the total for the two classes of Bills being now 43, as against 38 last year and 32 in 1890. The capital required for gas purposes is £480,824 more, and that for water purposes £6,545,748 more than last year. For Gas and Water Orders the capital proposed is £32,550 more, and for Electric Lighting Orders £913,987, less than last year. The applications for the last-named Orders show a very marked falling off—32 now, against 70 last year and 161 in 1890. The report contains, as usual, an analysis of the Bills and Orders; and a peculiar feature of it this year is the absence of Gas Bills relating to Scotland, and of both Gas and Water Bills for places in Ireland.

METROPOLIS WATER SUPPLY.

The Quality of the Water in January.

The returns furnished to the Registrar-General by the London Water Companies as to the water supply of the Metropolis during the past month, show that the average daily supply was 184,589,018 gallons, as compared with 192,454,640 gallons in the corresponding month of 1891; being at the rate of 30·3 gallons per head of the population. Of the entire bulk of water sent out, 92,617,596 gallons were drawn from the Thames, and 91,971,422 gallons from the Lea and other sources. Reporting upon the quality of the supply, Dr. E. Frankland said: "Taking the average amount of organic impurity contained in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies and by the Tottenham Local Board of Health was: Kent, 1; East London (deep-well), 1·4; Tottenham, 1·6; Colne Valley, 2; Southwark and Lambeth, 3·6; New River, 3·8; Grand Junction, 4·3; East London, 4·4; Chelsea, 4·7; and West Middlesex, 4·9. The water abstracted from the Thames by the Chelsea Company was much inferior, as regards organic impurity, to that delivered by them in December. The water supplied by the other Thames Companies was, on the other hand, of much better quality in January than in December; the most marked improvement being observed in the water of the Southwark and Lambeth Companies. All these waters were efficiently filtered before delivery. The water taken chiefly from the Lea by the New River Company exhibited only a slight improvement over the December sample; while that sent out by the East London Company was not quite so good. Both these supplies were inferior to the best of the Thames waters. They were efficiently filtered before delivery. The deep-well waters of the Kent, Colne Valley, and East London Companies, and of the Tottenham Local Board of Health, were, as usual, of excellent quality for dietetic purposes; and the Colne Valley Company's water, having been softened before delivery, was rendered suitable for washing. All these waters were clear and bright without filtration. Seen through a stratum 2 feet deep, the deep-well waters were clear and colourless, and the river-derived waters clear and pale yellow. The bacteriological examination by Dr. Koch's process of gelatine plate culture gave the following results: One cubic centimetre of each water, collected on the same days as the samples for chemical analysis, developed the following numbers of colonies of microbes: Chelsea, 42; West Middlesex, 46; Grand Junction, 74; East London (river supply), 114; Lambeth, 176; New River, 196; Kent, 204; and Southwark, 830."

Messrs. Crookes, Odling, and Tidy, in the course of their report to the Official Water Examiner for the Metropolis (General A. de Courcy Scott) on the quality of the water supplied by the London Water Companies during the past month, as shown by samples taken daily for analysis, say: "Of the 182 samples examined, 179 were found to be clear, bright, and efficiently filtered; three being recorded as very slightly turbid. Except for the occurrence of these three instances of but very slight turbidity, the condition of the water supply to the Metropolis during the month of January was entirely satisfactory. Thus, taking the Thames-derived supply for comparison, the mean degree of colour-tint was found to be 12·4: 20, as against 18·7: 20; the mean amount of oxygen expended in oxidation to be 0·052 grain, as against 0·079 grain; and the mean amount of organic carbon to be 0·158 part in 100,000 parts, as against 0·240 part in the previous month's supply. Moreover, the maximum amount of organic carbon in any single sample examined was found to be reduced from 0·319 part in December to 0·204 part in January; the next highest amount recorded during the month being only 0·189 part in 100,000 parts of the water."

A New Filter Bed for the Farnham Water Supply.—The Farnham Water Company have just added to their works a new filter-bed for the purpose of removing the iron from the water, which has hitherto given a great deal of trouble. The new tank is of substantial construction, 60 ft. by 30 ft., and 6 ft. deep, made of cast-iron plates, bolted together and jointed with rust cement. The plans and specifications for the work were prepared by Mr. J. W. Lewis, the Company's Engineer.

PROPOSED NEW WATER-WORKS FOR SHREWSBURY.

The most important matter to come before the Shrewsbury Town Council at their last meeting was a report by the Gas, Water, and Lighting Committee on the question of supplementing and improving the water supply of the borough. Appended to the report was one by the Borough Surveyor, in which he dealt with the various schemes which have been proposed up to the present time. His report, the Committee stated, had so far commended itself to them as to make them desirous of obtaining the sanction of the Council to investigations and inquiries being made in order to enable them to thoroughly examine the question of a supply from the Stretton Hills, especially as to the estimated cost and the quality and sufficiency of the water. Without committing themselves further, they remarked that there was the strongest possible ground for believing that the quality of the water was unquestionable; and that the two points which required elucidation were the sufficiency of the supply and the cost at which it could be impounded and brought to Shrewsbury. The Borough Surveyor suggested that the cost of the investigations necessary to ascertain the practicability of the scheme would require £200 (exclusive of boring); and the Committee therefore asked permission to expend a sum not exceeding that amount. To prevent any misapprehension, they added that it should be borne in mind that the Stretton scheme now suggested by the Borough Surveyor had not hitherto been considered by the Council. The gathering-ground was formed by connecting two extensive valleys, the area of which was about 1500 acres. Considering its elevation, and the physical outline of the collecting area, the Committee were advised it should yield more than sufficient water for the borough, even with an increased population of 35,000 inhabitants, after allowing for compensation water. The adoption of the report was moved by Mr. Barker, and seconded by Alderman Herbert; and then Alderman Lloyd said that, as Chairman of the Finance Committee, he felt that it was incumbent upon him to draw their attention to the figures he was about to submit to them, for it was no use granting any sum of money if they were afraid of adopting the scheme, if suitable, at last. The data he would submit was very imperfect; but perhaps it would be the means of guiding them in any decision they might arrive at. Mr. Baldwin Latham had told them that the Church Pulverbatch scheme would cost £60,000, and that the Church Stretton scheme would cost more than that. If they presumed that the Stretton scheme would be carried out for £80,000, then, according to the Borough Surveyor, £20,000 would be required for the fittings in the borough. This would make £100,000; and there was the present debt of £30,000, which brought the total up to £130,000. The interest on this sum at 3½ per cent. would reach £4550 a year. They might be allowed to borrow money for fifty years; but thirty years was generally the time allowed. It would not, however, be like borrowing money on machinery, which would be liable to get out of repair, and possibly they would get the money for fifty years. This would necessitate a repayment, together with the annual expenses, of £7900 a year. The present income for water was 6 per cent. on the rentals, bringing in £5000 a year. To meet the expense of £7900 a year, they would have to increase the 6 per cent. to 10 per cent.—that was, if the money had to be repaid in 50 years; but if they could not obtain it for that period, but only for 30 years, the annual amount would be £9600—almost 12 per cent. on the rentals. The Council would have to consider whether the borough was likely to stand the expense of such a scheme. This was a serious question; and he thought the price they would have to pay would be almost prohibitive. There was a protracted discussion on the question—the speakers appearing generally in favour of the scheme; and the report was adopted *nem. con.*

The Richmond Well.—The well-sinking operations which are being carried out by the Corporation of Richmond (Surrey) in the Terrace Gardens in that town are proceeding satisfactorily. According to the last report presented by the Water-Works Engineer (Mr. W. Peirce), the length of adit driven in the direction of the well at the Corporation's water-works is now 1003 feet; leaving 1317 feet still to be driven. The total length of adits completed is 1836 feet. Two further fissures have lately been passed; yielding together about 11,000 gallons of water per diem. The average daily yield of the Terrace Gardens well is now 119,111 gallons.

The New Water Scheme for Mansfield.—The Mansfield Town Council last Friday week had under consideration the new project for obtaining a supply of water from Rainsworth at a cost of £20,000. A memorial was first read from the Ratepayers' Association in opposition to the scheme. In this it was pointed out that at Rainsworth the water supply would be imperilled owing to the probability of coal being worked there; and the memorialists were satisfied that, by sinking near the present works, a sufficient supply could be procured to last for many years to come, at a cost not exceeding £10,000. The minutes of the Water Committee were next presented; and these contained a recommendation that various alterations should be made in the scheme, whereby its cost might be reduced to £18,000. After a short discussion, it was agreed to postpone the minutes for further discussion.

Gas, Water, and General Investment Trust, Limited.—In the report which the Directors of this Company will present to the proprietors at their ordinary general meeting on Friday next, they state that, after debiting the revenue account with all expenses, and adding thereto the sum of £2539 brought forward, there remains a balance of £31,291, out of which interim dividends at the rates of 4½ and 5 per cent. per annum on the preferred and deferred stocks respectively, amounting to £11,779, were paid in August last. The Directors now propose to pay further dividends at the rate of 4½ per cent. per annum on the preferred stock, and at the rate of 10 per cent. per annum on the deferred stock, for the half year ending the 28th ult.; making for the year 4½ and 7½ per cent. respectively for the two classes of stock. This will absorb £18,291, and leave a balance of £12,211 to be carried forward. The reserve fund has been raised to £64,341 by the addition of £11,070; and, in the Directors' judgment, this amount is sufficient for all eventualities.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

What threatened to be a wide-spread dispute in the coal trade has fortunately terminated without the dreaded event taking place. This is in itself good news, for a stoppage of the coal supply is attended by consequences more dire, perhaps, than that of any other commodity within the range of striking probability. But the circumstances of the threatened dispute and settlement are of quite as much importance as the fact itself. Like many other similar movements, it arose over a very small matter. The Earl of Rosslyn is owner of one or two coal pits at Dysart, in Fifeshire, regarding which, a month or two ago, an outcry was raised by men working in other collieries—members of the Union to boot—that the wages paid were a shilling a week below the standard rate. On being appealed to, Lord Rosslyn pointed out that, owing to the thickness of the seams in his pits, men were able to earn as much at the low rate of wages as they did at the high rate in most other pits; that men sometimes left his pits to get higher wages elsewhere, but his experience was that they were always glad to get back to his employment; and he refused to give an advance. Thereafter the Union camp began to prepare for a struggle. The Dysart men were ordered by the Union to strike; and they were promised that they would be supported. They came out ten weeks ago. A counter-move was then made by the employers, in the shape of an intimation of a general reduction of 15 per cent. This, of course, was resisted by the men, who, however, were willing to accept a 7½ per cent. reduction. The masters were agreeable to modify the reduction to that figure upon condition that the Dysart men should resume work at once. To that offer, however, the men replied by lodging their notices to cease work on Tuesday of this week. The masters then announced that, irrespective of the Dysart affair, they would enforce a 7½ per cent. reduction. A ballot was taken among the men at the end of last week, to determine whether or not they should proceed with the strike; and they resolved, by 302 out of a vote of 4304, to accept the masters' terms. When Tuesday came, therefore, work went on as usual. But the Dysart men were still out; and eviction notices to quit their dwellings had been served upon them. These poor men had been taken from their work by the Union, and a general strike was being organized in their interest; but the whole affair crumbled to pieces when the question came to be a personal one with each individual miner. It is impossible to blame the miners for displaying self-interest in the matter of quashing the strike proposal; but one cannot too strongly condemn their policy in moving the Dysart men to strike, and then leaving them in the lurch. There was nothing left for the Dysart men but to surrender and go back to work, which they did yesterday; and then the eviction notices were withdrawn. In this incipient struggle, the familiar feature was presented of an employer fighting, not his own men, but men at a distance and over whom he had no control—a policy which has its rise deep down in the human instinct which prompts the feeling that if disagreeable work has to be done, somebody else had better do it and not yourself. The action of the masters was wisely directed, not against the Dysart men, but the great body of men who were making them their tools. The incident presents a highly instructive contrast. The Democratic spirit—the spirit of progress, so called—ranged itself to do battle with a privileged and grasping aristocracy. It forced an innocent party to pick a quarrel and to relinquish its livelihood, upon a pretext of principle; and then, for a monetary consideration, threw principle to the wind and left the innocents at the mercy of the aristocrat. Viewed in that light, there can only be satisfaction that the meanness of Unionism did not in the end lead to a triumph, and that the honourable dealing of the master did.

I recently mentioned that the Hamilton Corporation Gas Committee had important extensions of the local gas-works in contemplation; and I am now in a position to say that the consulting gas engineer to whom the matter was referred, has prepared a report in which he recommends what the Committee should do for the future wants of the burgh and its suburbs in respect of gas supply. The gentleman in question is Mr. A. Gillespie, of the late firm of Laidlaw, Sons, and Caine, who superintended the reconstruction of the two "exploded" holders at the Dawsholm gas-works of the Glasgow Corporation. As regards the Hamilton Gas-Works, I may say that Mr. Gillespie recommends the entire "disestablishment" of the ordinary retorts now in use; and the substitution for them of retorts set on the regenerative system which has been devised and has been so successfully worked out at the Paisley Corporation Gas-Works by Mr. G. R. Hislop. He considers that the retort-house is capacious enough to admit of eighty retorts on Mr. Hislop's setting. His most important recommendation, perhaps, is that a new gasholder should be erected at or near the works, of much larger capacity than any holder in the county of Lanark. He advises that it should be 120 feet in diameter, and consist of two lifts of 28 feet each. These figures mean, I believe, that its capacity should be between 400,000 and 500,000 cubic feet. It is very probable that the Gas Committee will shortly give a deliverance on the recommendations made to them by Mr. Gillespie.

If the example of the School Board of Glasgow is followed at all generally, there will be a large demand for gas-engines for driving mechanical ventilators on the principle adopted by Mr. William Key in the Victoria Infirmary, Glasgow, and by Mr. Cunningham, of Dundee, in Board Schools in that city and in Aberdeen. The Glasgow School Board have two new schools in progress, in which gas-engines of 4-horse power are to be installed in due course; and additions are being made to two other schools for which engines of 1½-horse power are wanted.

At the last monthly meeting of the Rothesay Town Council, there were submitted the Gas Committee's and Manager's reports, which showed that there had been an increase in the quantity of gas made amounting to 13 per cent., which was accounted for by the unusual darkness of the weather during the month of January. Mr. Fisher suggested that in the Manager's monthly report there might in future be given the average cost of the coal used, the average amount of gas produced from it, and the average cost per ton for carbonizing the coal.

By doing so, they would see what the coal was producing. He only threw out the suggestion then; and he hoped that the Convener would take it up later on.

The development of the oil-gas method of lighting railway carriages has been very rapid. The industry is still a growing one. In Scotland, the Caledonian Railway Company already use it almost over their entire system. They have evidently found it to be the most profitable of all existing modes of illumination, for they are about to erect a manufacturing station in connection with their Edinburgh terminus. Hitherto, they have been in the habit of carrying gas under compression from Glasgow to Edinburgh in a specially-constructed tank; but the process of charging the reservoirs in the carriages from it was not so satisfactory as could be desired. They have consequently applied for and obtained permission from the Dean of Guild Court of Edinburgh to erect an oil-gas works. The works are to be accommodated in a building 82 feet long by 26 feet wide. The Law Agent of the Company assured the Bench that there would be no smell of an offensive nature from the works, and that the Company would take the risk of nuisance being created by them.

The Glasgow Alum and Ammonia Company have got among the breakers with a vengeance. The action which I mentioned a fortnight ago as having been instituted against them by the Dundee Gas Commissioners, to recover an account due for residuals, was not defended by them; and decree in absence was granted by Lord Stormonth Darling on Tuesday. The Commissioners were just in time to secure a preference over other creditors, for next day two petitions relating to the Company were presented to the First Division of the Court of Session. The first was by the Barrhead Gaslight Company, that the Alum Company should be wound up; and the other petition was by the Alum Company itself, and asked that the Company should be wound up under supervision of the Court. Both petitions were ordered to be intimated to the parties concerned, and to be advertised.

The municipal deputations from Glasgow to London have begun unusually soon this season; and there are a number of questions not involved in Parliamentary Bills which have drawn deputations to the Metropolis this week. One of them has reference to electric lighting, both central stations and in the public street lamps; and the members of it (who have been away from home most of the week) include Mr. Ure, practically the chief of the Gas and Electric Lighting Committee; Mr. James Bell, Convener of the Sub-Committee on Electric Lighting; Mr. Foulis, the Gas Engineer; Mr. Arnot, the Electrical Engineer; and Mr. Bowers, the Assistant Town Clerk, who looks after the gas and electric light affairs. By the way, I should also like to mention Mr. R. Hamilton, the Inspector of Public Lighting—a thoroughly practical man in his own department of municipal work. He has returned; and possibly he has brought home with him some "wrinkles" which may be turned to account in the course of the next few months when street lighting by electricity begins to take shape in this city, as resolved on some weeks since by the Watching and Lighting Committee of the Police Board, in conjunction with the Gas and Electric Lighting Committee.

Electric lighting, or rather the establishment of it, makes slow progress in Aberdeen. It is now a year since the Gas Committee, who have charge of the subject, collected very complete information as to the patronage they would receive if they started an installation, and made inquiries into the cost. Apparently, they are yet unable to make up their minds to go in for the expenditure, for this week they appointed a Sub-Committee to collect information upon what other corporations are doing in the matter. Meantime, half of the three years allowed by their Provisional Order for the completion of an installation, has expired. If the Committee go on making inquiries in the leisurely fashion they have been doing, the time will expire without anything being done.

The terms of the settlement between the Falkirk and Larbert Water Trustees and Messrs. D. Y. Stewart and Co., of Glasgow, the contractors for the work of constructing the new water-works, as given in last week's "Notes," were altogether in favour of the Trustees, and might be read in an unfavourable light towards Messrs. Stewart. It is right, however, to state that at a meeting of the Water Trust, at which the settlement was confirmed, Provost Watson said they never believed that a knowledge of the state of the works was ever in the possession of the contractors, who, they thought, were a thoroughly honest firm.

Gas Exhibition in Carlisle.—Last Tuesday afternoon Mr. Richard Forster, the Chairman of the Carlisle Corporation Gas Committee, opened, in the City Hall, an exhibition of gas cooking-stoves, gas-heaters, gas-fires, and gas cooking-utensils, the productions of Messrs. Richmond and Co., Limited, of Warrington and London. There was a large attendance, consisting principally of ladies. Mr. Forster, before opening the exhibition, referred to the success of previous similar undertakings in Carlisle, and expressed a hope that the present one would also be prosperous. There had been a good demand in Carlisle for cooking-stoves and gas-fires. Recently he found that there were 34 gas-engines in the City, 487 cooking-stoves, 711 heating-stoves, 104 water-heaters, and 287 boilers, all using gas. In seconding a vote of thanks to Mr. Forster, Mr. J. Hepworth, the Gas Engineer, observed that everything that the Gas Committee did to promote the consumption of gas and the use of appliances entailed more work upon them; but they were interested in increasing the comforts of life, and they believed they were doing something in that direction. The figures which had been quoted by the Chairman were not quite accurate; the number of appliances having increased since they were supplied. As a matter of fact, one consumer in every twelve in Carlisle cooked with gas; but he thought there were towns which had gone further in that direction. If he mistook not, in the town of Leicester one consumer in every six used a cooker; and he believed that in Carlisle there was room for about 500 more than were used at present. The Gas Committee did everything they could to facilitate the convenience of persons in the matter, and had introduced a new departure lately. In addition to letting out ordinary cookers, they had undertaken to hire out the large ranges then exhibited in the room. The motion was carried, and Mr. Forster acknowledged the compliment. Miss Golding, of London, proceeded to deliver the first of a series of cookery lectures which she intended to give twice a day till the close of the exhibition.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

THE

JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MARCH 1, 1892.

A Portentous Conspiracy.

IT is not a little remarkable that while there is actually a Labour Commission sitting for the purpose of inquiring into the relations subsisting between capital and labour in every industry of the kingdom, the thoughts of those who take most interest in this matter are not centred upon the proceedings of the Commission, but upon the living movements of the working world. It is doubtless instructive to read the stories told before the Commission by "all sorts and conditions of men;" but it is difficult to resist the intrusion of a suspicion that much of what they so patiently hear is merely "cross swearing." Moreover, it is all more or less history; and men in business care little for history except for the light which it can throw upon the affairs of the moment, and the guiding which it can supply for dealings in the future. It is

very interesting, after a fashion, to hear how certain past strikes came about; but just now the working world is more exercised to learn something reliable about a peculiar kind of strike which is threatened for the middle of the current month. There has been a portentous amount of talk and of newspaper writing about a proposed suspension of coal mining; and last week every news sheet in the country was full of the "coming coal crisis," which is to be brought about by the action of the Miners' Unions in stopping the output of coal for a period variously stated as a week or a fortnight, commencing on the 12th inst. In the *Daily News* of Friday last, it was categorically stated that a quarter of a million of men owning allegiance to the Miners' Federation would stop working on the day named; and it was expected that the Durham and Northumberland miners, who belong to another Union, would do the same, albeit acting independently of the Federation. The object of this proposal—the initiative in which, be it observed, is ascribed to the men—is stated to be the prevention of the fall in coal prices at the pit's mouth which is actually in progress, and which if not arrested will infallibly entail a reduction in miners' wages. It appears that in Durham and Northumberland the necessity for a reduction of wages is not disputed, but there is a difference of opinion between the employers and the men as to the amount. Hence the distinction between the views taken by the Federation and National Union men respectively is that, whereas the former contemplate stopping the output in order to prevent any reduction of wages, the latter are not so confident that the proposed week's or fortnight's "play" will be so effectual, and will only resort to it if the employers insist upon making the full reduction of wages of which notification has been given.

Frankly, we do not know what to believe of all this. If there is anything in the rumours that have taken such seeming solidity in the Press, the coal-owners will be found to be at the bottom of it. The proposed suspension of work may be a conception of the men's leaders; but we have a shrewd suspicion that it would suit the book of the owners better than that of the Unions. There is never a possibility of understanding the "true inwardness" of these movements in the coal-mining industry. We are not alone, however, in suspecting the complicity of the owners in this hazardous project; for we find in one newspaper of Friday last these significant words: "The Miners' Federation have counselled a general stoppage of work for one or more weeks. They are proceeding on the theory that a lessening of the output will stop the fall (of wages) by preventing that competition which a decline in trade always creates. That may prove a delusive and shortsighted view, as artificial checks cannot, in the long run, control such a necessary as coal, and in the meantime other of our national industries will suffer. However that may be, the present movement on the part of the men appears to have the sympathy, if not the active support, of many of the coal-masters." Just so. The masters—nominally so-called—or some of them, and the men, are engaged in a conspiracy to artificially force up the price of a necessary of life; and this in an age which has its Labour Commissions, and in a nation which has been dosed with Political Economy for at least three generations!

Now let us see how this precious scheme is expected to work. Our contemporary the *Daily News*, which never willingly says hard things of men with so much voting power as the miners—especially with a General Election so near—timidly asks, if the price of coal is to go up, who is to pay the difference. "Not the ordinary householder," says the agent of the Miners' Federation, "unless by some means or other the middleman gets more than his share." The admission is significant; and all we need add to it is the remark that, unfortunately for both producers and consumers, the middleman is generally able to take very good care of himself. But again let us hear the Federation leader. He says: "We do not want to punish the public; there is no reason why we should. The people who *should* pay the difference are the coal-owners' principal customers—namely, the Railway and Gas Companies." The italics are ours. The spokesman of the Federation went on to state that housekeeping consumers pay for their coal a price sufficiently high to remunerate both the owners and the miners, but that "the Railway and Gas Companies get coal at their own prices,

"They are too strong for the coal-owners. Buying coal on their terms, they put into the pockets of the shareholders money which should reward the mining trade." It seems a pity the Editor of the *Daily News* did not take the trouble to inquire as to the truth of this fancy picture, at least with regard to the part played by the Gas Companies, of that eminent authority to whom he has gone on other occasions for information of the kind. The Secretary of The Gaslight and Coke Company could tell where the money has come from to satisfy the shareholders; and he might ask in return what has become of the increased price of 4s. and 5s. per ton which these purchasers who are declared to be able to command their own terms—the Gas Companies—have paid over to the coal-owners during the last two years.

It is hardly necessary, however, to trouble the representatives of the Gas Companies to supply material for the demolition of the fallacies which the coal-mining conspirators are so laboriously building up, with the complaisant assent of politicians who cannot bring themselves to admit that 250,000 voters, more or less, may conceivably make egregious fools of themselves. The ordinary householder is not to suffer from the miners' folly in playing catpaw to the owners, is he not? Then what are we to understand by this report in the *Daily News* of the day following that which saw the publication of the reports we have already mentioned: "Yesterday it became generally known on the Coal Exchange that the North of England miners intended to adhere to their decision of ceasing work on the 12th of March. The excitement in London in consequence was considerable; and the price per ton on all qualities was raised 1s., while several members of the Coal Merchants' Society stated that it was certain a further rise would take place on Monday next. . . . The owners of collieries took the first step towards sending up the prices; and this falling upon the merchant, the merchant in his turn consequently puts it upon the consumer. The consumer, therefore, is the person by whom the full brunt of the coming upheaval will be mostly felt, and by none more acutely than the artizan and the unskilled labourer." It is also reported that in London it is "the merchants"—i.e., the middlemen—"who will thus gain by the advanced prices when the cessation of the output at the collieries takes place."

Surely, it might be thought, there is for the Federation men warning enough in all this of the share they will be forced to take in this public robbery. It is they who will be accused of doing it all, while the middlemen and the coal-owners will put the reward into their pockets. They will have the blame and the loss, while the employers and agents will take all the plunder. If they are only one-half as wide awake as they claim to be, they will take to heart the lesson of the too grasping coal merchants, and baulk the designs of these "forestallers," as they would have been called in the days when the Political Economy of which we are all so proud had not been dreamt of. We preach Political Economy now-a-days; but some of us are very ready to dispense with it when there is anything to be gained by so doing. In the bad old days of the Tudors, the enterprising gentlemen who are now so pleasantly and profitably engaged in turning the rashness of the Miners' Federation to their own advantage would have run considerable risk of losing their ears. Things are much better managed in our times; and "regraters" can victimize poor miners and starve struggling consumers without incurring any danger of personal inconvenience.

Happily, however, these plotters and schemers can still be punished through the most tender part of their anatomy—their pocket. It is not too late for the miners to stay their course towards self-destruction. Much mischief has been done already; but infinitely more will be avoided if the miners shake off the toils in which they have become entangled. It will be better for them to take their $7\frac{1}{2}$ per cent. reduction of wages now than to make matters worse by first upsetting all the minor trades of the country, merely for the purpose of enriching a few middlemen. So far as the liability of Gas Companies to pay the supposititious increase in the value of coal is concerned, we frankly declare that the notion is a delusion and a snare. If the agent of the Miners' Federation knows his trade, it is inconceivable that he can have spoken in good faith the words put into his mouth by the newspaper correspondent. Gas manufacturers buy all their coal by contract, often covering far too long periods; but rarely for shorter times

than one year. Although they can be, and in some cases are, victimized by astute and unscrupulous persons in the coal trade, temporary disturbances of the coal market seldom materially affect gas companies or gas committees of corporations. It sometimes happens that when coal-owners are reproached with the high price of their commodity, and the absence of any corresponding increase in the rates of wages they pay, the ready answer is given that these high selling prices are illusory because much of the output is sold to Gas Companies, &c., under contracts made when coal was cheaper. But did anybody ever know of an instance where a coal-owner continued to pay high wages in a falling market, because he had a contract running at famine rates? All these things are for the different parties in the coal industry and the public generally to consider. This article should find its way to every miner's club-room and Trade Union office in the Black Country, so that the men may not go wrong, if they must act foolishly, with their eyes shut to the circumstances. We hardly expect Trade Unions to be considerate of the public interest. The Tyne strike shows how little the slaves of one Union care for the suffering their action may inflict upon other workers for daily bread. But that Trade Union officials should play the game of the middlemen—that miners should throw away their bread to make coal dealers fat—is, as Talleyrand would say, "worse than a crime; it is a blunder."

The Chartered Assessment Appeals—Another Adjournment.

ONCE more the finish of the great assessment case is deferred—this time until next Saturday week, by which day it is hoped on all sides that what Sir Peter Edlin, Q.C., calls a "compendious statement" of the effect of his judgment may be ready for the correction of the multitudinous Metropolitan rate-books affected by these proceedings. It was hoped, rather than believed, that last Friday would have seen the last of the meetings in this matter at Clerkenwell. But the day was not lost after all; for, after a little preliminary debate between the Chairman and Mr. Littler, Q.C.—not devoid of acerbity—Sir Peter Edlin settled the last protest advanced on behalf of the Company by the use of that "soft answer" which proverbially "turns away wrath," and it thereafter appeared that the appellants had wisely decided to make the best of the situation; and to assist the respondents in working out the application of the judgment in the prescribed manner. It must have been rather galling for Mr. Littler and his learned friends to be satirically complimented by the Solicitor-General upon the setting in of "sweet reasonableness" in their councils. But the combative Mr. Danckwerts did not happen to be present, and Mr. Littler had no fight left in him; so the future conduct of the business settled down, after the appellants had uttered a final complaint of having come off worse than the Company on the other side of the water. The general acceptance of the principle of the judgment, however, did not remove all the uncertainty from its application; for all the parishes involved in these appeals do not occupy the same footing with regard to the rating of the hereditament. Some parishes have stations and unproductive mains within their borders; while others harbour only directly-productive works. Of course, every parish wants to adopt the principle of valuation or of apportionment most profitable to itself; but this eclecticism is sternly discouraged by Sir Peter Edlin, who insists upon the adoption of a uniform way of treatment of this most complicated case. He sees that the Company's back is broad; but he will not have it unduly loaded. In order to facilitate the final apportionment, the Chairman suggested that debateable questions of detail might be left to the arbitrament of a single independent valuer, or of two; while the Solicitor-General, for his part, offered to see the Company's Accountant if there should be any hitch in the progress of the settlement. After a great deal of discussion, most of the points respecting which difficulties might be expected to arise were fairly disposed of; and the parties adjourned with the consciousness, that, although the case had had another costly "squeeze," the end is now in sight.

Standards of Light.

THE Standards of Light Committee are meeting regularly and have succeeded in arriving at a general conclusion respecting the work of their precursors in the field, which

is the best promise of their being able to do something new and valuable upon their own account. The inclusion in the Committee of gentlemen who have not hitherto been identified with photometrical work has at least one advantage—it ensures the re-examination of all the data for the accepted conclusions of the technical experts, and thus avoids that “taken-for-granted” style of doing business which committees composed wholly of experts are apt to fall into, with the result that, sooner or later, when scientific opinions take a fresh colour, the results so hastily arrived at need explanations which are not always forthcoming. Thus, it will probably transpire, when the Committee come to issue their report, that almost their first task has been to decently inter the parliamentary standard candle, while retaining the name and the average quantity of light as the unit for the more exact photometry of the future. How the unit is to be represented is one question, and its exact value is another. There have been several substitutes for the parliamentary standard candle, some of which, as Mr. Vernon Harcourt’s pentane flame and the Methven slot, have come into considerable use. The question, “What is a candle?” however, like the historic query, “What is a pound?” is not to be answered off-hand. The new Commission may, by a single vote, carry the recommendation that the average light of a parliamentary standard candle shall be the unit of light for all photometrical purposes; but then comes the responsibility for fixing what is meant by the term. It is the commonest experience of physical experimenters with standards of light, that they first have to calibrate their working unit; for it by no means follows that a philosophical instrument is always perfect and fit for use. It has been suggested that, when the Committee have satisfied themselves that the average light of the parliamentary standard candle can be reproduced at will, they should seal up the remainder of the purchase of candles with which the decision has been come to, and build them up in some safe place for the benefit of posterity. At all events, the determination of the equivalent of the standard candle can hardly be made with too much care, whatever may be the shape which this equivalent may ultimately take. It may be pentane; but a good deal will have to be said and done before every member of the Committee shall have put his hand to the final report on this most interesting and important investigation.

The Meeting of the Manchester District Institution.

THE members of the Manchester District Institution of Gas Engineers met on Saturday under the presidency of Mr. C. Armitage, of Lancaster, who succeeds Mr. T. O. Paterson, of Birkenhead, in this honourable, but rather onerous, office. We publish the presidential address in another column. This composition covers a good deal of ground; and the author has one or two things to say in it which should interest a wider audience than that which listened to him last Saturday. Mr. Armitage is a practical man in the good sense of this much-abused term. He has ideas of his own, and he puts them to the proof of working; and then he tells his professional brethren all about it. One of the subjects to which Mr. Armitage, as an experienced coal distiller, has devoted particular attention, in connection with his gas making at Lancaster, is condensation. He begins his study of the condensation of gas with the hydraulic main, in regard to which, and the foul gas main, there have been held, as he says, many wrong opinions. The difficulty about the old practices of uninstructed gas managers was, in truth, to discover where these were wrong, and why; for of systematic investigation of the results of treating the gas in any particular way there was little or none. Consequently, a man would persevere for years in draining all the benzene out of his gas, and never know what mischief he might have prevented by a very simple alteration of the pipes. It is pleasing to hear a gas manager stand up, as Mr. Armitage does, for naphthalene, which, as he says, is one of the most valuable things to have in gas—provided, we may add, that it can be made to stay in it. Naphthalene in mains and services, in the objectionable form of a solid deposit, is eminently an example of “matter in the wrong place.” There is no difficulty in retaining the naphthalene in rich gas; but it is the “14-candle men” who feel the worst that misdirected naphthalene can do. Mr. Armitage had something novel to say about the advantage of keeping gas warm in a foul main falling towards

the hydraulic—the heavy tar from the latter being, of course, separately removed. His arrangement is so simple and easily applied that, if it only succeeds elsewhere as well as it has done in Lancaster, this modification of condensing plant should become popular. The subject of purification was also discussed by Mr. Armitage in an original way. He has strong views, moreover, upon the best way to deal with ammonia and the other bye-products. On the whole, this Manchester address contains a good deal of profitable matter which gas managers in every part of the kingdom will do well to consider with care. The Manchester District Institution are to be congratulated upon securing such a valuable and suggestive composition for their Transactions. The other business of the meeting included Mr. Newbigging’s paper upon “Management,” of which it is only necessary to say that it belongs to a class of essays which the universally respected author has made his own.

Mr. W. J. Russell, Secretary of the Croydon Gas Company, has been appointed a Director of the Carshalton Gas Company, (in accordance with the wish of a very large majority of the shareholders, expressed in votes obtained by ballot), to fill the vacancy at the Board caused by the death of Mr. Charles Newton, the Chairman.

Death of Herr Julius Ginzel.—News has just reached us from Vienna of the death of Herr Julius Ginzel, whose writings on gasholder construction, &c., have been mentioned from time to time in our columns. The deceased had a thorough knowledge of the principles of engineering, and wrote very clearly on any subject with which he was dealing.

Presentation to Mr. S. W. Durkin.—A presentation of an interesting character took place last week at the Southampton Gas-Works; the Manager (Mr. S. W. Durkin) being the recipient. It consisted of a series of photographs of the works and staff; there being twelve pictures in all, well mounted and framed in oak. In the centre was a photograph of Mr. Durkin, who has been in the Company’s service for 39 years, and has occupied his present position for upwards of a quarter of a century. The senior foreman (Mr. John Dear) made the presentation; and, in a few well-chosen words, explained that it was in recognition of Mr. Durkin’s services in their midst, and the consideration which the men had always received at his hands. He asked Mr. Durkin’s acceptance of the photographs as a token of their esteem. In reply, Mr. Durkin said he had the greatest pleasure in accepting the gift, especially as it was a spontaneous action on the part of the men at the works. He thanked them for the presentation, and for the assistance they had always rendered him in the discharge of his duties, especially through the winter months.

South-West of England District Association of Gas Managers.—The next meeting of this Association, which, according to custom, should be held on the 8th inst., has been postponed to April 12. So many of the members have recently suffered from sickness, that the Committee considered this step to be advisable. By the kind permission of the Directors, the meeting will be held in the Board-room of the Bristol Gas Company, at Canons’ Marsh. The whole of the arrangements are not yet completed; but it is understood that the Association will receive an official welcome from Alderman J. W. S. Dix, the Chairman of the Company, and from the Mayor of Bristol (Dr. Highett). The President, Mr. D. Irving (the Engineer of the Stapleton works of the Bristol Gas Company), will deliver an Inaugural Address; and Mr. Charles Richardson, C.E., Engineer and originator of the Severn Tunnel, has promised to contribute a paper descriptive of the undertaking; and it is proposed to arrange a visit to the tunnel and pumping works at Sudbrooke on the day following the meeting, under the guidance of Mr. Richardson; so that altogether there is a good prospect for a useful and enjoyable meeting.

The Official Nominations for the Incorporated Gas Institute.—An imperfect version of some of the business transacted by the Council of the Incorporated Gas Institute at their meeting held last week having leaked out, we are requested, in order to prevent misapprehension, to state that the following arrangements have been made for filling some of the principal offices which will fall vacant at the end of the current administrative year. Mr. Harrison Veevers, the Senior Vice-President, having immediately after the Carlisle meeting expressed his desire that the Council should not nominate him for the presidency, as his business engagements would prevent him from devoting the necessary time to the duties of the chair, it was deemed desirable to request one of the Past-Presidents to return to office for 1892-3. Mr. Denny Lane, of Cork, was accordingly communicated with, and consented to be nominated if the Council were unanimous in desiring him to take the position, which, it is hardly necessary to add, was the case. Mr. John West, M. Inst. C. E., of Manchester, and Mr. Robert Mitchell, of Edinburgh, will be nominated the Senior and the Junior Vice-President respectively. The Honorary Secretary (Mr. W. Longworth) has also signified his intention of retiring at the end of his present year of office; but no nomination for the post has yet been decided upon.

WATER AND SANITARY AFFAIRS.

THE Birmingham Corporation Water Bill has excited a considerable amount of attention in a circle of which the London County Council may be described as the centre. Sir John Lubbock, fearing lest London should for ever be debarred from drinking the peaty waters of the Elan and the Claerwen, recently conferred with Mr. Chamberlain, and succeeded in persuading that gentleman to obtain a postponement of the second reading of the Birmingham Bill, so as to allow of time for a friendly conference. If this truce had not been secured, there would evidently have been decided opposition in Parliament to the Birmingham scheme. The Corporation of that city, therefore, lost nothing by delay. In the first place, Sir John Lubbock obtained a gathering of Metropolitan Members of Parliament, and representatives of sundry County Councils in the Home Counties, when a Committee was appointed to confer with the representatives of Birmingham, in order, if possible, to arrive at some amicable arrangement. On Thursday the conference took place, when it was pleaded, on behalf of Birmingham, that an increased supply of water for that city was a matter of urgency. London, it was argued, could get plenty of water from the coveted area, after Birmingham had been fully supplied. With this explanation to guide them, the Committee proceeded to draft certain clauses, intended to protect London from any damage by the Birmingham scheme. If these clauses were agreed to, the Committee were prepared to recommend that the Birmingham Bill should not be opposed. The proposals of the Committee were to be laid before another general meeting of Metropolitan members and County Councillors, to be held yesterday afternoon. But it will be a little strange if this Birmingham Bill is allowed to proceed, while a Royal Commission on the Metropolitan Water Supply is pending. One of the instructions to be given to the Commissioners, as set forth in the recent letter addressed by Mr. Ritchie to Sir John Lubbock, contemplates the possibility of a source of supply being sought outside the Thames and Lea watersheds. On this subject, Sir Matthew White Ridley's Committee of the past session made a distinct representation that Parliament, before granting any powers for further encroachments upon fresh areas of supply, should consider the possible requirements of the Metropolis and other large centres of population. It would seem, therefore, that Parliament ought to wait for such information as the Commission can obtain before deciding on the merits of the Birmingham Water Bill. If that measure may be proceeded with, it will strengthen the plea of the London Corporation that their Water Bill should also receive attention. Yet, if two such Bills are to be made the subject of debate, as capable of passing into law, it would seem that the labours of the Royal Commission can possess little practical importance. In opposition to the plea of urgency for the Birmingham scheme, the prospect has been held out that the Royal Commission will simply be composed of a few experts, and that they will make short work of their inquiry. Still it has to be remembered that the Water Companies have not yet been heard; and they cannot fail to produce an immense amount of evidence, differing widely from that with which the public have been entertained for some years past. The fringe of a great subject is all that has yet been touched. As for the Birmingham scheme, some doubt is thrown in certain quarters upon the suitability of the water for drinking purposes. It is apparently open to doubt whether the Elan and the Claerwen would furnish an acceptable supply for London, and at all events some of the Birmingham people seem to have no desire for it.

Presentation to Mr. T. W. R. White, of Sherborne.—The Directors and a few shareholders of the Sherborne Gas Company last Wednesday presented some silver plate to their Manager (Mr. T. W. R. White), in recognition of his 25 years' successful supervision of their works.

The Southern District Association of Gas Engineers and Managers will hold their annual meeting at the Holborn Restaurant on Wednesday, the 9th inst., when the President (Mr. A. Dougall, of Tunbridge Wells) will deliver his Inaugural Address. Only a few other matters—consisting of the election of new members and the reception of the Committee's report—will occupy attention; and at the close of the business, the members will dine together.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 407.)

THE past week opened with a rather better show in the direction of firmness in most of the markets; but nothing much came of it. Although most of the elements which, under ordinary circumstances, go to make strong markets and good business were fairly in existence, yet, somehow or other, there is a great dearth of business, and prices can only just hold their own. Seeing the strength of the Bank, and the cheapness and prospective cheapness of money, one might fairly expect something better than this *quasi*-stagnation; but it does not come. What oppresses everything and everybody is still the fear that troubles are ahead, and that the "arrangements" made to remedy the financial position of certain shaky institutions in the last twelve months or so have only postponed, and not averted, the inevitable. The Gas Market meanwhile has been tolerably active, considering the general slackness. The chief feature in it is the very large proportion of transactions in secured and preference issues, even after making allowance for the natural demand for choicestocks for investment purposes when money is abundant and speculation is in abeyance. The tendency was good all round, and most of the leading undertakings show a little advance in quotation. Gaslight "A" was only moderately dealt in; the last prices being not quite the best of the week. The debenture, preference, and limited issues were largely dealt in, and showed considerable firmness; but the only change in quotations was an advance of 1 in the $4\frac{1}{2}$ per cent. debentures. South Metropolitan were not very busy, but were very firm; but all three classes of stock come out a little higher upon *ex div.* adjustment. Commercial have been very little touched. The Directors announce a reduction in the rate of dividend to 13 per cent. on the old stock, and 10 per cent. on the new. We feel assured that this is a highly prudent step, seeing that the Company, like the other Metropolitan undertakings, have not for sometime past been earning the amounts they have appropriated. A moderate dividend, well secured, is the best; and a Company that keeps this in mind, and in practice, stands firmest in the market. Business in Suburbans and Provincials has been very quiet; but they are all firm. Brentfords and Bromleys are fractionally higher. The tendency among the Continentals was also favourable; and Imperial has regained the points it lost in the preceding week. Of the rest, nothing has moved but Bombay, which receded $\frac{1}{4}$ —the rate of Indian exchange having fallen to the lowest point reached. Water has been very quiet; and prices, though not much changed, are looking downwards.

The daily operations were: Gas opened well on Monday, and remained steady and unchanged. On Tuesday, the course of business was much the same for the leading issues; but Bombay fell $\frac{1}{4}$, and West Middlesex Water dropped 1. Wednesday was extremely quiet, and the only feature was a rise of $1\frac{1}{2}$ in Imperial Continental. New River fell $2\frac{1}{2}$. On Thursday, activity was renewed; but quotations underwent no change. Friday was moderately active, and also produced no changes except those due to *ex div.* adjustment, which were all favourable. Saturday's business was about as usual; and the only variation was a rise of 1 in Gaslight 4 per cent. debentures.

ELECTRIC LIGHTING MEMORANDA.

The Affairs of the Westminster Electric Supply Corporation—The Cork Gas Company's Abandonment of their Electric Lighting Scheme—The Choice of Motors for Central Lighting Stations—The St. Pancras Electric Lighting Scheme.

THE Westminster Electric Supply Corporation occupy a very good position among the Metropolitan electric lighting companies; their district being second only to that of the St. James's Company for eligibility, while really surpassing it in area. The Directors' report on the past year's working claims that a substantial profit has been made after allowing a fair amount for depreciation, and writing off a proportion of the preliminary expenses and suspense account. The report also states that the number of 8-candle power lamps on circuit increased during the year from 12,000 to 67,500; while applications have been signed for 5083 more, and there are 89 miles of copper mains in the district. The gross revenue of the Company for the year was £19,455; and the net profit, which was carried forward, was £3160. The capital sunk in the business amounts to £329,400; so that it is evident that a great deal more work will be required to be done before a good dividend is earned. There are three stations, actual or prospective; and the Directors will naturally be anxious to get these in full work for the money already provided for capital purposes, which is supposed to be enough to complete the producing power to the total of 295,000 lamps. It is illustrative of the conditions under which a company of this kind has to work, that the current which they sold last year for £19,000 only cost £8713 to produce and distribute. All the rest of the debit entries in the revenue account are for administrative and general expenses. If it could be supposed that the latter are at their maximum, the Company might hope to do all future extensions of their supply at a rapidly increasing profit. Professor Kennedy, the Company's Chief Engineer, has reported to the Board that no

great economy in the cost of producing electric light is to be looked for; and it is clear from these accounts that it is not in this direction that the Board must look for dividend, if they are ever to make one—of which, it is only fair to state, there is reasonably good promise.

It is announced in a paragraph of the recently published report of the Directors of the Cork Gas Company, that, in consequence of the unexplained opposition of the Corporation of the city to the application on behalf of the Company for a Provisional Order for electric lighting, this intended enlargement of their responsibilities has been dropped for the time being. The matter was mentioned at the general meeting of the Company; but very little additional information respecting the policy of the Board was allowed to transpire on this occasion. The Directors said that, although the opposition of the Local Authority would not necessarily hinder their obtaining the powers sought, they preferred not to “antagonize” the Corporation. Something was said at the meeting about the Company having desired a “monopoly” of electric lighting, such as they practically enjoy with regard to gas supply; but the net outcome of the local disagreement is that the interesting experiment contemplated by Mr. Denny Lane will not now be entered upon. On general principles, we cannot profess to be sorry for this result. We have never favoured the idea of gas companies entering upon electric lighting ventures, and did not approve of the project of the Cork Gas Company. At the same time, we acknowledged that there is something to be said for the particular variety of electric lighting speculation contemplated by Mr. Denny Lane, of distributing the electricity by means of gas-engine power; so that if a gas company is ever to be considered as justified in undertaking electric lighting, it must be when gas is used in generating the power at the central stations. Whether Cork is or is not a convenient locality for repeating the experiment claimed to be so successful at Dessau, must be a question for settlement on the spot; but, on the whole, we never thought the action of the Gas Company in this regard very well advised. However this may be, the problem has ceased for the present to possess any practical interest. It may be revived next year; but meanwhile we should strongly advise the formation of an independent Company for making the venture.

Our contemporary the *Electrical Review* is greatly exercised on the subject of the best method of providing power for central station work. It is all very well to talk of the superior economy of large steam-engines of the compound condensing type; but the exigencies of central station working forbid the employment of such motors, which cease to be economical the moment the demand for power falls below the maximum load. The high-pressure, high-speed engine is preferable when only a small amount of work has to be done; but the over-multiplication of motors must be guarded against for several reasons. Where to draw the line has not yet been settled. Our contemporary admits that “probably a maximum of economy is reached in the case of the gas-engine, where, immediately the engine stops running, all consumption ceases.” To this admission, however, is added the rider, in depreciation of the gas-engine, that “at present questions of power, size, and space absolutely prohibit its use for central station purposes.” Is this so really? How about the case of such a central station concern as that of Kensington, where the average output for the year is only 12·8 per cent. of the maximum. The engineer of the station observes that it looks ridiculous to keep all the paraphernalia of the station going to turn out perhaps only one-half per cent. of the maximum load. In view of these conditions, it strikes us that those who have affected to despise the gas-engine would be well advised to reconsider the question.

The first section of the St. Pancras Vestry electric lighting scheme has been completed and put to work—just in time, it will be remembered, to get into trouble in connection with the coal porters’ strike, which came when the central station was short of fuel. By suitably humiliating themselves before the belligerent coalies, however, the parish electricians succeeded in keeping their boilers going. The Regent’s Park station of the Vestry has been described and illustrated in the *Engineer*, from which we gather the materials for this notice of the plant. With regard to the lighting, we have independent sources of information, and have no hesitation in describing it as making a very poor show in the streets already given up to the tender mercies of the Committee. Nor shall we be contradicted when it is known that the Brockie-Pell arc lamps—good enough, so far as they go—are spaced, for the sake of economy, at distances of from 160 to 245 feet apart. The electrical plant of the station is good of its kind; the current being supplied by Kapp dynamos driven by Willans and Robinson triple-expansion engines. There are eleven of these to serve the estimated maximum requirement of 10,000 incandescent lamps of 16-candle power, and 90 arc lamps of 10 ampères each; so that if the designer has erred at all, it is not on the side of over-concentration. The Vestry are reported to be vastly well satisfied with the result of their electric lighting speculation up to date. Let us hope the satisfaction will continue. At present, however, they are their own largest customers.

The Salford Gas Frauds.—An official intimation has been received from the Home Office that Samuel Hunter, late Manager of the Salford Corporation Gas-Works, will be released from custody at Portland prison on the 18th inst.

STEVENSON AND BURSTAL ON THE METROPOLITAN WATER SUPPLY.*

THE professional position occupied by the authors of this concise treatise on the Metropolitan Water Supply gives especial weight to anything they may advance on such a subject. Adopting a purely impartial standpoint, Mr. Stevenson and Mr. Burstal nevertheless speak with freedom and independence, and give the reader the benefit of their judgment on several important points. The value of the constant service system is strongly insisted upon, providing it is accompanied by proper regulations, duly enforced. The experience of provincial towns is cited to show that companies are not only equally able with corporations to undertake the efficient management of water-works with a constant supply, but have even taken the lead in so doing, “though the London Companies lag far behind.” It is described as “disappointing” that, after the lapse of twenty years, not more than 65 per cent. of the whole of the houses served by the London Companies are receiving a constant supply, and at the same time the diminution of waste is scarcely perceptible. “Firmer management on the part of the Companies” is demanded, so as to secure the integrity of the fittings. To this we may reply that the Companies have met with small encouragement from the authorities in their efforts to extend the constant service, and to enforce regulations that should accompany it. If due economy were observed, there is no doubt that a little more than 20 gallons per head daily would suffice for the wants of the population served by the London Water Companies. Under such circumstances, the present supply would suffice for a population of 10 millions. With respect to the control of the supply, the authors of this pamphlet favour the idea of an amalgamation of the existing Water Companies; but beyond this they suggest the formation of a compact Water Trust, as tending to produce still greater economy. In making these and other suggestions, the two Engineers are influenced by the state of public opinion, which appears “rightly or wrongly” to demand some change in the existing arrangements. On the watershed question, it is remarked that the necessity for looking further afield is not a matter of urgency, though it might be wise to exercise some precaution, seeing how rapidly every area from which a supply could be drawn is being appropriated. Other matters affecting the main question are likewise discussed; and a quantity of valuable information is presented with much lucidity in a surprisingly small compass. The book deserves careful reading at the hands of all who are interested in the subject of the Metropolitan Water Supply; and its perusal may even serve a yet wider purpose, as with respect to the functions of the Local Government Board.

THE CRYSTAL PALACE ELECTRICAL EXHIBITION.

FOURTH NOTICE.

THE last article concluded with a reference to what was intended to be a commanding feature of the display of electric lighting at the Crystal Palace—the great screen of incandescent lamps erected by the Edison and Swan United Electric Light Company at the end of the North Nave, which, according to the “advance notices” obligingly published by some of the newspapers that have a leaning towards the electric lighting interest, was to be a most magnificent spectacle. In the catalogue, this exhibit is described as a “novel combination of incandescence electric lamps, in the form of a screen, filling up the entire perpendicular space of the Nave of the Crystal Palace, containing nearly ten thousand incandescence lamps. The lamps are arranged to be illuminated in various groups by a series of circuits. These separate circuits will be thrown in and out of contact at certain times. One of these circuits represents a fountain with changing colours. The screen will be illuminated for one hour during each evening; and during the last quarter of an hour 200-horse power will be employed in making the illuminating effects.” This work of united English and American electrical science and art took a long time to get ready, and was one of the last exhibits to be recorded as complete in this most unpunctual of shows. Now that it is finished (and displayed, as per programme, every evening), the most favourable thing we can say of it is that the credit of the exhibitors, and indeed of the whole exhibition, would have been higher if it had never been completed at all. Even the *Electrical Review* admitted some weeks ago that the great screen of incandescent lamps was not very effective, which we claim as supporting our more candid judgment of the affair as being the most wretched of failures. There is, to begin with, no particular reason why a “screen” of 10,000 lamps should rank as more convincing evidence of the triumph of the system of lighting to which they belong than 10 lamps. It should, however, be possible to arrange illuminating effects with 10,000 lamps which would be pretty to look at; but this is exactly where the Edison and Swan people have so lamentably failed. Their big “screen,” when it does not merely carry the name of the firm in coloured

* “Metropolitan Water Supply. Considerations affecting the Adequacy and Control of the Water Supply to the Metropolis.” By E. H. Stevenson and E. K. Burstal (MM. Inst. C. E.) London: Walter King; 1892.

lamps—no very startling object—has the appearance of a very ugly and badly-arranged illumination device in Vauxhall lamps; and we have no hesitation in averring that the skilful pyrotechnists of the Palace—Messrs. Brock and Co.—would lose their appointment instantly if on any “firework night” during the season they were to put up such a poor, thin, broken-down “set-piece” as this grand effort of the Edison and Swan Company actually is. So much for the “Ediswan” screen. It is an eyesore in the Palace, and an occasion of scoffing to the London public who know what Brock or Pain can do with fireworks of a less “scientific” character.

The plentiful lack of the sense of the fitness of things which is such a blot upon the lighting exhibits generally has at least one of its sources at the head-quarters of the lamp manufacture. The stall of the Edison and Swan Company, which is immediately underneath their “screen,” contains specimens of the productions of the firm, which include incandescent lamps of all kinds and forms, and fittings for use with the same. Here may be seen the flame lamps which make so much of the “artistic” lighting shown at the Palace appear ridiculous to the thoughtful observer; while the high price of lamps with fancy bulbs explains the origin of the coloured glass bead jackets which some exhibitors are driven to use in order to impart variety to the light-effects shown by them. There is a “sweet simplicity” about the system of business pursued by this monopolist Company. They have only one price for all descriptions of ordinary lamps, of from 1 to 16 candle power. These are all 3s. 9d. each. Even miniature and surgical lamps of glow-worm power are the same price. The figure runs as high as 30s., however, for a nominal 1000-candle power lamp, which is not often asked for, we fancy; though there must be a large trade in 25 and 50 candle lamps at 4s. or 5s. each. There is a case of Thomson-Houston lamps exhibited in another place, but not for sale, which illustrates the nature of the change that will come over the incandescent lamp trade in this country when the Edison and Swan patent expires.

The Edison and Swan stall shows how, in the application of incandescent lamps for lighting apartments, departure from the most rudimentary fitting may cause offence. Here may be seen the combination of a plain, stumpy bracket, which might carry a gas-burner, with a shade made from a sea-shell—a more incongruous mixture never occurred to the most Bœotian designer of the age of Churchwarden-Gothic. As we have already hinted, however, if we were to go through the exhibition only with an eye to these sins against taste and common sense, it would be difficult to pass any stall without saying something uncomplimentary of its contents. The case may be summed up in a sentence: Neither lamps nor fittings show any real improvement upon 1882; and where there is any difference, it is quite as often for the worse as for the better. We remember that ten years ago the Edison exhibit contained a beautiful pendant of wrought brasswork upon a floral pattern, sprinkled over with incandescent lamps. There is nothing in the present show better than that early example of incandescent lighting, and much that is vastly inferior to it; but the greatest deterioration is to be seen in the most prominent exhibit of the Edison and Swan Company.

Habitual visitors to the Crystal Palace will remember when there used to be a fountain in a sunk basin in the middle of the Centre Transept, between the Handel Orchestra and the great stage. This fountain has been covered over for many years—the site being wanted for a band stand; but it is now opened up again, and the fountain plays every night. The sunk basin is lined very prettily with rockwork and foliage, and illuminated with arc and incandescent lamps by Messrs. Laing, Wharton, and Down. The effect is not altogether bad, so far as it goes; but it would be greatly improved if the electric lighting firm were not so desperately anxious to make the best of the advertisement. As it is, the spectator is not allowed to admire the effect without being clamorously appealed to by placards which inform him wherever he looks that “the artistic illumination of this fountain is by Laing, Wharton, and Down.” Now, it is all very well for the painter of a picture to sign his work, but how can we admire it if he persists in writing his name large across every part of the scene? Besides, there is nothing so very wonderful about this piece of lighting to anybody who remembers the South Kensington series of exhibitions. If the last word upon fountain lighting was not said then by the late Major Francis Bolton, it is certain that the jovial Major’s shade, if permitted to revisit the “pale glimpses of the”—arc lights at Sydenham, will not discover anything here to envy.

Well, it may be objected by readers of these articles that we have said enough of a fault-finding character about the lighting exhibits, and that, unless it is our intention to damn the affair altogether, it is time we began to point out what there is praiseworthy in it. We certainly do not desire to condemn the show as utterly bad, for it contains much that is both instructive and pretty to look at. Having warned our readers against accepting implicitly reports that may be brought under their notice claiming that the present exhibition is better, prettier, and more successful than its predecessors; and having drawn attention to blemishes and shortcomings that not even electricians themselves can deny, although they are not likely to say much about them, we are free to admit that there is plenty of evidence in this exhibition to support the general conviction that incandescent electric lighting can be made very nice indeed for users

who combine good taste with plenty of money, or, having the latter, know where to go for the former. Money is, of course, the first necessary—not so much, perhaps, with regard to the fittings as for securing good light, and plenty of it. If a really good light is desired, the lamps must not be spared. There is all the difference in the world between the aspect of an apartment wherein the lighting is disposed with a view to economy, and another where this is not studied. It practically amounts to this: Whether a user of incandescent electric lamps is or is not prepared to spend a great deal of money upon his pendants, &c., he must not stint his wiring or the number of points available for the attachment of lamps, or the general effect will be disappointing. Again, when he has his lamps, he must work them at their highest efficiency, regardless of occasional breakages, or the resultant light will be bad in colour, and will fail to “carry” well. The latter consideration will come out very prominently when use is made of these lamps for reading or working. Take, for instance, a nominal 16-candle power Edison-Swan lamp, rated at 105 volts. If this lamp is “nursed” by supplying it at 100 volts, or even less, as is frequently done, its durability is increased, but at a very obvious sacrifice of brilliancy. Provided there are plenty of lamps, a better effect can be depended upon than when there are but few; although in the latter case the fittings may be of a more ornate character. Indeed, there are many stalls at the Palace where as good an effect as can be desired is attained by the use of very simple fittings—the lamps hanging straight down by plain suspenders, and shaded by paper screens. But—and this is the great principle—there must be plenty of them; and they must be bright. What these conditions mean would sound like an exaggeration if we were to base the statement upon our unsupported opinion. It is a fact, however, that many show-rooms and stalls at the Palace measuring about 14 or 15 feet square—rooms, at any rate, no larger than an ordinary sitting-room in a small private house—are hung with 12, 15, or 18 incandescent lamps. There is one picture-room, measuring 11 feet by 18 feet, which has eight 50-candle lamps to light the walls; and pendants carrying a dozen lamps or more are by no means exceptional. With lighting upon this scale, gas, it may be admitted, cannot compete. Gas engineers would never dream of putting from one to two dozen burners into a lady’s boudoir; and eight or nine lights in a bed-room would be regarded as an outrageous allowance. Yet, be it noted, these lavishly-lit rooms and stalls are not too bright. An instructive example of what gas could do, if used upon anything like the same scale, is to be seen at the well-known stall of Messrs. William Sugg and Co., which is a spot of brightness even where all is bright. Accusations have been laid against Messrs. Sugg of their going into the electric lighting trade; and one scientific gentleman inquired of the head of the firm, who happened to be standing by the stall, where he kept the dynamo which supplied a cluster of particularly brilliant “Cromartie” lamps in wavy glasses. It is hardly necessary to say that Mr. Sugg was equal to the occasion, and promptly introduced his inquisitive questioner to the gas-meter! If this story had not been true, it would be *ben trovato*; but it is, we believe, well founded.

Chemical Society.—At the meeting of this Society next Thursday, Professor Foster will bring before the members “Some Analyses and Lighting Values of English Coal Gas made during 1891,” and a “Note on the Origin of Luminosity of Coal Gas Flames.”

The Rotherham Gas Managership.—The appointment of Gas Engineer for which the Corporation of Rotherham invited applications in the JOURNAL a few weeks ago has been conferred on Mr. Newton, an assistant at the Sheffield Gas-Works. The duties include the management of the water-works.

Richmond and Co., Limited.—Owing to the great development of the business of this Company since its incorporation, and to the important extensions of buildings and plant consequent thereon, the Directors have decided to issue the remainder of the capital—viz., £10,000—in £10 shares. Of this amount, £5 will be payable on allotment; but no portion of the remainder will be called up till not less than three months have elapsed.

Increasing Use of Gas for Industrial Purposes.—In reference to the paragraph under this heading in the last number of the JOURNAL (p. 335), we learn from Messrs. Fletcher, Russell, and Co. that the eleven cases there referred to, entailing a gas consumption of 1300 cubic feet per hour for industrial purposes, were the result of *one week’s* incidental calls, employing a part only of their customer’s time; and the matter was mentioned as the result of a week’s experiment in a line which he intended to develop into a regular business in addition to his existing work.

Presentation to Mr. J. Duxbury, of Darwen.—At the Darwen Theatre Royal Assembly Rooms last Friday night, the workmen employed at the Darwen Corporation Gas-Works, presented Mr. John Duxbury, who has accepted an appointment with the Windermere Gas and Water Company, with a marble timepiece, a gold Albert chain, several volumes of books, and a case of drawing instruments, as a token of their respect. Mr. T. Duxbury, the Manager of the Darwen Gas-Works, presided; and the presentation was made by Mr. W. Pickering, the oldest employee at the works.

NOTES.

Preservative Paints.

The subject of preservative paints for structural ironwork is of perennial interest for gas managers, who have for many years been habituated to the use of iron oxide and zinc oxide paints, oil account alike of their protective and acid-resisting character. It now appears, from a communication of Mr. A. Sahlin to the American Institute of Mining Engineers, that the slags produced in iron puddling and re-heating furnaces are being introduced as "stock" for paint. The slag is ground to an impalpable powder, and mixed with oil in the ordinary way. Samples tested at the works at Boonton, New Jersey, show the material to have the following approximate composition: Iron oxides, 71 per cent.; manganese oxide (puddle slag), 6 per cent.; silicic acid, 16 to 20 per cent.; with a little lime, phosphorus, and alumina. Of sulphur, there is scarcely a trace. The cinder from the re-heating furnaces gives the best results; but both are said to make good paint stocks. When ground up with linseed oil, the material works up into a dark olive-green paint, so neutral in tint that a slight addition of positive colouring will make it bright blue, yellow, drab, or glossy black. The finest dust is used for the higher-class paints, for which purpose about 40 per cent. of the slag is available. The rest is collected in the settling chamber, ground to a fineness of about 225 mesh, and used for producing durable shades of dark red for railway and other purposes. Mr. Sahlin asserts that these slag paints are remarkable for their durability, body, gloss, and covering capacity, as well as for the stubbornness with which they resist all chemical reaction. They are also stated to be low in price, and of uniform fineness and composition. The raw material is available in great abundance, and at nominal cost. It would be interesting to hear whether or not slag-paint is likely to become a valuable bye-product of the British iron industry.

Lord Rayleigh on Heat-Engines.

Lord Rayleigh writes to *Nature* on the subject of the superheating of steam between boiler and engine, with a view to increasing the efficiency of the latter, and draws attention to what he calls a curious misapprehension, even on the part of high authorities, with regard to the application of Carnot's law to an engine in which the steam is so treated. This is the taking of the temperature of the superheater as the "superior temperature" for the computation of the efficiency of the plant under that law. Lord Rayleigh states that an estimate of the possible efficiency founded upon the temperature of the superheater must be immensely too favourable; and he suggests that the chief advantages which might attend the judicious use of a superheater "would be connected rather with the prevention of cylinder condensation than with an extension of the range of temperature." If it is wished effectively to raise the superior limit of temperatures in a vapour-engine, the boiler must be made hotter; and so the conditions operating in the case of a gas-engine will be copied. In a steam-engine this would mean pressures that would soon become excessive; and the only escape lies in the substitution for water of another and less volatile fluid. (This, it will be noticed, is going altogether contrary to the recent attempts to improve the efficiency of a steam-engine by introducing ammonia into the boiler.) In the absence of convenient liquids other than water, Lord Rayleigh recommends the restraining of the volatility of water by the addition of saline matters, such as chloride of calcium or acetate of soda. In this way the boiling temperature may be raised without encountering excessive pressures. This method would involve the condensation of steam at higher temperatures than with pure water; and it points to a new principle of compounding.

Breeze Concrete.

Further correspondence upon the subject of breeze concrete for flooring, &c., has appeared in the *Builder*. Mr. T. Potter, of Alresford, writes to say that in his opinion breeze from gas-works is very far from being the best material for concrete floors, especially of large span; its utility being confined chiefly to short spans, with a free use of iron or steel girders. Breeze is improved, so far as strength goes, by washing; but even then it is too sandy and deficient in strength to make good concrete. Mr. Potter declares that it requires a greater proportion of cement than many other aggregates to produce, in comparison, concrete capable of withstanding moderate tensile and compression strains. The same correspondent goes so far as to state that breeze does not make a good aggregate for walling; and assuming that it was obtainable for nothing, he asserts that, if measured by strength, it would prove to be the most costly material in use for this purpose. With regard to the nailing of flooring boards directly upon concrete Mr. Potter supports the practice. He recommends the forming of the mass of concrete at the earliest opportunity, finishing off with a layer $1\frac{1}{2}$ or 2 inches thick of breeze (or sifted brick rubbish, when the former is unattainable), which is to be carefully levelled. This should have at least a month to dry, being left as bare as possible to the wind; and after the longest practicable delay, the boards may be nailed down. The advantage of nailing boards directly upon the concrete, besides that of leaving no intervening space for mice and other house pests, is that much thinner flooring is required.

COMMUNICATED ARTICLE.

LIGHTING.

By W. H. Y. Webber.

(Continued from p. 293.)

PART IV.—THE PHOTOMETRY OF LIGHTING.

The actual photometry of illumination is a subject to which a few words of discussion may be given at the close of what has been advanced in these articles upon the general subject. It is a matter, as Mr. W. H. Preece has observed, which is full of difficulty. His own attempt to construct a diffusion photometer was a failure, for reasons which need not be further examined; and in what will now be said upon the subject, the aim of the writer will be rather to suggest the lines upon which practical experiments in this regard may be imagined to be most hopeful, than to recommend any particular instrument. The importance of the actual measurement of lighting is due to the fact that calculated values of lighting from the known or the estimated light-giving power of a light-source can never be more than approximations to the truth. If we know the illuminating capacity of any lamp, from tests conducted in the dark room, and calculate therefrom the lighting effect which such a lamp ought to produce at a definite distance, upon an object bearing a certain angular relation to it, the result may be vitiated by three sets of influences for which neither dark-room photometry nor the laws of optics enables us to find absolutely correct arithmetical expressions. These are: (1) aberrations of radiation of the lamp when compared with theoretical spherical radiation; (2) the reflection from walls, ceilings, &c.; (3) absorption of the light in its passage through the air. To these influences might be added a fourth—the disturbing effect of peculiarities of structure of the lamp or the lantern, presence and disposition of reflectors, state of the glass, and so forth.

Thus calculation can at best only tell us what ought to be the illuminating effect, under certain conditions, of a given light-source; but it cannot inform us how far our expectations are realized in any particular case. The practical efficiency of an example of artificial lighting, as compared with its theoretical value, is, in short, to seek, after calculation has done its best for the lighting engineer. This consideration does not in the least detract from the value of such calculations. Far from it; because the calculation is needed at the most important stage of the progress of a lighting experiment—*i.e.*, before the light is shown at all. This is when the engineer is called in. Afterwards, photometry will only clinch the experience, as it were, by helping to define the causes of success or failure for future guidance. Both kinds of information are needed for exhaustively dealing with a problem of the kind under discussion; just as in steam engineering, where, although the engineer must be able to specify the dimensions of the boiler he needs for any particular plant, he still finds a working test useful to teach him how far his expectations have been realized.

In the photometry of lighting, even more than in the photometry of lights, the difficulty of arriving at exact results arises in the first place in regard to the standard, and secondly in respect of the instrument. In regard to the standard, there is practically no choice. We must take the British standard candle. In France, the carcel is the legal standard; but it has so little superiority to the candle that, as we have already seen, a leading French authority in physical manipulations—M. Mascart—prefers to express his result in terms of the candle, even though he employs a lamp of ten times the illuminating power for his actual determinations. It would only labour the subject were we to enumerate all the objections expressed by photometrists with regard to the use of the actual candle in the measurement of light. For the present purpose, even if we take the parliamentary standard candle as less black than it has often been painted, it has one great drawback—the colour of its light, which is so much redder than that of gas-burners of any but the duldest kind, to say nothing about the electric arc light, as to gravely embarrass the observer who attempts to establish uniformity of illumination as between light-sources of such divergent characters.

The candle is quite powerful enough as a unit for measuring diffused light; but it is not intrinsically bright enough. What is wanted is either a small light-source emitting rays of the same character as those with which they are to be balanced, or, failing this, some means of neutralizing the discrepancy. It seems hopeless to look for the former requisite, seeing that, notwithstanding the efforts that have been made by the ingenious of the whole civilized world to attain this end, the various proposed substitutes for the standard candle have had but partial success. The most convenient and portable of these is doubtless the Hefner-Alteneck amyl-acetate lamp. But this has the great drawback that its light is even redder than that of the standard candle. No standard which is a fixture, like the Methven slot, is available for the photometry of diffused lighting, which presupposes that measurements may be made anywhere, indoors or out. It is open to suggestion, however, whether approximate determinations of the legibility of printed characters could not be made, by a sufficiently painstaking individual observer, by the light of a fixed standard in a dark room, which would serve the same observer as bases of comparison under different conditions of lighting. It is evident that such determinations would be

useless for different observers, on account of the divergency of individual visual acuity. M. Le Chatelier and others have constructed instruments to measure such acuity; but this principle has never been accepted as constituting a reliable basis of light measurement. Individually, however, as already remarked, some use might be made of the principle, if the determinations were carefully carried out. The test cards would need to be chosen from the same parcel, of course, to avoid difference of tint; and the printed characters would need to be arranged to form nonsense words, in order to eliminate scanning. The pentane standard bids fair to be adopted, for lack of a better, as the scientific expression of the light of a candle for Great Britain. Its light is whiter than that of its prototype, but still leaves something to be desired in this respect. Although the pentane standard is made in a portable form, it is doubtful whether this arrangement is really convenient enough to recommend it for use in a photometer for diffused light.

If a small incandescent electric lamp, working very near the limit of the endurance of the filament, could be standardized and maintained by a battery in a steady "gait" for (say) 100 hours, it would answer the purpose admirably. Such a lamp might be used in a manner different from that suggested by Mr. W. H. Preece, in which the illuminating power of the lamp was required to be varied. It would be better to treat it like any other standard, by simply moving its position with reference to the photometrical screen. The present reputation of incandescent electric lamps is hardly good enough, however, to warrant our looking in this direction for the wished-for practical unit of lighting.

There is nothing for it, therefore, but to fall back upon the candle itself. It is, to say the least of it, much handier than the lamp employed by M. Mascart and his fellow-workers in this field, and is not far from being as reliable. If the observer working with the candle is constrained to exercise some mental reserve with regard to the exactitude of his results, he can console himself with the reflection that, in the measurement of diffused lighting, the probable errors of observation, due to the inherent difficulties of this work, will be likely to outweigh the imperfections of the standard.

In the measurement of diffused light, the object is the same as in all photometry—to equalize upon a screen the effects of two lights of known and unknown powers. Mascart's apparatus (see Vol. LVIII., p. 798) may be cited, not merely as a practicable instrument in itself, but also as exemplifying one way of dealing with the problem. The instrument is not really so complicated as it looks, with its mirrors and Foucault screens; but, to judge it from sight, it has the disadvantage of being workable only in strong light. No feeble rays are those which are to survive filtration through a Foucault lens of thick paper and double reflection from mirrors at an angle of 45 degrees. Such an instrument, with its standard lamp of 10-candle power, would doubtless answer sufficiently well in a brilliantly-lighted saloon like the auditorium or the foyer of the Paris Opera; but it would not be delicate enough to deal with street lighting, when there are commonly some very obscure spots and corners to be explored by an instrument of the kind. A photometer which could not be made available, for instance, to interpret in figures the degree of spottiness of the light afforded from electric arc lamps in a thoroughfare as to the lighting of which the local authorities, although on "brilliancy bent," yet preserve a "frugal mind," cannot be recommended for general adoption.

In these circumstances, we shall best escape from the difficulty of selecting a perfect instrument by dispensing with all instrumental aid. There is much in what was once said about the troublesome and unnecessary complication of photometrical apparatus by Sir W. Thomson, while engaged in comparing the values of two lights by the aid of a sheet of paper, a lead pencil, and a tape measure. For diffused light, in point of fact, sufficiently accurate measurements may very often be made by similar means. Indeed, it is only necessary to seek for photometrical apparatus of any kind in lighting determinations, when the method of shadow comparison has been tried in vain. The shadow method requires absolutely nothing more than a candle, a lead pencil to throw shadows, a piece of paper to receive the shadows of the pencil by the different lights, a 2-foot rule for measuring the distance of the candle, and a tape for performing the same office by the unknown light. A simple description of stand, which will relieve the observer of a good deal of adjusting his candle, &c., by hand, is shown in the accompanying diagram.

Here a horizontal table T is clamped upon a tripod F, such as is used for supporting photographic cameras, and can be purchased for a few shillings. Fixed to an arm is the lead pencil R, which extends horizontally above the top of the table T at a distance of $1\frac{1}{2}$ or 2 inches. Its shadow is thrown on the table by the light-source S, and also by the candle C, which is carried in a balanced holder capable of being set firmly by a thumb-screw at any point upon the graduated rod M. This rod is produced to P and counterbalanced; so that, being pivoted on the side of the table T, it can be fixed at any angle corresponding to that of the rays of light from S. When the shadows of R are equidistant from the centre of the table, the angular incidence of the two lights is equal, and this angle may be read off from the quadrant Q, which is graduated for the purpose. It is evident that this arrangement will not measure light falling vertically through the plane of R; but even this might be managed by the aid of a couple of mirrors at an angle of 45 degrees. Although the table

is at some distance above the floor or the ground, it will receive practically the same effects of irregular reflection as it would if lowered to the ground; and consequently, when desired to give the lighting effect upon the ground, the height of the table may be allowed for without further correction. The difficulty caused by the colour of the candle-light may be minimized, if necessary, by using paper tinted a pale yellowish brown, for receiving the shadows of the pencil; but it cannot be wholly overcome.

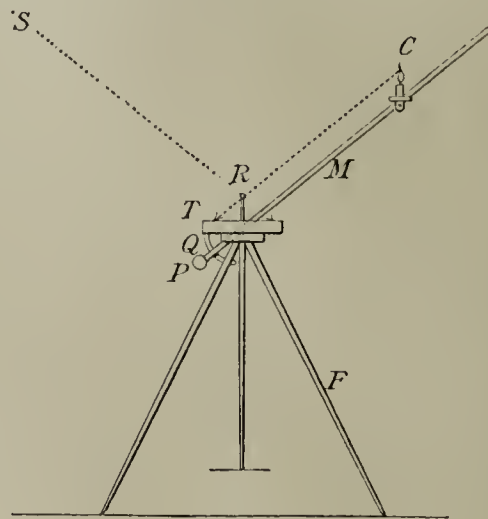


Fig 9

Students will find a great advantage in making their own apparatus for physical experiments, since in this way they become imbued with the principles underlying all such apparatus, which are apt to be hidden from sight by the varnish and polish of the instrument maker. There is room, however, for a good deal of ingenious contriving in regard to the provision of instrumental aids to the exact measurement of lighting; and this series of articles will have more than fulfilled the writer's object if they help forward the scientific study of the subject by exhibiting the deficiency of present knowledge in regard to it.

(To be continued.)

TECHNICAL RECORD.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

The Twenty-second Annual Meeting of this Institution was held last Saturday, at the Grand Hotel, Manchester.

At the time for commencing the proceedings,

The SECRETARY (Mr. S. S. Mellor, of Northwich) stated that he had received a letter from the President (Mr. T. O. Paterson, of Birkenhead), to the effect that he had met with an accident to his foot, and could not possibly be present that day. In Mr. Paterson's absence, he had to propose that Mr. W. W. Hutchinson, of Barnsley, be Chairman *pro tem*.

Mr. G. SMEDLEY (Buxton) seconded the motion, which was carried unanimously.

The CHAIRMAN said he regretted very much that the President was not with them, especially because this was the last occasion in his official year on which he would have the opportunity of presiding. They trusted Mr. Paterson would soon recover from the effects of the accident.

MINUTES OF LAST MEETING.

The SECRETARY then read the minutes of the last meeting, held at the Grand Hotel, Manchester, on Saturday, Nov. 21.

On the motion of Mr. C. ARMITAGE (Lancaster), seconded by Mr. W. DUFF (Morecambe), the minutes were adopted.

LETTERS OF APOLOGY.

Several letters of apology were received, amongst the writers being Mr. W. A. Valon, the President of the Incorporated Gas Institute; Mr. Isaac Carr, of Widnes; Mr. J. R. Smith, of Padham; Mr. J. Laycock, of Keighley; Mr. J. Crawshaw, of Tyldesley; Mr. T. Thomas, of Knutsford; Mr. W. C. Waddington, of Manchester; Mr. H. H. Ford, of Macclesfield; Mr. E. A. Loam, of Stalybridge; Mr. J. Timmins, of Wigan; Mr. J. C. Ingham, of Ramsbottom; and Mr. J. Hepworth, of Carlisle.

NEW MEMBER.

Mr. Henry Simmonds, of Colne, was nominated as a member by the President; and his election was unanimously agreed to, on the motion of the SECRETARY, seconded by Mr. W. R. CHESTER (Nottingham).

THE ANNUAL REPORT.

The SECRETARY read the report of the Committee and the statement of accounts. The former was as follows:—

The Committee in presenting the twenty-second annual report are glad to be able to congratulate the members on the continued usefulness of the Institution. There have been nine new members elected during the year. It is with deep regret that the Committee have to report that five members have been removed by death during the year—viz., Mr. S. Barratt (Manchester), Mr. A. Crawshaw (Tyldesley), Mr. N. Meiklejohn (Longwood), Mr. B. Midgeley (Milnebridge), and Mr. T. Moore (Macclesfield). One ceases membership under Rule 1; and two have resigned. The total number of members is 87.

The twenty-first annual meeting was held at the Grand Hotel, Manchester, on Saturday, Feb. 28, 1891. There was a large attendance, including many old members. The President delivered a very useful and instructive

Inaugural Address. The adjourned discussion of Mr. Newbigging's paper entitled "Lime Burning" was then taken, which proved interesting. On this occasion (the 21st birthday of the Institution) the members dined together at the close of the meeting.

The May meeting took the form of an excursion to Beeston Castle, which was very interesting and enjoyable, although there was only a moderate attendance. This no doubt was due to the large amount of sickness prevalent among the members at the time, and to the wretched weather experienced previous to the date of the meeting.

On the invitation of the President, the August meeting was held at Birkenhead; and it included a visit to Messrs. Lairds' works, the gas-works, and to the Ship Canal works at Eastham. The Gas and Water Committee invited the members to a sumptuous luncheon at the Town Hall (Mr. Bloor, Chairman of the Committee, presiding), and over 100 gentlemen were present. A number of toasts were proposed and responded to—including those of the "Birkenhead Corporation," "The Gas and Water Committee," and the "Manchester District Institution of Gas Engineers." At the close of the luncheon, a room was kindly placed at the disposal of the Institution by the Finance Committee, in which to hold the business portion of the meeting. The President, on taking the chair, gave a cordial welcome to the members. Mr. Newbigging contributed a paper entitled "Differential Rates." At the close of the meeting, the Ferry Committee of the Corporation kindly granted the use of the steamer *Cloughton* to convey the members to Eastham and back to Liverpool. The attendance was one of the largest on record. The thanks of all who were present are due to the various Committees of the Birkenhead Corporation, and to the President, for the handsome and generous manner in which they entertained the Institution.

The November meeting was held at the Grand Hotel, Manchester. There was only a moderate attendance. Mr. Charles Armitage (Lancaster) was unanimously elected President for the ensuing year. A discussion then took place on Mr. Newbigging's paper entitled "Differential Rates." Mr. John West contributed a practical and useful paper, entitled "Stoking Machinery, &c.," which caused a good discussion. Mr. Valon, President of the Incorporated Gas Institute, was present. Owing to a misunderstanding, a paper promised by one of the members was not forthcoming; and at very short notice Mr. Newbigging kindly consented to give a paper entitled "Management." Owing to want of time, it was adjourned to the annual meeting.

The Committee have during the year had under their consideration a communication from the Secretary of the Royal Labour Commission, inviting evidence on behalf of the Institution. After full and careful consideration, they decided not to appoint a witness. Mr. Valon, President of the Incorporated Gas Institute, has been appointed by that body to give evidence on their behalf, and has intimated his intention of consulting with the Presidents of the various District Associations before doing so.

In presenting the statement of accounts, the Committee regret that there is a small balance against the Institution; but this would have been discharged had the members who are in arrear paid their subscriptions before the books were closed.

The retiring members of the Committee are Messrs. Timmins and Cockcroft. Mr. Cockcroft is eligible for re-election.

T. O. PATERSON, President.
SAML. S. MELLOR, Hon. Sec.

In explanation of the extra expenditure and the deficit in the accounts, the Secretary said there had been a heavier expenditure on printing and stationery, and the expense of the meetings had been greater—the cost of the May meeting being especially enhanced by the small attendance.

The CHAIRMAN proposed the adoption of the report and accounts. He said he was sorry that so many of the members had died during the year. They had, however, had a larger number of new members; and at present they had one more than twelve months ago, which might be regarded as satisfactory.

Mr. ARMITAGE seconded the motion, which was carried.

ELECTION OF OFFICERS.

Mr. C. E. JONES (Chesterfield) proposed the election of Mr. W. R. Chester, of Nottingham, as Senior Vice-President for the ensuing year. His qualifications, scientific and otherwise, were well known. He would make a most excellent Vice-President; and an equally excellent President when the time came for his advancement to the chair. He (Mr. Jones) trusted that during Mr. Chester's term of office as President, the Institution would honour the town of Nottingham by a visit.

Mr. R. MERRELL (Mossley) seconded the proposition.

The CHAIRMAN, in putting the motion, said Mr. Chester had been a most attentive member of the Committee, and had been present at their meetings very regularly, notwithstanding that he had to travel long distances to the place of meeting.

The resolution was unanimously passed.

Mr. HARRISON VEEVERS (Dukinfield) moved the election of Mr. J. Braddock, of Radcliffe, as Junior Vice-President; and, in doing so, said there was no more frequent attendant at their meetings than Mr. Braddock. He had, moreover, served the Institution as Secretary—a circumstance which fully entitled him to the higher posts of Vice-President and President.

Mr. SHIRES (Kids Grove) seconded the resolution; and it was adopted.

Mr. BRADDOCK briefly acknowledged the kindness shown him by his selection as Vice-President. Nothing, he said, would be wanting on his part to justify their selection.

Mr. W. S. HADDOCK (Warrington) moved, and Mr. W. SMITH (Hyde) seconded, the re-election of Mr. Thomas Newbigging, of Manchester, as Treasurer; and the proposition was adopted.

The CHAIRMAN moved the re-election of Mr. Mellor as Secretary. He said he had served the Institution well during the whole period of his tenure of office, and had worked hard to secure the success of the meetings.

Mr. W. FOSTER (Nelson) seconded the proposition.

Mr. T. DUXBURY (Darwen), in support of the motion, referred to the indefatigable labours of the Secretary, and said he would not wish for a better man for the position than Mr. Mellor.

Members of the Institution who had passed the chair, and knew the work which the Secretary got through, were perhaps most fitted to judge of its worth; and, speaking as one of those, he (Mr. Duxbury) could say that Mr. Mellor was a most excellent Secretary, and he feared that, if they changed, it might be for the worse.

The resolution was carried.

Mr. MELLOR said he was much obliged to the members for re-electing him. There was certainly a lot of work to do in connection with the post; but one met with a good deal of kindness at the hands of the members, which stimulated one to do the work well.

Mr. DUFF proposed the election of Mr. J. Parkinson, of Brighouse, as a member of the Committee, and said he would do good work in the years to come.

Mr. E. LORD (Whitworth) seconded the proposition, which was passed.

Mr. W. SEVERS (Lymm) moved the election of Mr. R. Bridge, of Doncaster, as another member of the Committee.

Mr. H. VEEVERS seconded the motion, which was carried.

Mr. DUXBURY (Darwen) proposed, and Mr. C. E. JONES seconded, the reappointment of Mr. W. Smith, of Hyde, and Mr. J. Mackenzie, of Wilmslow, as Auditors; and this was agreed to.

THE NEW AND THE OLD PRESIDENTS.

The CHAIRMAN remarked that the next business was the introduction of the President for the ensuing year; and, in the absence of the retiring President, he had great pleasure in discharging that duty. Mr. Armitage would, he was sure, do honour to the Institution, and would fill the chair most admirably. As an Institution, they had visited Lancaster, and received at the hands of the Corporation kindness which showed that, in his own town, the President was respected and well supported.

Mr. ARMITAGE who was received with applause then took the chair.

Mr. T. B. BALL (Rochdale) proposed that the thanks of the Institution be given to the retiring President for his conduct in the chair, and his attention to the interests of the Institution during the past year. Mr. Paterson had performed his duties in an admirable manner. The Institution had maintained its prestige under his guidance; and he was sure they all regretted that he was not present to receive their thanks in person.

Mr. J. CHADWICK (Oldham) seconded the motion, which was adopted by acclamation.

The PRESIDENT then read the following

INAUGURAL ADDRESS.

Gentlemen,—I thank you sincerely and most heartily for the honour that you have conferred upon me in electing me to the presidential chair. At the outset, I have to confess that I have not merited the position. It is true that I have been a member for a number of years; but I have not taken such an active part in your deliberations in the past as would warrant you in placing me in such a distinguished position. But my apparent apathy has not retarded the work of the Institution. Many important matters have been investigated and discussed by the Institution, much to the advantage of its members and of the community generally. I am also cognizant of the fact that the presidential chair has been occupied by some of the ablest men of our profession, which makes the duty more difficult for me. However, I trust that I may have the assistance not only of the Committee, but of the whole of the members, in order that I may successfully discharge the functions of the chair, so that the work done during my year of office may at least be equal to, if not an advance upon, that of my predecessors.

There are many important subjects that require to be investigated. I would suggest one—viz., that which is usually termed "condensation." This subject is of vital importance, and is not at all well understood. I think I am right in saying that, notwithstanding its importance, it has received the least attention of any subject connected with gas manufacture. The quality of gas greatly depends upon the mode of condensing. Therefore I would suggest that this Institution should form a Committee to consider the question and conduct experiments; and I shall be pleased to give any assistance in my power. I am aware that it is difficult for gas managers to devote any lengthened period of time to research and investigation; their other duties, which are multifarious, demand practically the whole of their attention. The Council of the Incorporated Gas Institute have decided to make an appeal to owners of gas undertakings for donations or subscriptions to enable them to prosecute inquiries into technical subjects. I feel sure that the members of this Institution will join with me in wishing that the appeal may be heartily responded to. There are many difficult scientific problems in connection with gas manufacture which require to be investigated to ascertain their nature; and this investigation should be made by a properly authorized and qualified Committee.

Great progress has been made in the manufacture, purification, and distribution of coal gas since its first introduction by Mr. William Murdoch 100 years ago. In referring to the introduction of gas lighting, I may briefly mention that history says that in 1739 Dr. Clayton distilled Newcastle coal, and obtained as products an aqueous fluid, a black oil, and an inflammable gas, which he caught in bladders, and by pricking these he was enabled to

burn the gas at pleasure. It is further known that, in the beginning of the last century, Dr. Stephen Hales submitted pit coal to chemical examination, and found that, during ignition in closed vessels, nearly one-third of the coal became volatilized and assumed the form of inflammable vapour. In the year 1767, the Bishop of Llandaff made some experiments with the vapour and gaseous products evolved during the distillation of pit coal, and found that the volatile products remained inflammable after passing through water and ascending through high curved tubes. The other products obtained by this venerable prelate were aqueous ammoniacal fluid, a tenacious oil resembling tar and ammoniacal liquor, and spongy coal or coke. But the first discovery and application of coal gas for the purpose of illumination is claimed for Murdoch, who, in 1792, when residing at Redruth, in Cornwall, commenced a series of experiments upon the quantity and quality of the gases obtained by distilling coal, peat, wood, and other inflammable substances. In 1798 he constructed an apparatus for the manufacture of coal gas at the Soho Foundry, Birmingham. Soon afterwards, Mr. Samuel Clegg, of Manchester, a pupil of Murdoch's, communicated an account of his method of lighting up factories with gas to the Society of Arts, for which he received the silver medal. This gentleman became the first Engineer to The Gaslight and Coke Company; and he erected the first public gas-works in London in 1813. Gas-works were first erected in Paris in 1815; in the United States of America, in 1821; and in Berlin, in 1826.

Rapid strides in gas manufacture have been made up to the present day. Coal gas is now a necessity, not only for lighting purposes, but for cooking, heating, and motive power; and the demand continues to increase. The receipts for gas in the United Kingdom are about 15 millions sterling per annum. I may here mention that it has recently been computed that the consumption of coal gas per head of population in Germany is 350 cubic feet; in France, 560 cubic feet; in England, 2450 cubic feet; and in London, 5000 cubic feet; and that upwards of 10 million tons of coal are carbonized annually in the United Kingdom for the manufacture of coal gas. This quantity of coal is about 6 per cent. of the total quantity raised in the United Kingdom; and the capital employed in gas-works is upwards of £106,000,000 sterling.

No fundamental or material alteration has been made in the destructive distillation of coal for at least half a century. The principle is practically the same; but many improvements have been made for carrying on the process. The pole star of the retort-house is to produce the greatest quantity of gas from a ton of coal at the least possible cost for wear and tear, fuel and labour, due regard being paid to maintain the quality of gas at the prescribed standard. It is unnecessary that I should dwell much upon this subject, which has been threshed out during the last few years. Suffice it to say that I am greatly in favour of gaseous firing, which has proved its great superiority to the old system, not only in the saving of fuel and labour, but in the increased production per ton. Generator furnaces will, in my opinion, ultimately be universally adopted. The subject which is now being most considered in the retort-house is the saving of labour by the adoption of inclined retorts and mechanical appliances. I am not in a position to express an opinion, *pro* or *con*, upon the advantages claimed for the inclined retorts, not having had any experience with them; but I am patiently waiting, as, no doubt, others are, the result of trials now being made. During the last few years mechanical appliances for charging and drawing retorts have been developed, and have shown great superiority to the old system of hand labour. It has been repeatedly stated that the steam stoker not only does its work much better, but that there is a saving of 1s. per ton of coal carbonized. Now, I submit that these are two very important considerations, apart from the more humane manner in which the work is accomplished. The old system of hand labour, in my opinion, wherever possible, should be abolished. There is no part of a gas-works plant that I should take a greater delight in seeing perfected than the steam stoker.

Many attempts have been made to produce illuminating gas from other substances than coal; but I am not aware that they have proved a financial success. The most feasible substitute, or (say) supplement, in my opinion, is carburetted water gas. It has often occurred to my mind that a gas-works is a very suitable place for the manufacture of water gas; the principal materials required being coke and steam. Coke is produced there in great quantities as a bye-product, and is very often in winter a perfect drug in the works, in consequence of the supply being greater than the demand at that period of the year. Now if a portion were used for carburetting water gas, we should not only have a diminished quantity of coke, but the market would be relieved; and I feel certain this would be of great monetary advantage. It has also struck me forcibly that it is quite feasible to carburet water gas by volatilizing coal tar, and that it is also within the range of possibility to use the tar direct without being first distilled. These are only crude suggestions; but I submit that they are worthy of consideration, as by this means gas manufacturers will become users, to a certain extent, of the bye-products of carbonization. Another advantage would be that a large quantity of this gas could be produced at a short notice. I have just learned that a process to manufacture hydrogen gas has been patented; and if this hydrogen can be carburetted, as the patentee says

it can, it may afford facilities to large gas-works to meet any sudden and severe demand for gas. I may mention that the primary intention of the patentee was to get hydrogen for metallurgical purposes; but it may also be employed to aid us in periods of severe strain. Great difficulty is often experienced in giving an adequate supply of gas in foggy weather, especially in large towns, which necessarily creates a great amount of anxiety to those entrusted with the supply of artificial light. I may mention that I have decided to make some experiments in the direction of carburetting water gas; and, if successful, I shall be pleased to report progress on some future occasion.

In the ordinary process of carbonizing coal, "which is composed of variable quantities of its constituent elements," about 32 per cent. is volatilized, and many complex compounds are obtained. Fifty-three per cent. of this remains in a gaseous form, and is delivered to the public; about 5 per cent. constitutes the impurities; and the remainder, say, 42 per cent., is tar and ammoniacal liquor. The most valuable of these is the gaseous portion. Therefore it is necessary that the greatest attention should be given to this commodity, not only in the process of distillation, but in its after-treatment, in order that it may not suffer deterioration in quantity or quality. I remember an old saying, that good condensation is half purification. This is an error. Some little advantage may be gained in the way of purification; but the gain is far outweighed by the loss in illuminating power. Whenever excessive condensation is carried out, it reduces the quality. I maintain that more care should be devoted to this part of the plant, as on it the quality of the gas produced greatly depends.

Many forms of condensers have from time to time been constructed. The main object in construction generally has been to produce an apparatus to condense or cool the gas to the temperature of the air; and in many instances this is done at the expense of the luminous constituents of the gas. I will not trouble you by giving a description of the various forms of condensers which have been adopted, or of those which are now mainly in use at the present day, but will content myself by saying that all condensers should be avoided that prevent a free flow. The gas should not be allowed to strike against surfaces that are covered with tar, or assuredly many suspended particles, that otherwise would remain gaseous, will be precipitated. Various members of the benzene series are carried down in this way; and the quality of the gas is thereby impoverished. Formerly it was said that much benefit accrued from allowing the gas and tar to travel together in a foul main around the retort-house. This, too, has been proved to be fallacious; on the contrary, serious loss in illuminating power is the result. The tar is now usually taken from the end of the hydraulic main and the gas from the top, and is conducted through a foul main to the condenser; but frequently the foul main is allowed to fall the wrong way—*i.e.*, towards the outlet. This should be reversed, in order that the precipitated tar should return to the hydraulic main, where the greatest heat prevails, so that some portion of the precipitate may be again volatilized, and, in all probability, be eventually carried forward to the gasholder. It was also claimed that, if the gas and tar were allowed to travel together, the tar would absorb the naphthalene, and so prevent any deposit of that substance in the mains, and other parts of the plant. But I maintain that naphthalene is not to be regarded as an enemy; and that it should be retained. Coal gas contains only about 5 per cent. of illuminating matter, and naphthalene is one of the best of these. Therefore, we cannot afford to lose what appears to be a bad servant simply because we are unable to understand its qualifications. This subject has been brought to my mind quite recently through perusing a paper read by a brother engineer to a kindred Association, in which he sought to show that, by carburetting with oil, a 16-candle gas may be supplied without having recourse to cannel. In my opinion, there should be no difficulty in producing this quality of gas from ordinary gas coal, if the cooling, or condensing, is more scientifically carried on. Therefore I submit that our energy should be devoted to the matter of condensation rather than to any attempt to make up a deficiency of the quality by carburetting.

My thoughts have been turned in this direction, probably, mainly in consequence of my acquaintance with the process of the distillation of coal tar. I was led some time ago to make certain experiments in order to determine how I could best take advantage of the luminous constituents in coal. My thoughts naturally turned to analyzing tar taken from different parts of the plant. When this was accomplished, I ascertained where the light-giving properties were precipitated; and, after some consideration, I came to the conclusion that it was quite possible to precipitate the heavy hydrocarbons, and to keep the light ones in suspension. The simple process of fractional distillation of coal tar suggested this mode of arriving at a conclusion. The experiments taught me that it is as possible to keep the light hydrocarbons gaseous, and precipitate the heavy hydrocarbons in the condensation of gas, as it is to separate the light hydrocarbons from the heavy hydrocarbons in the process of fractional distillation. To accomplish this much-desired result, it is necessary to maintain the temperature of the gas after it leaves the hydraulic main, or even to increase its temperature for a lengthened period. By this means the heavy hydrocarbons will be precipitated, and the

light hydrocarbons kept suspended. Foul mains around the interior of the retort-house are favourable to this process; but these should be of large capacity to allow the gas to travel as slowly as possible. Wrought-iron mains should be avoided, unless they are covered with a composition of non-conducting material to retain the heat.

Some time ago I had occasion to make extensions in the retort-house of the Lancaster Corporation Gas-Works; and, having these convictions in my mind, I resolved to put them to the test. I accordingly erected a cast-iron foul main, 550 feet in length, 18 inches in diameter, with a fall to the hydraulic. I inserted in this main a 2-inch steam-pipe, which I suspended in the centre throughout its entire length. At the outlet I fixed a steam-trap, and conducted the condensed water into a water-tank. By this means I was enabled to keep up the temperature of the gas throughout the full length of the main. Unfortunately, I am not in a position to give precise data as to the merits of the process; suffice it to say that the quality of the gas was materially improved. Had I made some tests previous to the alteration, I could have supplied you with the information. Being a tar distiller, I had an opportunity of comparing the quality of tar obtained under both circumstances. Previous to the alteration, the tar yielded about 9 gallons of crude naphtha per ton, distilling 30 per cent. at 120° C., in addition to which a quantity of naphthalene was always deposited in the creosote tanks. Subsequent to the alteration, I have only obtained about half the quantity of naphtha of the quality named, and practically very little naphthalene—in fact, so little that it was readily dissolved in the heavy creosote, and sold as creosote oil. These facts therefore illustrate beyond doubt that a great portion of the benzene and naphthalene series are maintained in a gaseous state. Benzol is capable of carrying a large quantity of naphthalene in suspension; and I have no doubt whatever that naphthalene contributes to the increased illuminating power more than the benzol. Professor Foster, in his valuable paper read at the meeting of the Incorporated Gas Institute last year, states that 5 lbs. of naphthalene will double the luminosity of 1000 cubic feet of 14-candle gas. This was illustrated by Mr. Leicester Greville some years ago, who also demonstrated that 103·8 grains of naphthalene, added to 3·3 cubic feet of gas, increased the lighting power from 9·9 candles to 24·7 candles. This quantity is equal to 4½ lbs. of naphthalene to 1000 cubic feet of gas, which would increase the luminosity 14·8 candles. Consequently, I am justified in saying that our energy should be devoted to increase the luminosity with the material at our command rather than to seek a foreign substance to make up for our apparent unscientific manner in treating the gas. I may mention that the gas at the Lancaster Gas-Works passes through an ordinary annular condenser after leaving the foul main. I am not much in favour of such condensers, and question very much whether I shall ever erect one of this type again. I should much prefer to pass the gas through large chambers at a slow rate. If the inner column were taken out of annular condensers, in my opinion much better results would be got. However, I may possibly have something further to say on this subject on a future date. Perhaps it would also be interesting to know that in Lancaster I have never seen a particle of naphthalene in the gas-works plant or in the mains and services; neither have I found any deposit of oil in the street syphons. This is a very important subject, and worthy of thorough investigation.

There is practically now no difficulty in eliminating the impurities from coal gas. When gas was first introduced, caustic lime was the only purifying material employed. Since then other methods have been adopted—viz., oxide of iron, Brin's oxygen process, admission of atmospheric air, and the Claus system. When the ammonia has been removed, caustic lime will remove the remaining impurities—i.e., carbonic acid, sulphuretted hydrogen, and other sulphur compounds; but there are objections to using lime exclusively, in consequence of the nuisance arising from the removal of the spent lime, and the extra cost entailed. Lime is now used only to arrest carbonic acid and sulphur compounds other than sulphuretted hydrogen. Oxide of iron is employed for the elimination of sulphuretted hydrogen. The quantity of natural hydrated oxide of iron raised in Ireland during last year was 14,512 tons. The whole of this was used for the purification of coal gas, in addition to a large quantity of artificial oxide that is annually prepared from sulphate of iron. With the adoption of Brin's oxygen process, lime can be used exclusively. Sulphuretted hydrogen is decomposed by passing through hydrate of lime and calcic sulphide formed. This, in turn, is acted upon by the oxygen, and the sulphur precipitated in a free state, thereby rendering the lime again active, until eventually it becomes carbonated by the carbonic acid, save a small portion of the calcic sulphide, which is converted, in consequence of the presence of oxygen, into a higher sulphide, which combines direct with the remaining sulphur compounds, and forms what is usually termed a double salt. This can be decomposed if excess of carbonic acid is allowed to enter the purifier. We are indebted to Mr. Valon, the President of the Incorporated Gas Institute, for the experiments that he has made with this process. The atmospheric air process has now been known for some considerable time, and answers the purpose admirably; but it entails loss in illuminating power.

Some time ago the writer patented the application of oxygen

obtained by the electrolysis of water; but, unfortunately, the system did not prove a financial success, in consequence of the large amount of motive power required to decompose water into its constituent elements. I made some experiments with a dynamo and a 2-horse power gas-engine; but the results obtained did not warrant me in continuing the process. I was unable accurately to estimate the quantity decomposed per horse power per hour, in consequence of the loss of water by evaporation as steam; but from information that I have been able to gather, I find that motive power from 1 ton of coal would be required to decompose 20 gallons of water. This would furnish 1992 cubic feet of oxygen, which would purify 398,400 cubic feet of gas, providing the gas did not contain more than 624 grains of sulphur per 100 cubic feet.

Purification in closed vessels appears the ideal of the future. This has already been accomplished by the Claus ammonia gas purifying process. The object aimed at in carrying out this process is to utilize one impurity—an alkali—to arrest the acid impurities. The process is rather complicated, but effective. It does not, however, assist the gas. It would be difficult to give a full description of the Claus system without inflicting upon you a very lengthy address. I may, however, just briefly state that the process is continuous, and consists in passing a quantity of gaseous ammonia and water, with the coal gas, through a series of tower scrubbers, which combine and take up the impurities of the gas, and are then freed from them by means of heat and distillation. The ammonia and water are again passed into the plant to absorb further impurities, and so on to complete the circuit. I have taken great interest in this subject, and will heartily hail any system which may ultimately lead to the purification of coal gas in closed vessels. I am indebted to Messrs. C. and W. Walker for a communication on this subject. They state that the amount of the several impurities passing into the plant at Belfast were as under:—

Ammonia	0·5 per cent. by volume.
Sulphuretted hydrogen	1·4 " "
Carbonic acid	3·4 " "
Oxygen	0·3 " "
Hydrocyanic acid	0·1 " "
Carbon disulphide	0·03 " "

And that the scrubber liquor that is produced is similar to ordinary gas liquor, and of about the following composition:—

Ammonia	4·0 to 4·5 per cent.
Sulphuretted hydrogen	0·8 to 1·0 "
Ammonium carbonate	3·7 to 4·0 "

It will therefore be seen that, to effect perfect purification, the supply of ammonia must be equal to about twice the volume of carbonic acid, plus once the volume of sulphuretted hydrogen, deducting the ammonia already in the gas, or (say) from 6·0 to 6·5 per cent. by volume of the foul gas. It is also necessary to pump through the circuit between 100 and 150 gallons of liquor for the purification of gas per ton of coal; but this would vary with the amount of impurities. In the Belfast gas it will be seen that there is a larger amount of impurity than usually exists in coal gas. It has been proposed to recover the cyanides from the spent liquor; but as the process of recovery would be somewhat complicated, nothing has been done in the matter. I shall, however, continue to watch this process with great interest; and I trust that it may eventually be successful.

The products of coal tar and ammoniacal liquor have now become of great importance in the world's industry. The present value of the tar and ammoniacal liquor produced in the United Kingdom as bye-products in the manufacture of coal gas is about £2,000,000 per annum. The ultimate value when manufactured into benzol, anthracene, sulphate of ammonia, &c., will probably equal £4,000,000. To this may be added the value of coke—about £2,500,000; making a total of £6,500,000. Previous to 1845 coal tar was practically valueless. At that time A. W. Hoffman discovered that it contained benzene, and proved this by transforming it into nitro-benzene and aniline. Its industrial preparation, however, in any quantity was worked out by one of his pupils, Charles Mansfield, who unfortunately fell a victim to his discovery in 1854. While occupied with the distillation of benzene on a somewhat large scale for the Paris Exhibition, the liquid in the retort boiled over and took fire, burning him so severely that he died in a few days. Since 1854 the manufacture of aniline has progressed rapidly; and to a great extent it has superseded indigo, while alizarine, which Græbe and Libermann discovered in anthracene in 1868, has practically annihilated the importation of madder. The popular opinion is that all coal-tar colours are fugitive to light, while all the good old-fashioned dyes are fast. Professor Hummel, of the Yorkshire College, declared this a few weeks ago to be utterly false, and said he was persuaded that at the present time the dyer had at his command a greater number of fast dyes derived from coal tar than from any other source; and he believed it possible to produce from such dyes—obtained alone, if need be—tapestries, rugs, carpets, and other textile fabrics, which would vie successfully in point of colour with the best productions of the East.

I regret that I am unable to congratulate you on a brisk market and high prices for coal-tar products; unfortunately it is the reverse at present. Some time ago greater profits could be realized by extracting the benzene from coal gas, than by supplying gas for illuminating purposes at 3s. per 1000 cubic feet, such have been the vagaries in prices. Ninety per cent.

benzol, in 1883, was 14s. per gallon; the present price is at 2s. 5d., and this is not the lowest figure for which it has been sold. Anthracene, too, has suffered considerably in price, and will not realize more than 25 per cent. of its former value. These great differences I am unable to reconcile, and will not therefore attempt to venture an opinion upon the subject. During this serious decline in the price of tar products, we have also had to bear a great reduction in the price of ammonium sulphate, from £21 in 1882, to less than one-half in 1891. These are some of the difficulties which we have encountered in the manufacture of coal gas; and they necessarily compel owners of gas undertakings to vary the price of gas from time to time, apart from the variation in the price of coal, and the ever-increasing cost of labour, which are becoming very important factors in our calculations. But ammonium sulphate is now manufactured at most of the large gas-works; and a great saving is the consequence, because the ammoniacal liquor is used on the ground, and thus there is no outlay for carriage. The process is not very intricate, and can be worked with very little difficulty or extra trouble. I would not hesitate to recommend its adoption in all moderate sized works. Some of the largest gas-works have erected plant for the manufacture of sulphate; but unfortunately do not work the plant themselves. They prefer to allow a contractor to work up the liquor, the price of which is based on a sliding scale, according to the selling price of ammonium sulphate. It has often occurred to my mind that this is a bad system, and should be abolished. If not, in all probability the price of sulphate will continue to decrease, as the contractor has practically no interest in keeping it up. The calculations upon which he tenders will no doubt be based upon a certain profit per ton of liquor, whatever the price of sulphate may be, or perhaps he may have a better profit per ton of liquor when the price of sulphate is low. Such a system equally applies wherever the liquor is removed to the contractor's works, if the sliding scale is adopted. I would strongly recommend the abolition of the sliding scale, if only to give the contractor an interest in obtaining the best possible price for sulphate. If this cannot be carried out, then I would advise owners of gas-works to take the manufacture of ammonium sulphate into their own hands. There is practically no nuisance in carrying on the process. The noxious fumes can be readily arrested and decomposed by passing through hydrated oxide of iron, or by the Claus process, which is preferable if the works are of moderate size.

The distillation of coal tar is carried on at very few gas-works. The addition of this branch of industry has not so far found favour in the eyes of gas manufacturers. Many argue that the process is complicated and dangerous. For my part I have never seen it in this light; but I confess that I am very fond of the business. To me it has a peculiar charm, and I should be very pleased if I could devote more time to it. Coal tar contains all the elements of organic chemistry; is a great field for investigation; and I have no hesitation in saying that it has a great future before it. Tar distillation, of course, is a somewhat dangerous process, and should be isolated from the gas-works. The business is a moderately profitable one; but it cannot be expected that gas managers can make themselves acquainted with every branch of the industry—their duties are already multifarious. If tar distillation be adopted, a practical chemist should be engaged to take entire charge of the undertaking. If the two conditions mentioned be given effect to, I fail to see why the owners of gas-works should not distil the tar into its various products—viz., benzol, naphtha, carbolic acid, creosote, anthracene, pitch, &c.; and furthermore manufacture sulphuric acid, which can be readily obtained from spent oxide. Gas coals usually contain from 0·80 to 1 per cent. of sulphur, about one-half of which is volatilized in carbonizing, and is arrested, usually by hydrated oxide of iron, in the process of purification. This quantity of sulphur is capable of making from 27 to 34 lbs. of absolute sulphuric acid—a quantity more than sufficient to neutralize the whole of the ammonia in the manufacture of ammonium sulphate. The remainder could be used for separating tar acids from crude naphtha in the manufacture of benzol, &c. In fact, I fail to see why gas-works, or undertakings in connection therewith, should not be a veritable chemical works. The whole process of the manufacture of gas and utilization of the various products are closely allied to the science of chemistry, and should not be separated. If any profit is to be made by distilling the crude products, why should the owners of gas undertakings not reap the benefit, and hand over the profit to the gas consumer by supplying gas at a lower rate than prevails at present?

The gas industry is assailed on all sides by competitors, and a would-be wise people prophesy its extinction. Some little time ago water gas, made luminous by burning in contact with a comb made of a rare metal, was to supersede coal gas; but I am not aware that this system has made a tithe of the progress prognosticated. Oil is an old competitor, and will continue to be used to a certain extent wherever the charge for gas is high. But in towns where gas is sold at a cheap rate, it is only a question of time to entirely supersede it by gas. Electricity is now considered the great rival of coal gas, and by some people the *beau idéal* light of the future. For my own part, I wish electricity every success. Why should purveyors of coal gas stand in

the way of its progress? No permanent advantage can be gained by offering resistance. Give it full scope—in fact, all the assistance one possibly can to reach perfection. When full advantage has been taken of the great sources of power in Nature, the fittest will survive. Great progress has certainly been made during the last decade in developing electricity, but it is yet the light of luxury. The Manchester City Council have decided to supply the electric light to the central portion of the city; but they state that whoever wants it will have to pay for it, as they do for all other luxuries. It is evident that the City Council is fully aware that electricity cannot be supplied as an illuminant as cheaply as coal gas. Some people prefer the electric light as a novelty; but the majority consider the pounds, shillings, and pence side of the question. The great desideratum in the cost of production is motive power. This is a very important item; and until this cost is materially reduced, electricity will not be able to compete, financially, with coal gas as a lighting agent. Many plans have been proposed for utilizing water as motive power. I am not aware that any have been carried out except for very small installations. An important public body in the north has been discussing the desirability of supplying electricity, by means of water power, but has abandoned the scheme, and decided to extend the gas-works. The report of the hydraulic engineer states that, to obtain 200-horse power, about 30,000 gallons of water per minute would be required. With a fall of 28 feet, this is equal to 42,000,000 gallons in 24 hours, sufficient to supply a population three times the size of Manchester. An alternative scheme of a supply of 10,800,000 gallons in 24 hours would give 600-horse power, with a fall of 330 feet. Such a quantity of water would supply a population of 432,000 at the rate of 25 gallons per head. Many corporations who are owners of gas undertakings are very desirous of supplying electricity, but are naturally timid to launch out in consequence of the extra cost that must necessarily be charged in order to avoid loss in carrying on the undertaking. As a means of reducing the cost, the various resources of water, including the supply of water to towns, have been discussed, but none have yet been found practicable. Water, save in very exceptional circumstances, will not be found favourable as a motive power for the supply of electricity.

It is quite natural that corporations should be desirous to be in the van of progress. They are the custodians of the rate-payers' property; and in many towns control the supply of gas and water, and are ever on the alert to adopt any new process for the benefit of the community. Wherever electricity is supplied, corporations or gas companies, or upon whomsoever devolves the supply of gas, should be the purveyors; and they could, without prejudice, allow the public to make choice of their illuminant. The Bradford Corporation have now supplied the electric light for a period of two years. The amount of capital expended is £36,119; and the price charged at present is 6d. per Board of Trade unit. The loss during this period is £2157. Since writing the above, I find that the Bradford Corporation have now completed another half-year's supply of the electric light, and that a net profit of £971 is claimed to have been made during the six months. The Committee appear to be gratified with their seeming success, which is yet, in my opinion, very unsatisfactory, especially when we take into consideration that they can supply coal gas light at about one-third of the price charged for electricity, and that too, despite the fact that a portion of the gas profits is transferred to the borough fund in aid of the rates. The value of the Board of Trade unit is not very significant or expressive except to electricians, and is not so well understood as the solid measure by which coal gas is sold. The Board of Trade unit is equal to 1000 watts; and as 60 watts are required to give a light of 16 candles, one unit will supply 16⅔ 16-candle lamps for a period of one hour. This is equal to a light of 268 sperm candles, for which the Corporation charge 6d. In Lancaster, the town which I have the honour to represent, 20-candle gas is supplied at 2s. 3d. per 1000 cubic feet, and no meter-rents are charged. Therefore 225 cubic feet of gas can be purchased for 6d. This quantity of gas would supply 55½ burners of 16-candle power each for a period of one hour. This is equal to 888 sperm candles; or, in other words, 67 cubic feet of 20-candle gas give an equivalent of light to a Board of Trade unit at a cost of 1·8d., which is 70 per cent. less than the cost of electricity. With regard to cost, the matter is perfectly plain. Coal gas can be stored with infinitesimal loss, and the production need not be varied throughout the twenty-four hours. Not so with electricity. It can only be stored at a very serious cost, and with a loss of from 30 to 40 per cent. The production will therefore vary according to demand, and must necessarily increase the cost of plant, which should also be in duplicate, unless a supply of gas can be turned on at a moment's notice, to prevent serious disaster by fickleness of the electric light.

I venture to predict that coal gas has yet a very important part to play in the world's industry. It will not only hold its own as a lighting agent, but will be more extensively used for cooking, heating, and motive power. The consumption throughout the country continues to increase year by year. The price charged for gas must necessarily vary according to the locality of the works, and the demand for coke and other products. A few corporations are to be commended for endeavouring to supply gas at the lowest possible figure. Wherever this policy has been adopted, the consumption has rapidly increased, and

the cost has been materially reduced, as the increased production does not increase the cost in proportion.

There are many important subjects that I should have liked to have touched upon—viz., the standard of light, the labour question, columnless gasholders, &c.; but I feel that I have already occupied sufficient of the time at your disposal, and must apologize if I have wearied your patience, and thank you heartily for your kind attention.

VOTES OF THANKS.

Mr. C. E. JONES said they had listened with much pleasure to the address, ranging as it did over a very large number of subjects of special interest to themselves. Many excellent points were alluded to in the address, which, he had no doubt, would receive due attention when they saw it in print. Some of the problems named were not new; but they might be worthy of consideration nevertheless. He (Mr. Jones) was himself in the unfortunate position of having to prepare a presidential address shortly, and he could sympathize with the President, and with the Presidents of kindred Associations, upon whom was cast the responsibility of delivering inaugural addresses. Their thanks were due to the President for an address which had given them all great pleasure.

Mr. J. HUTCHINSON (Barnsley) had pleasure in seconding the motion, which was carried with applause.

The PRESIDENT having briefly acknowledged it,

Mr. W. W. HUTCHINSON moved a vote of thanks to the Auditors for their services in the past year.

Mr. SMEDLEY seconded the proposition, which was carried.

Mr. J. HUTCHINSON proposed a similar resolution in acknowledgment of the services of the Committee and the other officers of the Institution.

Mr. DUXBURY seconded the proposition, which was agreed to.

MR. NEWBIGGING ON "MANAGEMENT."

In the absence of the author, the Secretary read a paper by Mr. T. NEWBIGGING on the subject of "Management." This, with a report of the brief discussion which followed, will be given in an early issue.

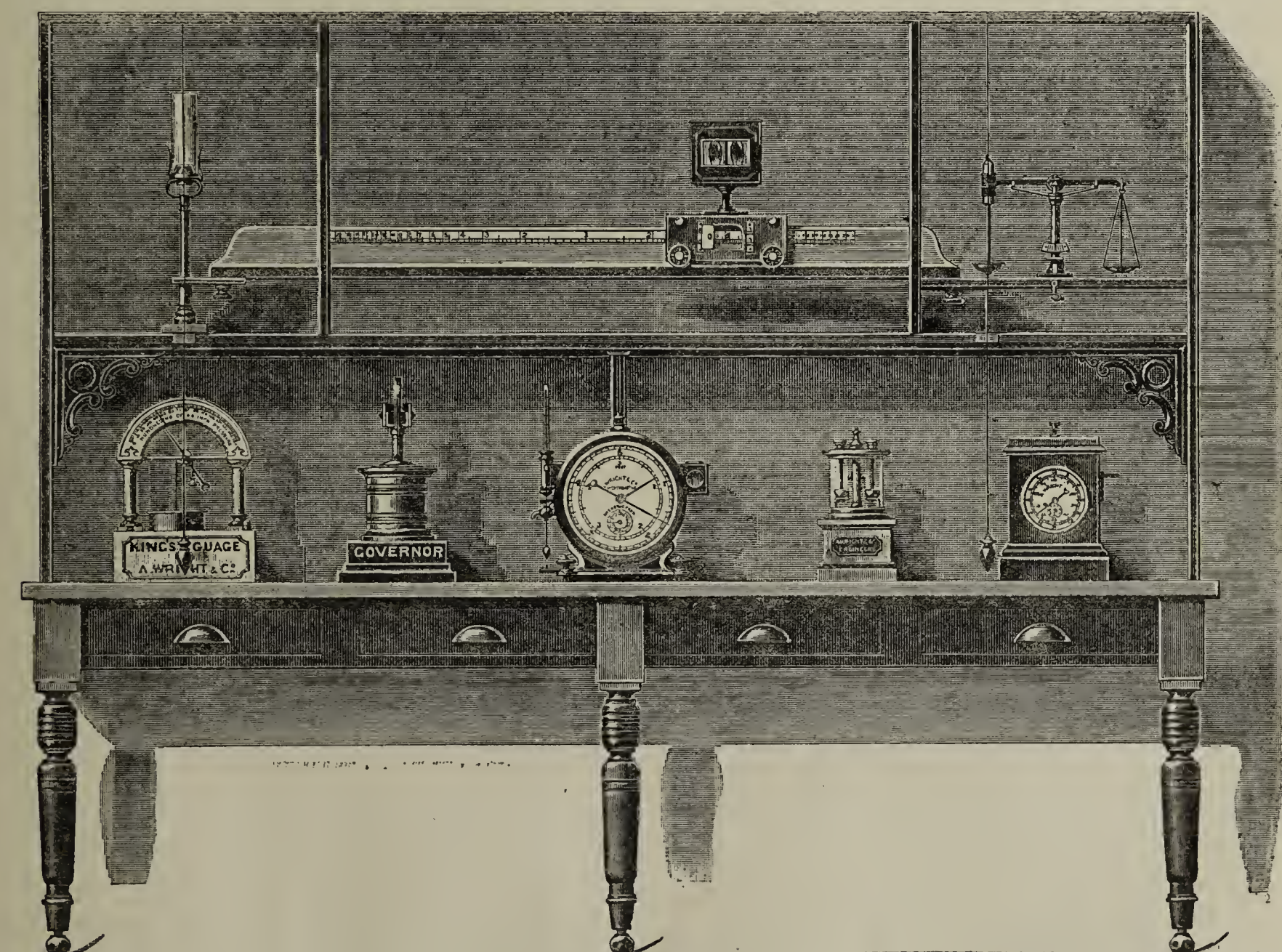
Subsequently, on the motion of Mr. VEEVERS, seconded by Mr. SMEDLEY, the thanks of the members were voted to Mr. W. W. Hutchinson and the President for their conduct of the proceedings.

This concluded the business before the meeting; and the members afterwards had tea together.

WRIGHT'S LETHEBY-BUNSEN PHOTOMETER.

The accompanying illustration shows the form of Letheby-Bunsen photometer manufactured by Messrs. Alexander Wright and Co., in accordance with the requirements of the Standards Department of the Board of Trade. The photometer is of the open 60-inch type; and with it testings of gas up to 50 candles illuminating power may be taken. The bar, which is of pine, accurately graduated and calibrated, is mounted at one end on a stiff gas pillar, to which a standard Argand burner may be affixed, and at the other on a wooden table or slab whereon is mounted the candle balance, which, as well as the pillar, is attached to a shelf or base-board, supported 18 inches above the table on two side screens. The disc-box, with silvered glass reflectors, is mounted upon a polished mahogany slide, provided with brass rollers, and carrying a pointer directly underneath, and in a vertical line with the centre of the disc or grease spot. This pointer is illuminated by means of a reflecting prism at the point of observation of the scale. The two screens are so fixed that their outer edges are, in the case of the screen at the

burner end, 10 inches from the centre of the gas pillar, and at the candle end 5 inches from the centre of the candle-holder. The screens are securely fixed in a vertical position, and held apart by two pine rods mortised into them at the top edges back and front. Four plumb-bobs are suspended in pairs at either end of the photometer. The accessories consist of a Hartley's candle-balance, King's gauge, an experimental meter, governor, Methven screen, &c. The photometer, with the various appliances connected with it, stands upon a polished pine table having a top 7 ft. 6 in. long and 2 ft. 2 in. wide, framed, with turned legs resting on brass levelling castors of original design, whereby the apparatus may be adjusted to perfect position; and there are four drawers fitted with partitions and arrangements for the reception of the whole of the materials and implements used in photometry. We learn that Messrs. Wright and Co. have in hand at the present time some 30 orders for this form of apparatus for certain of the largest corporations and companies in England.



Death of Mr. E. Fox.—The death is announced, in his 70th year, at his residence at Totland Bay, Isle of Wight, of Mr. Edwin Fox, one of the Directors of the Totland Water-Works Company.

Resignation of Mr. W. Blackledge.—At the meeting of the Chorley Town Council last Thursday, a letter was read from Mr. W. Blackledge, the Gas Manager, resigning his appointment on account of increasing years and infirmities.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress was made with Bills last week :—

Further Standing Orders complied with : Liverpool United Gas Bill ; North Shields Water Bill ; Oxford Gas Bill ; Pontypridd Water Bill ; Western Valleys (Mon.) Water (Gas Purchase) Bill. Bills read a second time : Ashton-under-Lyne, Stalybridge, and Dukinfield (District) Water Bill ; Barrow-in-Furness Corporation Water Bill ; Bradford Corporation Water Bill ; Glasgow Corporation Water Bill ; Ipswich Corporation Bill ; Kilmarnock Corporation Water Bill ; Liverpool United Gas Bill ; Newport Corporation Bill ; North Shields Water Bill ; Oxford Gas Bill ; Pontypridd Water Bill ; Rhymney Valley Gas and Water Bill ; Southborough Local Board Bill ; Swansea Corporation Water Bill ; Swinton and Pendlebury Local Board Bill ; Tredegar Local Board Water Bill ; Uttoxeter Water Bill ; Western Valleys (Mon.) Water (Gas Purchase) Bill.

Petitions against the following Bills have been presented :—

North Shields Water Bill, from the Corporation of Newcastle-on-Tyne.
Pontypridd Water Bill, from Halswell Milborne Kemeys-Tynte.
Rhymney Valley Gas and Water Bill, from the Local Board of Bedwellty and Halswell Milborne Kemeys-Tynte.
Swansea Corporation Water Bill, from the Usk and Ebbw Board of Conservators, the Breconshire County Council, the Newport Harbour Commissioners, the Corporation of Newport, and the Duke of Beaufort.
Swinton and Pendlebury Local Board Bill, from Andrew Knowles and Sons, Limited, and the Barton-upon-Irwell Rural Sanitary Authority.
Tredegar Local Board Water Bill, from the Duke of Beaufort.

HOUSE OF COMMONS.

The following progress was made with Bills last week :—

Further Standing Orders complied with : Airdrie and Coatbridge Water Bill ; East Grinstead Gas and Water Bill ; Ormskirk Gas Bill. Bills read a second time, and committed : Blackburn Corporation Bill ; Bournemouth Improvement Bill ; Ilkley Local Board Bill ; Leeds Corporation (Consolidation and Improvement) Bill ; London County Council (Subways) Bill ; Middlesbrough Corporation Bill ; Newcastle-upon-Tyne Improvement Bill ; Rhyl Improvement Commissioners Bill. Bill withdrawn : St. Pancras Vestry Bill.

Petitions against the following Bills have been presented :—

Airdrie and Coatbridge Water Bill, from the Upper Ward District Committee of the Lanarkshire County Council and Owners of lands and mills on Hilly Gill Burn and Culter Water.
Barry and Cadoxton Gas and Water Bill, from the Barry and Cadoxton Local Board.
Birmingham Corporation Water Bill, from the Corporation of London ; London County Council ; Guardians of King's Norton Union ; Northfield Highway Board ; Owners, &c., of fisheries on the River Wye ; Breconshire County Council ; Sir J. Bailey ; Viscount Cobham ; Hereford Corporation and Herefordshire County Council ; Worcestershire County Council ; the Duke of Beaufort, and others ; South Staffordshire Water-Works Company ; Rhayader and Knighton Highway Boards ; Builth Lead Mining Company ; Monmouthshire County Council ; Radnor County Council.
Blackburn Corporation Bill, from the Blackburn Burial Board, Blackburn Guardians, and the Lancashire County Council.
Bryn-mawr and Abertillery Gas and Water Bill, from the Abertillery Local Board, the Blaenavon Company, and Philip Samuel Phillips.
East Grinstead Gas and Water Bill, from the Conservators of Ashdown Forest.
Ilkley Local Board Bill, from the Ilkley Gas Company.
Lanarkshire (Middle Ward District) Water Bill, from the Duke of Hamilton, Lord Blantyre, and Ratepayers within the Bothwell Special Water Supply District.
Leeds Corporation (Consolidation and Improvement) Bill, from the Board of Overseers of the Township of Leeds.
London County Council (General Powers) Bill, from the Bromley Local Board, The Gaslight and Coke Company, the New River and other Water Companies, and the Hertfordshire County Council.
London County Council (Subways) Bill, from the Commissioners of Sewers of the City of London ; The Gaslight and Coke, South Metropolitan, and Commercial Gas Companies ; New River and other Water Companies ; Southwark and Vauxhall Water Company ; Westminster Electric Supply Corporation.
Middlesbrough Corporation Bill, from Owners, &c., of iron-works and other property in Linthorpe.
Mold Water Bill, from Henry John Potts.
Newcastle-upon-Tyne Improvement Bill, from the Tyne Improvement Commissioners.
Ormskirk Gas Bill, from the Ormskirk Local Board and the Lancashire County Council.
Pontypool Gas and Water Bill, from John Capel Hanbury and the Pontypool Local Board.
Rhyl District Water Bill, from the Rhyl Improvement Commissioners.
Rhyl Improvement Commissioners Bill, from the Rhyl District Water Company.
Stamford and St. Martin's Stamford Baron Gas Bill, from the Stamford Corporation.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Friday, Feb. 26.

(Before Mr. Justice NORTH.)

Kirkleatham Local Board v. Stockton and Middlesbrough Water Board.

This was a motion to restrain the defendants from discontinuing the supply of water to the district under the control of the plaintiff Board ; but as, since the granting of an *ex parte* injunction, an affidavit had been filed by the Secretary of the Water Board, disclaiming any such intention, the matter now resolved itself into a question of costs. In August, 1891, the plaintiff Board determined, under certain powers contained in their Act of Parliament, to take into their own hands the supply of water to the district under their control, which had hitherto been supplied by the defendant Board ; and, in pursuance of this determination, they gave notice of their desire to purchase on Feb. 14, 1892, the pipes and fittings in such district. The consideration offered was £2669 ; but to this sum the defendant Board objected. After some negotiations, the matter was referred to an Arbitrator, who ultimately fixed the amount at £25,424. The plaintiff Board thereupon took proceedings to set aside this award ; and as reported below these proceedings are now pending in the Queen's Bench Division. Meanwhile, as the date fixed for the completion of the purchase, according to the notice given, was fast approaching, and the plaintiff Board having become aware, by reports in the local newspapers, that the defendant Board were taking steps to cut off the supply of water from their district, wrote to the Secretary inquiring whether or not such reports were well founded, and if the Water Board intended to complete the sale on the date named. To this and subsequent communications they received no reply ; and consequently, on the 12th of February, application was made to Mr. Justice North to restrain the defendant Board from cutting off the supply after the 14th, whether or not the sale was then completed. This application was granted.

Mr. COZENS HARDY, Q.C., M.P., and Mr. WOOD appeared for the plaintiffs ; Mr. BALFOUR BROWNE, Q.C., and Mr. BAGGALLAY represented the defendants.

For the defendants, it was contended that the plaintiffs were not justified in entertaining any such apprehension, and had no right to assume that they would act otherwise than in accordance with the statutory powers by which they were bound. It was argued on their behalf that what they had done, in making certain preparations to cut off the water, was merely for their own protection, and not in any way with the view of acting as it was alleged they intended to act.

Justice NORTH, in giving judgment, considered that the Water Board were in fault in not replying to the communications of the plaintiffs, which they could, he said, easily have done, notwithstanding the temporary absence of their Secretary ; and he ordered them to pay the costs of the motion.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Monday, Feb. 22.

(Before Justices WRIGHT and COLLINS.)

In re an Arbitration between the Kirkleatham Local Board and the Stockton and Middlesbrough Water Board.

This was a case arising out of the recent arbitration between the Stockton and Middlesbrough Water Board and the Kirkleatham Local Board, in regard to the price to be paid by the latter authority to the Water Board for the mains and the privilege of supplying water in the Kirkleatham district. The terms of the award made by the Arbitrator (Mr. H. Law) were given in the JOURNAL for Jan. 26 last.

Mr. FINLAY, Q.C., and Mr. J. G. WOOD appeared for the Local Board ; Mr. BALFOUR BROWNE, Q.C., and Mr. BAGGALLAY for the Water Board.

Mr. FINLAY said this was an application to set aside an award, and to send it back, on the grounds that the Arbitrator had included in his valuation matters which did not fall within his jurisdiction, and that, when asked to state a special case for the opinion of the Court upon the legal points raised, to be taken before the award was made, or to make it in an alternative form, he had declined to do so, and had made it in a general form. The arbitration took place under the Stockton and Middlesbrough Corporations Water-Works Act, 1876, the object of which was to enable the Corporations to acquire the undertaking of the Stockton Water Company, and to supply water to the district, which included Kirkleatham, Coatham, and East and West Coatham. It provided that the Sanitary Authority of these places might purchase the portion of the undertaking in their district, and that the price to be paid therefor should be fixed by an arbitrator to be appointed for the purpose by the Local Government Board, on the application of either party ; and after such sale the Joint Board were to cease to supply water within the district. The Kirkleatham Sanitary Authority had, under the powers conferred upon them, required the Water Board to sell to them the pipes, mains, and fittings within their district ; and a valuation had therefore to be made under section 4 of the Act. The point raised was whether the Water Board were entitled, as they claimed, to be paid by the Sanitary Authority, in addition to the price of the mains and pipes, for the loss of profits or revenue to them in consequence of the abstraction of the Kirkleatham district, including the Coatham parishes, from their area of supply. The Kirkleatham Local Board, on the other hand, contended that the Water Board were only entitled to be paid the value of the mains, pipes, and fittings, on the principle familiar in rating cases in valuing plant as between outgoing and incoming tenants—viz., on the assumption that they were in a condition to be worked at a profit by the person or body taking them over. In other words, that what the Sanitary Authority were going to take over—i.e., the mains, pipes, and fittings—must be valued as part of a going concern. The valuation put by the Kirkleatham Local

Board upon this plant was between £4000 and £5000; and the claim made by the Water Board, on the basis of the profits lost to them by the abstraction of the Kirkleatham district, was upwards of £29,000.

Justice WRIGHT asked if the £29,000 was for profits exclusively, and did not embrace anything else.

Mr. FINLAY said it embraced everything—the Water Board's witnesses putting the value of the pipes, mains, and fittings at between £7000 and £8000. After reciting the provisions of the Act, the Arbitrator stated: "I award the price to be paid by the Kirkleatham District Sanitary Authority for the mains, pipes, and fittings to be £25,424."

Justice COLLINS said there could be no doubt whatever that the profits were included in the award.

Mr. FINLAY agreed, and said that, under section 4 of the Act, profits could not be awarded.

Mr. BAGGALLAY remarked that the Water Board contended, first, that the Court could not go behind the award in the circumstances under which it took place; secondly, that if it were interfered with, its basis was not as had been stated on behalf of the Sanitary Authority; and, thirdly, that the legal construction of the word "price" in the section would, if necessary, have to be contested—this being the question which the Arbitrator had to determine.

Mr. FINLAY proceeded to read two affidavits—one for the applicants, the other for the respondents. The first was by Mr. Sutor, the claimants' Solicitor, stating the acquisition of the water-works by the two Corporations, whose Joint Water Board had ever since supplied the district in question, until notice was given by the Kirkleatham Sanitary Authority for taking over this portion of the undertaking. Then followed the arbitration; and there the Local Board contended that the sum they had to pay under section 4 was the value of the pipes, mains, and fittings, regard being had to their condition, the state of repair, and suitability for affording the required water supply, but quite irrespective of the income derived from them—due allowance being made for depreciation since they were laid. This value they represented as being £4700. On the other hand, the Water Board contended that the measure of the price to be paid for this part of the undertaking was the present capitalized value of the revenue, actual and prospective, lost to the Water Board by having taken from them the right to supply water to the Kirkleatham district, with the customary addition for compulsory sale. At the conclusion of the proceedings, the Arbitrator was asked to state a special case for the opinion of the Court. He did not absolutely refuse to do so; but on Jan. 18, 1892, he published his award for £25,424. The second affidavit referred to verified the proceedings before the Arbitrator, at which Counsel for the Water Board contended that the section would be the most monstrous one ever inserted into an Act of Parliament, if it authorized or enabled a Local Board to leave a Water Board or undertaking without its revenue upon merely paying the value of the pipes, &c., taken over. When the Corporations purchased the works originally from the Water Company, they had to borrow between £700,000 and £800,000; and they were only able to borrow this large amount on the revenue from the undertaking. Accordingly, what they now claimed was the net capitalized value of the revenue derived from this part of the Corporations' water supply area. The evidence of Mr. Fenwick, M. Inst. C.E., for the claimants, proceeded upon an estimate of £1316 for the net income, after allowing for discounts, working expenses, way-leaves, and rents. This sum, capitalized at 28 years' purchase, and making the necessary allowances, brought out a net claim of £29,816 for lost profits or revenue. Another valuer gave the worth of the mains, pipes, and fittings at £6209, or £1000 less than the previous witness. Other valuations of the same plant were £4692 and £4713. It was submitted to the Arbitrator that by going into the question of revenue, he was proceeding on an erroneous principle altogether; and he was asked to state a special case for the purpose of taking the opinion of the Court on the legal points raised—it being urged that this was not the proper construction of section 4. Counsel now contended that there had clearly been a miscarriage upon the arbitration in making the award in this final form, and that great injustice would be done if the Local Board were precluded from raising the question. Taking the figures on their own basis, the Water Board were not entitled to claim more than £2000 to £3000, instead of £7000 or £8000, for the pipes, &c., in question. Corporations were not obliged to take over reservoirs, and they might lay down their own plant, at their own expense, for serving the district, or make any bargain they chose with a water company, or even with the very body from whom they were buying, to sell a supply of the water at a certain rate per gallon. The Act provided: "That the Joint Board, when constituted, shall, if required, sell to the Sanitary Authority all mains, pipes, and fittings within the district—the price to be fixed by arbitration; and that after such sale the Joint Board shall cease to supply the district with water." Now, what the Water Board had obtained here was compensation for their loss of revenue, whereas it was impossible to find in the section that anything but the value of the pipes, mains, and fittings was to be paid for.

Mr. BALFOUR BROWNE contended that no reason whatever existed for interfering with the Arbitrator's award; and that, in fact, the Court had no jurisdiction to touch it—this being in the nature of a voluntary, and not a compulsory arbitration. In such cases, the ordinary jurisdiction of the Court was ousted; and everything—even questions of law, should they arise—must be determined by the Arbitrator. In any case, if the Court were in a position to interfere, it would not send back the award for reconsideration unless the Arbitrator had taken into account matters which he ought not to have regarded, and would certainly not do so upon a mere suggestion that he might have adopted a wrong view of the legal points. The fallacy of the applicants was in supposing they had the right to make the supply; but the Water-Works Clauses Act provided that where a company already existed, by statute, for supplying water, the local authority of the district should not be entitled to do it, so long as the company was in a position to give a proper and sufficient supply for all purposes. That was the case here. In this district, water was already being supplied by a Company; and the Local Board could never have acquired the right of supply at all, but for the words in section 4 of the Act of 1876, providing that after the purchase there should be a cesser of the Water Board's right to supply. It was not the intention of Parliament that

these large undertakings should be dismembered and split up; and it never meant that the value of the pipes and mains as old iron, and the mere cost of laying them, were to be the measure of compensation. The question for the Arbitrator to determine was the value of this plant to the seller, and not to the purchaser. This principle had been distinctly laid down in many compensation cases. Once laid, the pipes became of far greater value, in regard to the water to be supplied through them. The Act of Parliament did not provide that arbitrators were to value the dry pipes; and clearly what the Local Board bought was the right of supply.

Justice WRIGHT said the Court had not to decide whether or not the Arbitrator had proceeded upon a wrong principle. The Act of Parliament left it to him to find the price at which certain things were to be sold or taken over. If the Court could see that there was really ground for saying that the Arbitrator had followed an improper course, it had power to require him to state his award in the form of a special case, so that the matter could be submitted for its decision. There appeared strong grounds for judging that he had given compensation in respect of the cessation of the Water Board's power to afford a supply of water to the district, or that he had taken into consideration, as his guiding principle in the matter, the loss of revenue sustained by the Board by reason of their ceasing to supply the district. If this were so—if he were wrong in taking this view—it would certainly be unjust to allow the award to stand without giving an opportunity to the parties to contest it as a question of law. Accordingly, the matter must be referred back to the Arbitrator, under the 10th section of the Act of 1889, for the award to be stated in the form of a special case, to be remitted for the opinion of the Court.

Justice COLLINS concurred.

COUNTY OF LONDON ASSESSMENT SESSIONS.

Sessions House, Clerkenwell, E.C.—Friday, Feb. 26.

(Before Sir P. H. EDLIN, Q.C., Chairman, and a Bench of Magistrates.)

The Gaslight and Coke Company's Assessment Appeals.

The Counsel in this case attended to-day, as arranged, with the view of obtaining the final judgment of the Court as to the allocation of the amount of rateable value fixed amongst the various parishes.

Mr. LITTLER said he did not desire to re-open anything that had taken place on the previous occasion; but, on the assumption that he had any rights, he wished to say that all that he did now was under protest, though he was willing to do what he could to assist the Court and the other side.

The CHAIRMAN said he was not quite sure that he correctly appreciated the expression "under protest." Mr. Littler was there as Counsel in an exceedingly important case for a very important public Company; and the Court had listened, and given great attention to everything that had fallen from him in the course of the long proceedings. He thought it would be better that Mr. Littler should withdraw the expression, because he (the Chairman) should really not allow it. The judgment of the Court had been given, or an interlocutory judgment had necessarily been given, in the matter; and the Court were asked to put an interpretation on the words they used in expressing their opinion contrary to that which was intended. Now that judgment had to be carried out; and he had requested the loyal assistance of everybody—and had no doubt he should receive it on both sides—for the purpose of giving effect to it.

Mr. LITTLER said they felt it to be a very important matter; and therefore he wished to preserve the position of his clients, as he had done hitherto.

The CHAIRMAN remarked that Mr. Littler had done so hitherto; and it was absolutely impossible that there could have been a finer grasp of the position in which the Company stood than that which was shown by Mr. Littler's conduct of the matter. They had had a very difficult task—Heaven forbid that he should have such another—and he did not think that anything Mr. Littler had urged had been overlooked.

Mr. LITTLER said there were three matters for consideration—first of all, the directly-productive mains; secondly, the indirectly-productive mains; and, thirdly, the stations, where there were any. With regard to the first, Mr. Field had worked out the figures; as to the third, it could be got rid of by Mr. Ryde's schedule; but in respect to the second, there was some difficulty. Correspondence had taken place with Mr. Ryde on the matter; but as he was only engaged for three parishes—St. Pancras, St. Giles-in-the-Fields, and St. Marylebone—that gentleman felt that he could only deal with the amounts for those parishes. On the 24th inst., Mr. Field had a long interview with Mr. Ryde; and he was pressed as to how the £1223 which he assigned to St. Pancras was made up. He then explained that there were 5183 yards of 24-inch, 800 yards of 26-inch, 197 yards of 30-inch, and 3846 yards of 36-inch main; whereupon it was pointed out that he assigned to St. Pancras, according to this, rather more than twice as much 24-inch unproductive mains as was allowed to the whole of the parishes supplied by the Company. Then, again, St. Pancras was credited with 800 yards of 26-inch main; while this diameter did not appear in Mr. Ryde's statement at all, and there was nothing to be allowed for it. Then Mr. Ryde said this was immaterial, because any allowance for it might be taken from the sum of £5998 given as the value of the testing-stations, &c., which, his Lordship would remember, was the last figure that made up the £250,000; and he said this was an odd sum arrived at for the purpose of completing the amount.

The CHAIRMAN asked if this was not a matter for the parishes to fight out amongst themselves.

Mr. LITTLER said it was not entirely so, for the reason that there were other parishes in which there were no appeals; and therefore to this extent the Company were interested, because they must take care that it was so distributed that they were not rated twice over.

The SOLICITOR-GENERAL said he was sensible of the way in which the appellants had now endeavoured to deal with the judgment which his Lordship had given; and he was glad to acknowledge that the parishes he represented had received from the appellants' Solicitors the figures which they worked out in respect to the directly-productive

mains; and the difference between these figures and those which the Surveyors on his own side had prepared for the information of the Court was so trivial and insignificant, that he would be prepared at once to accept the figures that the Company's representatives had produced. In one case, in which the amount of the assessment now arrived at exceeded the sum of £17,000, the difference between them was only £8. He suggested that it would save time if his Lordship would adjourn the proceedings till another day, to enable them to further consider the figures.

The CHAIRMAN: Do those figures relate to the indirectly-productive works?

The SOLICITOR-GENERAL: No, my Lord.

The CHAIRMAN: Then what you are now saying has no direct relation to what has fallen from Mr. Littler?

The SOLICITOR-GENERAL replied that it had not; it was in addition to it. He was only anxious to get the actual application of his Lordship's judgment. The figures which had been supplied to them that morning were in this form: Parish of St. John, Hackney—gas meter and stove rental for the account year, £110,904; then value of directly-productive mains, at 19'67 per cent. on the rental, which was the rateable value *plus* rates, £21,115; rates, at 5s. 5½d. in the pound, £4663; net amount, £17,152. The amount that had been arrived at by his clients was £17,160—only £8 difference.

The CHAIRMAN remarked that this showed that the greatest possible attention to the calculation had been given on both sides. He thought they might accept this result as excellent evidence of such attention.

The SOLICITOR-GENERAL said that a sweet reasonableness had set in on both sides. There was, however, a divergence of interest between the parishes represented by Mr. Ryde and those represented by other persons; and he had no doubt that, if an adjournment were granted, the figures could be amicably worked out.

Mr. LITTLER agreed that they could not go much further into the matter then; but with regard to the question of "sweet reasonableness," he wished to point out that, according to Mr. Field's return, they were actually rated at 19'67 per cent., whereas with the South Metropolitan Company the greatest amount was 10 per cent.

The CHAIRMAN observed that this might involve considerations later on.

A further discussion ensued, in the course of which the Chairman suggested that the differences between the parishes should be referred to Mr. Vigers, who, although retained by the appellants, was not called as a witness. This, however, was objected to by Mr. Poland; and the suggestion was withdrawn by the Court.

Mr. FULLARTON, on behalf of the parish he represented, pointed out that the assessment was £1077 gross and £897 rateable value, whereas the Company claimed £481 gross and £391 rateable value.

The CHAIRMAN: How does the judgment work out?

Mr. FULLARTON said that, according to the Company's own view, it worked out to a rateable value of £1222, as against £897 on the assessment—actually £400 above what was on the valuation list.

The CHAIRMAN said the Court had no power to increase the assessment. This might possibly have been a power which an arbitrator would possess in the matter; but the Court could not do it.

Mr. FULLARTON asked his Lordship for judgment, with costs, in respect of his parish.

The CHAIRMAN stated that he should not deal with the question of costs until he had the whole of the figures finally before him.

Mr. MARSHALL, for the parish of Chelsea, said that, after this intimation, he should not press for judgment at present; otherwise he should have had to make the same application as Mr. Fullarton.

It was arranged that the parishes should have an opportunity of inspecting the plans of the Company, so as to ascertain the lengths of the mains; and after the Chairman had referred to the remarks of Mr. Danckwerts on the previous occasion, and maintained that the Court had power to act, even though it was not constituted as it was previously, the proceedings were further adjourned till Saturday, the 12th inst.

WEST LONDON POLICE COURT.—Saturday, Feb. 27.

(Before Mr. CURTIS BENNETT.)

Water Companies' Powers of Cutting Off Supply.

To-day his Worship gave judgment in an adjourned summons taken out against the Secretary of the Chelsea Water-Works Company in respect to cutting off the supply of water to premises in the occupation of Mr. J. T. Elgar. The matter had stood over to allow his Worship to look through the statutes. The facts are fully stated in the judgment.

Mr. BODKIN appeared on behalf of the Company, and wished to address the Magistrate; but he declined to hear him.

Mr. CURTIS BENNETT said: This is a summons taken out under section 48 of the 34 & 35 Vic., cap. 113 (The Metropolis Water Act, 1871), under the following circumstances: The complainant entered into possession of certain premises at 667, Fulham Road, from Sept. 30 last; and in the month of November, he received a printed demand-note to pay the amount (not specified) for the water-rate. The previous note, left in October, did not reach him; but this had contained the amount. In December he received the final notice to pay the sum of 6s. 11d. for one quarter and a half-quarter, up to Christmas, on or before Jan. 18. On that day I find he had attended at the office of the Company, taking with him the deposit receipt for £2 which he received from the landlord on taking possession on Sept. 30, and produced it to the officer of the Company to prove that he had only entered into possession on that date, and therefore was not liable for the water-rate from Aug. 6 to Sept. 29, which the Company claimed from him. As to this I find the complainant was perfectly correct, as the section under which this summons is taken out enacts that "the incoming tenant shall not pay the arrears unless there is an express stipulation with the outgoing tenant to that effect." On this occasion I find the complainant offered to pay, and tendered in payment, the amount due from him—namely, the quarter up to Christmas; and this was refused by the officer of the Company. On

Feb. 6 a representative of the Company called upon the complainant, and again demanded payment of a sum which they had no right to demand from the complainant, who again produced the deposit note and offered to pay all that was due from him. This was again refused; and the Company's officials then took the very high-handed, and in my opinion absolutely monstrous, steps of cutting off the supply to the complainant's house, because he refused to pay for that for which he was not liable. But I have looked through all the Acts relating to Water Companies, and I do not find that I can inflict any fine upon the Company for this act, although the health and happiness not only of the complainant, but also of his neighbours, were endangered thereby. The complainant was then kept without water for seven days; and not until the case was brought before the Court was the water supply restored. The complainant says that on Feb. 6, when the Company's official called upon him, he offered to pay the proper amount up to Lady-day—namely, a quarter in advance in addition to the quarter due at Christmas; and I find that he did so. But then the Company say, under sections 56 and 70 of 10 Vict., cap. 17 (the Water-Works Clauses Act, 1847), the water-rate must either be actually paid or "tendered" in advance for a quarter before any complaint can be made for cutting off the water, and therefore the Company are not liable for the penalties imposed by section 43 of this Act. This leads to the consideration of what "tender" is as set out in the Act. The complainant, I find, did not actually produce the amount in payment, but only said "I will pay you"—putting his hand into his pocket, in which was money. But I hold that the tender must be a legal tender, which, to be good, must be actual tender of the very amount. This I find the complainant did not do; and therefore, hardly as he has been used by the Company, he has no legal remedy. I should like to point out all through the various Acts every provision is in favour of the Water Companies, and against the consumer. For instance, if any neighbour had given the complainant a glass of water when his supply was cut off, such person would be liable, under section 58 of the Water-Works Clauses Act, 1847, to a penalty of £5. The complainant even rendered himself liable, under section 59 of the same Act, to a penalty of £10 for consuming any of the water from the pipe to his house before making an agreement with the Company, although he found the water in the house ready for use; and he has always been ready and willing, and offered, to pay for the water since he took possession of the premises. Legislation is imperatively needed to give the consumers some set-off against the present powers of the Water Companies, who supply that which is absolutely essential for health and life, and without which people cannot live in the Metropolis. At present, although persons have duly paid all rates demanded from them—say, in October up to Christmas—on Dec. 26, or on any subsequent date before another payment, the Companies have power, without any notice, to cut off the whole of the supply to London. A short Act would, in a great measure, meet many of the difficulties; and I suggest the following:—

That it shall not be lawful for any water company to cut off the supply at any time existing to any premises for non-payment of any water-rate, without first leaving, either with the owner or occupier thereof, or affixing on some conspicuous part of such premises, a notice stating the amount due to them for any water-rate and giving 14 days for the payment of such amount; and if any dispute should arise between the parties as to the amount due, either party within the said 14 days may apply to any Court of Summary Jurisdiction for a summons against the other party to hear and determine what amount is due. Should any water company cut off any water supply to any premises contrary to this provision, the company shall forfeit the penalty of £20, and the further penalty of £5 for every day during which such supply is so cut off. Provided always that if the Court shall be satisfied that the water has been cut off solely on account of any necessary repairs to the works, or mains, or pipes of the said company, then the company shall not incur any penalty for cutting off the water.

In my judgment the power of cutting off the water supply to any premises for non-payment of water-rates should be absolutely taken away from the Companies, for that which to life and health is essential should not be so dealt with. The remedy should be that, if the water-rate is unpaid 14 days after having been demanded, the Companies should have power to recover the amount due in a Court of Summary Jurisdiction, in the same way as poor rates are now recoverable. And within the 14 days of the demand, the person from whom the rate is demanded should have the power to dispute the same by a summons in a Court of Summary Jurisdiction.

The summons was then dismissed, without costs.

Sales of Shares.—At West Hartlepool yesterday week, a number of shares in the *Hartlepool Gas and Water Company* were sold by auction. Thirty fully-paid "D" shares of £10 realized prices ranging from £16 12s. to £16 15s.; and three £10 "D" shares (on which £2 only was paid up) produced £7 12s. each.—Last Thursday, at Folkestone, nine £10 shares in the *Folkestone Gas Company* were sold at the rate of £23 5s. each; seventeen 7 per cent. shares realizing £17 2s. each.

The Estimates for the Birmingham Water Scheme.—Mr. J. Mansergh, M. Inst. C. E., the Engineer of the water scheme of the Birmingham Corporation, has prepared his parliamentary estimate of the expense of the undertaking. Including all works and contingencies, he sets it down at £5,851,000. In this estimate the cost of constructing the 3½ miles of railways in Wales is put at £26,950. The object of these lines is "to facilitate the construction and maintenance of the water-works."

The Lead-Poisoning Question at North Bierley.—In the course of the report of the Medical Officer (Dr. Logan) presented at the last meeting of the North Bierley Local Board, he stated, in reference to lead-poisoning, that it had been somewhat prevalent throughout the greater part of the district, but seemed to be more intense during certain months—for instance, in August and September. The months of increased intensity apparently coincided with an increased growth and decay of certain minute organisms, which, on reaching the lead supply-pipes, dissolved or determined the solution or disengagement of a sufficient amount of the mineral to affect those persons susceptible to its toxic operation. The greater part of the district, it was added, was supplied from the Bradford high-level service.

MISCELLANEOUS NEWS.

SHEFFIELD UNITED GAS COMPANY.

The Half-Yearly Report and Accounts.

The report which the Directors of the above Company will present to the shareholders at their half-yearly general meeting on the 14th inst. is very short; but the accounts by which it is accompanied are considered satisfactory, and consequently the payment of the maximum dividend will be recommended. The receipts from the sale of gas in the six months ending Dec. 31 last amounted to £99,257, as compared with £97,872 in the corresponding period of 1890; the meter and stove rental was £4932, against £4767; the residuals produced £37,725, as compared with £41,230—the total revenue being £144,314, as against £146,329. The expenditure incurred in the manufacture of gas was £95,542, against £100,929; in its distribution, £8593, against £6790; the management expenses were £5441, as compared with £4181; and the total expenditure was £116,849, as against £118,324. The balance carried to the profit and loss account is now £27,465, as compared with £28,005 this time last year. The sum available for division was then £45,107; it is now only £35,702, which comprises £5546 taken from the undivided balance of the past half year. The dividends on the various classes of stock will come to £34,493; so that there will remain a balance of £1209 to be carried forward. The reserve fund (which is at its maximum) stands at £78,618. With regard to the Company's manufacturing operations, coal cost £52,005 in the past half year, as compared with £54,895 in the latter half of 1890; and the Directors explain that, though the Company benefited somewhat by the reduced price paid for raw material, the advantage gained was neutralized by the smaller amounts obtained for coke and other residuals. The quantity of coal carbonized was 78,438 tons; of cannel, 18,443 tons—together, 96,881 tons. The products were: Coke and breeze, 58,581 tons; tar, 6352 tons; ammoniacal liquor, 3,015,500 gallons. For the latter half of 1890, the figures were: Coal, 79,991 tons; cannel, 16,241 tons; coke and breeze, 59,114 tons; tar, 6155 tons; ammoniacal liquor, 2,670,275 gallons. Of the £693,678 raised on capital account, a sum of £666,052 has been expended; leaving a balance of £27,626. The Company have £92,510 of share capital issued, but not paid up, and £6222 remaining to be issued; also borrowing powers to the extent of £76,073 unexercised.

CROYDON COMMERCIAL GAS COMPANY.

The Half-Yearly Meeting of this Company was held last Wednesday at the Offices, Katherine Street, Croydon—Mr. CHARLES HUSSEY in the chair.

The SECRETARY (Mr. W. J. Russell) read the notice convening the meeting; and the Directors' report and the statement of accounts were taken as read.

The CHAIRMAN, in moving the adoption of the report and accounts, said he exceedingly regretted that, in taking the chair, his first duty should be to have to refer to the great loss which they had sustained in the directorate by the death of Mr. Charles Newton, who had been for more than 26 years a member of the Board, and for nearly five years their Chairman. He went on to speak of the eminent services rendered to the Company by Mr. Newton. Having, he remarked, been a Director of no less than nine gas companies and an Auditor of two, he brought a great amount of experience to bear upon his work; and the Board felt they had lost a valuable colleague, and the shareholders a valuable servant. To fill the vacancy, they had elected Mr. J. Pelton, whose knowledge of business matters would be of great advantage to the Company. Directing attention to the working of the half year, the Chairman stated that there had been an increase in the quantity of gas sold of 2,487,500 cubic feet, or 1.16 per cent. This was not their usual increase; but seeing that they compared it with the very abnormal half year of 1890, it could not but be considered satisfactory. The second half of 1890 showed an increase of 10 per cent. in comparison with the corresponding period of the previous year; and this was accounted for by the severe weather in November and December. If they took the whole of 1891, it would be seen that they made an advance of 5.55 per cent., which was very gratifying. Taking the two years 1890 and 1891, they had an increase of 10.3 per cent.; while in the ten years from 1881 to 1891, they actually showed an advance of 70.9 per cent. Turning next to the residuals, he said he was sorry to say that this portion of their business had not been so profitable during the half year. From coke they had not received gross so much by £1646; breeze and tar had produced less; and, in fact, all residuals had been at a bad price for gas companies. The total difference in the gross prices realized between the December half of 1890 and 1891 was £2309; but notwithstanding this, by the excellent management of their Engineer (Mr. J. W. Helps), he had been able to reduce that in the balance-sheet by £641. With regard to gas cooking and heating stoves, they had made rapid strides; and they were trying to foster this branch of their business as much as they could. The number of additional stoves sold was 144; cooking-stoves on hire, 81; and heating-stoves on hire, 102—making a total of 327, or an increase of 20.50 per cent. The total number of stoves on hire to Dec. 31 last was 1778. Since the previous meeting they had sold 500 new shares; and, in disposing of them, they had departed somewhat from the old lines of doing so. Instead of putting them up to auction, they had sold them by tender; and the amount realized was £11,224—giving the Company the handsome sum of £6220 of non-dividend paying capital. For the 500 shares, the Directors received 854 applications; and the average price realized was £22 9s. per share. Dealing with the improvements which had been made at the works, the Chairman said it would be remembered that at the last meeting it was stated that the Directors intended to spend a certain sum in the erection of new plant. Since then they had added a third lift to one of their gasholders. They had taken away an old station meter which was only capable of

passing 45,000 cubic feet per hour, and replaced it by one that will pass 100,000 feet per hour. They had disposed of the old meter; and this considerably reduced the expenditure on the new one. They had also built a new governor-house; and put in two governors of an improved type. During the present year, they were proposing to build another retort-house. Their Engineer had been put under the greatest strain during the winter to meet the demand for gas, which had had to be sent out from the works as quickly as it was purified; and the new retort-house would relieve them of much anxiety for some time to come. They also contemplated the erection of a new scrubber, capable of doing four times as much work as the present one. Referring to the prepayment system of supplying gas, he said that it had only been adopted by the Company about two years. They had, however, already fitted up 301 cottages under it; the increase during the past six months having been 104, or 52.79 per cent. Each cottager paid at the rate of 3½d. per 100 feet; and he thought that the results achieved must be considered very satisfactory. The Chairman then referred at some length to the establishment by the Board of a superannuation fund, for the benefit of those workmen who might be incapacitated from performing their usual work; and he stated that, acting under legal advice, they had, for the purpose of making the fund financially sound, placed to the credit of five Trustees the amount of the Actuary's (Mr. Mark Knowles's) valuation. The Directors had been induced to go into this for two reasons. The first was to teach the men to be thrifty, and to save something that would be serviceable to them in their old age; and, in the second place, to endeavour to foster a feeling of good-fellowship between employed and employers. Continuing, he observed that the Directors recommended that the salary of the Secretary should be increased by £50 per annum; and, in justification of this proposal, he pointed to the great expansion of the business, and the consequent increased responsibility and labour which fell upon Mr. Russell. In 1879, when the returns were £51,829, the Secretary was receiving £400; and in 1892, with receipts amounting to £87,208, they proposed to give him £600. Mr. Russell had been in the service of the Company from 1863; and the manner in which he performed his duties had given the Directors great satisfaction. Regarding the dividend, the undivided balance amounted to £19,041, out of which the Board recommended the payment of dividends at the rate of 14 per cent. per annum on the capital of £51,600, and 11 per cent. on the capital of £137,000 for the half year, and at the last-named rate on the new capital of £5000 for the three months ending Dec. 31, all less income-tax. These dividends would amount to £11,312, and leave a balance of £7729 to be carried forward. As to the accounts, it would be seen that there was the addition to the capital of the £5000 already referred to; and £4768 had been expended in new plant, &c.—the balance of capital amounting to £6453. Touching the revenue account, £27,330 was received from private consumers; and for public lighting, £3767. This was a slight increase in the sales; but it had been borne down by the loss on residuals. Still they were able to pay the dividends out of the profits made; and there were scarcely any gas companies who were able to do this on the working of the past half year. The amount of coal carbonized in the six months was 21,736 tons, compared with 21,445 tons in the corresponding period of 1890. The average quantity of gas made per ton of coal was 10,652 cubic feet, of which they sold 9964 feet.

The DEPUTY-CHAIRMAN (Mr. A. J. Lambert) seconded the motion, which was carried unanimously.

On the proposition of Mr. W. Hyslop, seconded by Mr. J. C. BENWELL, the dividends recommended were declared.

The retiring Directors (Mr. H. Chasemore and Mr. A. J. Lambert) and Auditor (Mr. Benwell) were re-elected; and, in accordance with the Directors' recommendation, a resolution was passed increasing the salary of the Secretary by £50 per annum from Jan. 1 last.

The usual complimentary votes were passed; and the proceedings then terminated.

BARNET DISTRICT GAS AND WATER COMPANY.

The Half-Yearly Meeting of this Company was held last Friday, at the Guildhall Tavern, Gresham Street, E.C.—Mr. JAMES GLAISHER, F.R.S., in the chair.

The SECRETARY (Mr. Alfred Lass, F.C.A.) read the notice convening the meeting; and the Directors' report and the accounts (which were alluded to in the JOURNAL last week) were taken as read.

The CHAIRMAN said he had no doubt that every one of the shareholders had gone through the balance-sheet with more than ordinary interest. The crisis through which all gas companies were now passing, due to the increased price of coal and labour and the bad market for coke, would, he was sure, have interested the shareholders so much that they would have looked with the greatest satisfaction at the position in which their own Company stood. Taking first the gas branch of the business, they found that the revenue for gas had amounted to a sum exceeding £7000; and it was the first time in the history of the Company that the receipts for gas had reached that figure. The gas produced in the half year had been nearly 2,750,000 cubic feet more than in the corresponding six months of 1890; resulting in an increase in the revenue of about £515. With regard to the residuals, there had been a small decrease. But this arose principally in relation to the tar; for in the corresponding period of 1890, they opened a tar-well which had been closed for some time, so that they then had more tar for disposal. Compared with the December half of 1890, the total revenue showed an increase of £434. Turning to the expenditure side of the account, under the heading of manufacture, they had had to pay away something more. Coal had cost them an additional £239; but as they obtained £515 more for gas, he thought they might congratulate themselves upon having done very well. The other items were so much like what they had been in previous years, that he did not think he need refer to them. The plant had been well looked after by their Engineer (Mr. T. H. Martin); and it was in good working order. In connection with the water undertaking, he said that the increase in the business had continued, but at a less rapid rate than in the preceding two or three years. There

had not been so much building going on in the past two years; but this could not last long, as building operations must proceed in a district like Barnet and Finchley. The Company's revenue for water had amounted to more than £7000—a sum they had never had before. Both branches of the business were therefore healthy; both were doing well; and both held out the prospect of doing even better in the future. He concluded by moving the adoption of the report and balance-sheet.

Mr. C. HORSLEY seconded the motion.

Mr. THOMPSON called attention to the item in the gas revenue account of "wages and gratuities at works, £564," and asked how much of this sum was for gratuities.

The CHAIRMAN replied that it was nearly all wages; only a few pounds having been spent in gratuities.

Mr. WAKEFIELD considered that the balance-sheet was a very satisfactory one; but he was rather surprised that the gas business had not increased to a greater extent, because he had observed, when he had been to the gas-works, that building was going on in Oakley Park. [Mr. MARTIN: We do not supply gas there.] That, continued Mr. Wakefield, was unfortunate. Everywhere, when one saw houses were being built, they were told that somebody else had the right to supply the gas. Having complained about the price charged for water, he referred to the question of the coal supply. About two years ago, at a meeting of the Great Northern Railway Company, he suggested that they should give greater facilities for getting coal from the district lying between Mansfield and Chesterfield. At that time the Company did not seem to think much of it; but at the last meeting, the Chairman told him they were going to do something in that direction. If coal from the district referred to was good for gas making, he suggested that the Directors might, by making a direct connection, save a good deal in their manufacturing expenses.

The CHAIRMAN, in reply, remarked that the little gratuities they had given to their workmen had been attended with great advantage. With respect to the charge for water, he said their Act of Parliament did not allow them to alter it; so that it could not have been increased. As to the greater facilities for getting a supply of coal, the Directors would be very glad to see them; but he could assure the proprietors that they kept their eyes open to see what could be done in this matter. He thought their present coal supply was good, and it was carbonized very well; for they obtained from it 10,600 cubic feet of gas per ton. He also mentioned that the increase in the gas sold during 1891 was 10 per cent.

The motion was carried unanimously.

On the proposition of the CHAIRMAN, seconded by Mr. HORSLEY, a dividend for the past six months was declared, less income-tax, at the rate of 8 per cent. per annum on the "A" and "C" stocks, 7 per cent. on the "B" stock, and £5 12s. per cent. on the "D" (water) shares.

The retiring Directors (Messrs. A. H. Baynes and J. W. L. Glaisher, Sc.D., F.R.S.) and Auditor (Mr. F. Lennard) were next re-elected.

Votes of thanks were passed to the Chairman and Directors and the various officers for the faithful discharge of their duties during the past half year; and the proceedings then terminated.

CORK GAS CONSUMERS' COMPANY.

The Half-Yearly General Meeting of this Company was held on Thursday, the 18th ult.—Mr. T. MAHONY in the chair.

The SECRETARY (Mr. Denny Lane) read the notice convening the meeting, and also the report and statement of accounts for the six months ending Dec. 31, 1891. An abstract of these appeared in the JOURNAL last week.

The CHAIRMAN, in moving the adoption of the report and accounts, said it was very gratifying to find that the consumption of gas was steadily advancing; it being a considerable time since there had been so large an increase in private lighting. Generally, the Directors had had to be satisfied with an improvement of from 1½ to 2 per cent.; but the past half year showed an increase of 4 per cent. This was the more gratifying as some large establishments were supplied with electric lighting—the electricity being generated by steam and not by gas engines; and it proved what the Directors had always asserted, that lighting by gas and electricity might co-exist without any damage to the former. In a very extensive concern, where both systems of lighting had been in use for some years, a large addition had recently been made, and this was to be lighted with gas instead of electricity. The increase of gas consumption had been so great with many companies, that the engineers had been driven to the greatest straits to provide a sufficient supply of gas, and had, at considerable cost, been obliged to supplement their coal by the use of oil. The Company's prospects were very good; and in some districts it would be necessary to enlarge the mains to meet the demand for gas. The use of gas-engines was also increasing; and in this connection he remarked that the price charged for gas supplied for motive power was about 3d. per 1000 cubic feet lower than that obtained in London on the north of the Thames. It was very satisfactory for the Directors that they had not had to raise the price of gas, as so many other companies had been compelled to do. For instance, the Chartered Company, in London, had advanced their price by 7d. per 1000 cubic feet, which was equivalent to an additional tax of £600,000 a year on their consumers; and yet within the last three years they had taken from their reserve fund the following amounts: First year, £106,623; second year, £344,376; third year, £308,578—making a total of £759,577, and leaving only £115,244 in the reserve, or about one-third of the sum withdrawn in the last year. In Cork they had not advanced the price—in fact, the Directors had rather made concessions to those who used gas for motive power; and although on more than one occasion it had been necessary to resort to the reserve fund, it was still about 8 per cent. more than it was five years ago. Of course, this was to be accounted for, in a great measure, by the favourable contracts made for coals when they were at or near the minimum price. These contracts had now expired; but if the sales of gas continued to increase as they had done, there was every reason for hoping that it would

not be necessary to advance the price. The Directors anticipated that the current half year might not yield so good a net result as that ending in December last; and the shareholders must be prepared for the possibility of a draft upon the reserve fund to supplement the earnings for the summer dividend. But, taking the whole of 1892, the Directors trusted the results would be satisfactory to the proprietors. Referring again to the electric light, the Directors still held that if this system of illumination were required in Cork, the Company were in a better position than any other body to supply it. Their present staff could, without difficulty, execute the greater part of the duties, which would be discharged by a separate and expensive body of officers if any other organization undertook the supply. Last October the Secretary addressed a letter to the *Electrician* newspaper—and it was copied into several other technical newspapers—pointing out that, in the present state of science, gas-engines and gas-mains afforded the cheapest and most efficient mode of distributing electricity.* No one had yet denied the soundness of his conclusion; and as it was freely admitted that he knew not only something, but a great deal of both sides of the question, the Directors believed his opinion was of very considerable weight. If that was so, the conclusion must be that the Company were the most suitable purveyors of the electric light for the city. They did not expect, however, that the demand for it would be very large, when, in a wealthy city like London, where the price was not half that charged in Paris, the number of consumers was so small. Although some brilliant experiments had lately dazzled the public—experiments of the highest interest from a scientific point of view—it was believed that no improvement whatever had taken place in the condition of practical illumination by electricity. Passing to another subject, the advantages to be gained by the use of a steam-roller in the maintenance of the city roadways had been several times discussed by the Town Council; and the objections put forward on the part of the Company had been, the Directors considered, quite misunderstood. Being, as the Company were, the largest ratepayers, and therefore interested in aiding any economy of the rates that could be carried out with safety to the lives and property of their fellow-citizens, and being aware of the risk of damage to the gas-mains (which in some cases had only 18 inches of cover) which were almost certain to occur, from the construction of the main sewers in the principal thoroughfares, by the working of a heavy steam-roller passing over them, the Directors considered they were bound to place on record their strongest protest against the introduction of what they fully believed would be a source of great danger to the public. They were not singular in this action, as it was reported in the JOURNAL OF GAS LIGHTING that The Gaslight and Coke Company were granted an injunction against the Vestry of St. George's, Hanover Square, in a similar case; the parish having to pay damages and costs to the amount of £2800. An action was also brought against the Vestry of St. Mary Abbots, Kensington, who were condemned in costs; an appeal against the decision being dismissed with costs.† It would be impossible to put a limit to the damage which might result from a broken gas-main if it came into communication with a large sewer, wherein an explosive compound of fearful power might be concentrated. The Directors felt bound by their position to make their conviction known in this important matter, in the hope that prudence might prevail with those who had the power to decide.

Mr. LYNCH seconded the motion.

Mr. BANKS, referring to the electric light project, asked if the Company applied to the Corporation for a monopoly of the lighting of Cork.

The SECRETARY said the way in which the matter stood at present was that in the year 1889 a notice was served on the Corporation by the Irish House-to-House Electric Lighting Company, who had not a single shareholder in Ireland. The Corporation refused to give their assent. In 1890 that Company again gave notice that they would apply for a Provisional Order; but they did not do so. The result was that in 1891 the Cork Gas Consumers' Company came forward. He thought the view the Board of Trade would take of the matter was that if the people of Cork desired to have the electric light they ought to have it; and if the Corporation did not introduce it themselves, someone else should be allowed to do so.

Mr. BANKS: Then it is a monopoly you would be applying for?

The SECRETARY: I think that would be the result.

In reply to further questions from Mr. Banks,

The SECRETARY said that some of the large gas-lamps in the city had been lighted free by the Company, in order to show the Corporation what a good illuminant gas could be. The Corporation were now putting up gas-lamps of high illuminating power.

Mr. ROWE said, with reference to the steam-roller, he wished to point out that the wheels would be spread over a very large space, so that the pressure on a particular point would be less than many loads at present carried on two wheels. It was the opinion of the City Engineer that no damage would result to the gas-pipes from the roller; while it would, no doubt, be a great advantage to the city, the streets of which were at present in a very unsatisfactory condition. Steam-rollers were used in other places, and were of great benefit to the streets, while causing no injury to the gas-mains.

Mr. OGILVIE said he would like to know from Mr. Lane whether the weight of steam-rollers would be greater than that of traction-engines and other heavy vehicles of the same kind.

The SECRETARY said it was quite true that traction-engines had passed through the city at various times; and they were very objectionable. However, they only went through the middle of the street, and at long intervals. He pointed out that, formerly, several of the principal streets in Cork were branches of the river, and were now arched over. In those streets the gas-mains were very near the surface. In objecting to the steam-roller, the Directors were not speaking theoretically, but had before them the actual facts. There had been several cases in which steam-rollers had broken the mains. With reference to the argument that the wheels of the roller would be broad, and the pressure therefore distributed, he pointed out that where the streets were arched, the greater part of the weight would sometimes be thrown on one wheel.

* See JOURNAL for Oct. 20, 1891 (p. 711).

† These cases will be found reported in the volumes of the JOURNAL for 1884, 1885, and 1887.

After some further remarks, a suggestion was made that a conference should take place between the officers of the Company and those of the Corporation, with a view of some *modus vivendi* being arrived at.

Mr. BANKS thought the Directors should go before the Corporation on the electricity question, and say they did not take steps in the matter because they wished to create a monopoly for themselves, but because they thought they could produce electricity cheaper than anyone else.

The CHAIRMAN said it was open to the Directors to go again to the Corporation any time before next July. However, he thought if the Company went in for electricity at all they should have a monopoly. Mr. Banks must be aware that the demand for electricity would be very limited; and it would not pay anyone to supply it who had not plant, &c., like the Company, available.

The motion was carried.

A dividend of 8 per cent. was then declared for the half year ending Dec. 31 last; and the proceedings closed with a vote of thanks to the Chairman.

COVENTRY CORPORATION GAS SUPPLY.

The Powers of the Gas Committee.

A good deal of the time of the Coventry City Council at their last meeting was occupied in considering the following resolution, which was proposed by Mr. Lee: "That it be referred to the General Purposes Committee—(1) To consider and report whether it is desirable that the Gas Committee should submit to the Council for confirmation any, and if so what, portion of their proceedings, in addition to proceedings with respect to the following matters upon which that Committee are now required by the Standing Orders to make reports—viz.: Alterations in the price of gas; legal proceedings (as occasion may require); the borrowing of money for the purchase of lands or buildings, or the erection of new buildings or works. (2) To frame and submit to the Council with their report such alterations (if any) in the standing orders as may be necessary to carry their recommendations into effect." Mr. Lee had not much to say in support of the resolution. He believed that if the Gas Committee were privileged, they should enjoy their privileges with immunity; but then the question as to whether they should be a privileged Committee, and how far, was another question altogether. In thinking over this matter, he did not forget that in every business of importance there were certain things which should be known only to the head; and he took it that, in this Committee as in any other, the same principle ought to apply. He had been told—he had heard it said by members of the Council—that the arrangement by which the Gas Committee had power given to them was an oversight, or a mistake. He did not believe that for one moment. The Council, he was sure, were too well advised for anything of that kind to take place. But there was a feeling of irritation occasionally respecting this Committee; and he heard only the other day of a question being asked in Committee if a certain matter of business which was then being considered was to be reported to the Council, and the answer was: "No; we are not amenable to the Council; we are a Council in ourselves. We have full powers." Mr. Starley seconded the resolution; and then the Chairman of the Gas Committee (Mr. Andrews) said that he failed to see that Mr. Lee had produced a single good reason in favour of his proposition. He might remind the Council that the Gas Committee consisted of fifteen members—that was fully one-third of the Council. In other towns the Gas Committees were much smaller. At Birmingham, for instance, where there was a turnover in the Gas Department of half a million sterling, the Committee consisted of only nine members, including the Mayor. As to the powers of the Committee, he might safely say there was no oversight or mistake whatever when their duties and powers were fixed seven years ago; and they were mainly modelled on those of the Leicester Gas Committee. Mr. Wormelly said probably Mr. Andrews could explain how it was that at Leicester the question of salaries was decided in open Council. That was a slight difference which, however, might not appear of any consequence to Mr. Andrews; but it was a difference in the opinion of many people that was very important. He should support the resolution, although he did not altogether agree with the manner in which Mr. Lee had put it before them. Alderman Marriott believed that, as far as the Gas Committee were concerned, the interests of the Council were in perfectly good hands. If there was anything wrong at the gas-works, surely some one member out of the whole fifteen would come before the Council and have a complaint to make. It did not follow, in his opinion, that because the salaries of the gas managers at Leicester and Birmingham, or any other town, were discussed in open Council, that injustice was done to either those managers or to the Council of Coventry. Mr. Loudon observed that an arrangement by which the Manager (Mr. G. Winstanley) would ultimately receive £1,400 a year had been brought down to £850; and he thought it was right that the Council should have some voice in settling the salaries of the head officials of the department. Mr. Worwood having expressed his intention of voting for the resolution, Alderman Dalton said he hoped the members of the Council who were in favour of this motion did not suppose there was a single member of the Gas Committee who had not the interests of the city at heart; but beyond the members of the Committee, he thought, if this motion were carried, it would be not only a reflection on, but a positive humiliation to, their excellent Gas Manager. Hitherto he (Alderman Dalton) had laboured under the impression that they had one of the best managers in England. He had never heard one single complaint against Mr. Winstanley; but he had heard many complimentary observations, and he thought that, by attempting to disturb the present arrangement, and upsetting the Committee, they were opening a door that would lead to future confusion in the Council. After further discussion of a similar nature to the foregoing, Mr. Lee wound it up by remarking that the resolution did not settle anything definitely. It merely asked the General Purposes Committee "to consider and report as to whether it is desirable." If they decided it was not desirable, he should accept their decision, and there was an end of it. The voting then took place, and the Mayor declared the resolution carried.

PROVINCIAL GAS AND WATER COMPANIES.

The following paragraphs contain some particulars as to the working of various Provincial Gas and Water Companies during the periods mentioned.

Gas Companies.

The Directors of the Canterbury Gas and Water Company, in submitting the two half-yearly statements of accounts for the year ended Dec. 31 last, congratulate the proprietors upon the continued prosperity of the undertakings. In the gas department all the plant at the works has been maintained in efficient order, and it is equal to the present requirements. It is not proposed to make any additional capital expenditure during the ensuing year, beyond a small amount which will be required to increase the size of the distributing mains in places where the demand for gas renders such a course necessary. In the water department, the Directors are glad to be able to state that a new engine, pumps, and machinery have all been most satisfactorily completed by the Resident Engineer (Mr. Buckley). Arrangements have been made to lay down an additional rising main between the pumping-station and St. Thomas's Hill reservoir in the coming summer. The amount now standing to the credit of the dividend account is £4639; and the Directors recommend that a uniform dividend at the rate of 4 per cent. be declared on the gas and water stocks, and paid free of income-tax, making, with the interim dividend, 8 per cent. for the year.

The ordinary general meeting of the Caterham and District Gas Company was held at the Guildhall Tavern on the 17th ult.—Mr. F. A. White presiding. The Directors, in their report, stated that the net profit for the past year, after the payment of interest on debentures and the temporary loan, was £1057. This, added to the balance brought forward (£642 12s. 4d.), with the interest on deposit, left £1736 available for distribution. From this the Directors recommended the payment of a dividend of 7½ per cent., free of income-tax. The Chairman, in moving the adoption of the report, said that, as compared with the two previous years, the working in the period covered by the report had been of a very satisfactory nature. There had been a larger consumption of gas, and a greater sum had been earned; and this notwithstanding the fact that the price of the Company's gas had been reduced. The cost of coal, too, had been greater than in the preceding year; if it had remained the same, they would have increased their income by upwards of £200. This, in itself, showed that the reduction in the price of gas had led to increased consumption. The sale of residuals had yielded less than last year, in consequence mainly of there not having been so large a demand for coke as formerly, although the quantity on hand at the present time was very considerable. He regretted to inform the shareholders that Mr. H. W. Smith, who had been connected with the Company for many years as Secretary and Manager, had resigned; having accepted an appointment abroad. The Board had engaged the services of Mr. G. W. Anderson to succeed Mr. Smith in the office; and he hoped that the Company would continue to progress under his management. Mr. P. H. Hall seconded the motion; and it was carried—a dividend being declared in accordance with the recommendation of the Directors. A vote of thanks to the Chairman concluded the proceedings.

The half-yearly meeting of the Derby Gas Company was held last Wednesday. Mr. H. Swingle, J.P., presided; and, in the course of his remarks, he said the Directors had expended £1395 in securing two pieces of land for the extension of their works at Litchurch, and carrying out the works recently authorized by Parliament. A sum of £5124 had also been spent on new buildings; the principal item in that amount being the settlement for the buildings and the extension of plant in Cavendish Street and renewals. There had been an increase in the sale of gas and residuals. Last year the amount spent on coal was £28,558, and the wages for carbonizing alone were £8260; and both these items showed an increase. They had drawn from the reserve fund to the extent of £2814; and as £2235 was abstracted from the same fund in June last, it had reduced it to something like £10,000, in round figures. He, however, hoped that shortly the present state of affairs would be altered, and that they would return to the condition of things which existed in 1888-89. The balance-sheet was approved and adopted. Dividends on the different stocks were then declared at the rate of 10, 7, and 5 per cent. per annum.

The annual report of the Directors of the Eckington and Mosbro' Gas Company states that, after providing for bad and doubtful debts, the profit and loss account for the past year stands at £1557; and a dividend of 8 per cent. is recommended on the original or £1 shares, and 7 per cent. on the £5 shares, £200 is added to the reserve fund, and a balance of £655 carried forward. A new two-lift telescopic gasholder, capable of containing 80,000 cubic feet of gas, has been recently erected at a cost of £2502, including the purchase of additional land.

The annual report and balance-sheet of the Elland Gas Company shows that during the year the capital account has been augmented by £930; the sum of £446 having been spent on new condensers, steam-pump, and testing apparatus, and £484 on extensions of mains. This leaves a balance to the debit of capital account of £649. The profits, including the balance brought from the previous year, amount to £4426. An interim dividend at the rate of 12 per cent. per annum was paid for the June half year, absorbing, with the prescribed dividends on the preference shares, and interest on the loan capital for the year, £2306 and leaving a balance of £2120 now available for dividend. The Directors recommend that out of this sum, after providing the prescribed dividends on the preference capital, a dividend of 12s. per share on the ordinary capital be declared for the past half year, making the dividend for the year 12 per cent. In consequence of a continued increased consumption of gas, considerable alterations and additions will have to be made to the manufacturing plant to meet next season's requirements. Consequently the Directors have under consideration the advisability of issuing 500 £10 4½ per cent. preference shares in the course of the present year.

The half-yearly report of the Directors of the Gloucester Gas Company states that the balance carried to profit and loss from the revenue account shows a falling off, compared with the corresponding period of 1890, of nearly £1900. This is mainly attributable to the increased

price paid for coal and to the large decrease in the receipts for coke, owing to the low price at which it has had to be sold. The Directors express a hope that this is only a temporary state of affairs, as they are anxious to avoid raising the price of gas. They are pleased, however, to be able to report a satisfactory advance in the revenue from the sale of gas. After deducting interest on mortgages, &c., the net profit is £2099; and the Board recommend that the usual dividends be paid, which will amount to £3484—thus leaving a deficiency of £1385 to be met from the undivided profits. The 544 "C" third series shares offered to the shareholders in August last have been taken up; and the first and second calls of £5 each per share paid. In view of the continued increased demand for gas, the Directors are advised that a further extension in the manufacturing plant is necessary. This will involve additional capital outlay, to meet which a further call of £5 per share will be made during the current half year.

In the report submitted to the proprietors of the Harrogate Gas Company, at their half-yearly meeting last Friday, the Directors congratulated them on the outcome of the past year's operations. Notwithstanding the additional cost of coal, and the presence of other adverse conditions, they were in a position to present a very satisfactory revenue account—a result attained mainly by an increased consumption of gas, an improvement in the value of residuals, and the exercise of prudent economy in every department of expenditure. The accounts presented (covering the entire year) showed a sum of £7104 available for division; and out of this the payment of the balance of the statutory dividend for the year was recommended—leaving a sum of £2488 to be carried forward. The Directors alluded with satisfaction to the appreciation by their customers of their efforts to encourage the use of the most effective and economical apparatus for the consumption of gas—whether for cooking, heating, or lighting purposes. In this connection, it may be mentioned that of the 112,673,000 cubic feet of gas made last year, 76½ millions were sold for lighting purposes, and 17½ millions (registered separately) for gas-stoves, &c.; while about 9 millions additional were estimated to have been consumed in stoves but registered as lighting gas. Allusion was made by the Directors in the report to the retirement of Mr. P. H. Wilkinson, who for 32 years discharged the duties of Secretary and Engineer of the Company, and to his election as a member of the Board. These two offices have now been divided; Mr. H. Wilkinson taking charge of the secretarial work. Reverting to the accounts, the total receipts in the past year amounted to £21,105; the expenditure to £12,580 (coals figuring for £7791). The bulk of raw material dealt with amounted to 11,261 tons; the residual products being 6807 tons of coke, 523 tons of tar, and 97½ tons of sulphate of ammonia.

The Directors of the Harwich Gas Company, in their annual report, state that there is a balance of net profit for the year of £1098. This shows an increase upon the previous year of £259, which, in the face of the continued high price of coal, is satisfactory. The total make and consumption of gas shows a slight falling off; but this is attributable to the expiration of the Company's contract with the Public Health Committee of the borough in July last, and the consequent loss of half a year's consumption by the Authority. The Directors offered to make a fresh contract with the Public Authority on very reasonable terms. But their offer was refused; and though negotiations have recently been reopened by the Authority, no agreement has been arrived at, and the streets continue to be illuminated by oil-lamps. The consumption of gas by private consumers shows the satisfactory improvement of 8 per cent. The Directors recommend the payment out of the net profits of a dividend at the rate of 7 per cent. on the original shares, and 5 per cent. on the additional shares, which will absorb the sum of £941.

At the recent half-yearly meeting of the Ossett Gas Company, the Chairman (Mr. W. Statter) stated that during the past six months there had been a considerable expenditure upon additional purifiers. New cupping had also been provided out of revenue for one of the gasholders, which was not likely to need any further repairs for twenty years to come. The works were in first-class order; and the consumption of gas had increased more than 7 per cent. in the last twelve months. He did not know of another gas company in the kingdom which could show an equal increase. The reserve fund was at the maximum amount; and, owing to the special expenditure referred to, £742 was being taken from it in order to make up the amount required for the usual dividend. Resolutions were passed declaring dividends of 10 per cent. on the "A" shares and 7 per cent. on the "B" shares.

The report of the Directors of the Pontefract Gas Company, submitted at the half-yearly meeting of the shareholders last Friday week, showed that during the year 15,255,082 cubic feet of gas had been sold at 2s. 10d. per 1000 cubic feet; realizing £2161. The amount divisible among the shareholders was stated to be £1696, £943 of which it was decided should be used in paying the maximum dividends of 10 per cent. per annum on the original shares, and 7 per cent. on the new ordinary shares—the balance being carried forward. The sale of residuals, it was also mentioned, had realized £582; and the average price paid for coals during the half year had been 11s. 11d. per ton.

The Directors of the South Shields Gas Company are able to submit to the proprietors a very good account of the working of the past year. Compared with the preceding twelve months, the results showed an improvement. In the sale of gas, there is a gross increase of 11,595,153 cubic feet; and in the rental, £5658—a large proportion of the latter being due to the increased price of 3d. per 1000 cubic feet which came into operation at the beginning of the year. (The bulk of the gas is sold at 2s. 6d., and a small quantity at 3s. 3d. per 1000 cubic feet.) The receipts from residuals show a slight decrease. A better price has been obtained for coke, at the same time there has not been such a good sale for it as during the previous twelve months. The coal cost £2520 more for the year. This is partly due to the increased quantity carbonized; but chiefly to some of the high-priced contracts, which did not terminate till well on in the year. Cheaper contracts are now in operation, and will tell in favour of the current year's revenue. The gross balance of profit for the year is £17,600, as against £14,804 for 1890. After deducting interest paid on loans, and the interim dividend, there is an available balance of £9081. This sum admits of the payment of 5½ per cent. for the past half year, which, with the 4 per cent. paid in March last, makes 9½ per cent. for the year, the full amount the

proprietors are entitled to according to the present price of gas under the sliding scale; leaving a balance of £906 to be carried forward. From the accounts, we learn that the sale of gas and public lighting produced £44,131; the rental of meters, stoves, engines, and lamps, £3181; residual products, £13,777; and sundry items, £485. The total amount of the disbursements on revenue account was £43,975, of which coal absorbed £22,652. The balance of profit is £17,600.

In addressing the shareholders at the recent annual meeting of the Uxbridge and Hillingdon Gas Consumers' Company, the Chairman (Mr. W. Fassnidge) stated that, as compared with 1890, the shareholders would observe that the receipts for gas and meter-rental, residual products, &c., were less than the year previous by the small sum of £32, which was accounted for by the lowering of the price of gas by 3d. per 1000 cubic feet, from Lady-day, 1890. The quantity of gas sold and brought to charge in 1890, was 33,575,100 cubic feet; and in 1891, 34,972,000 feet—showing an increase in the consumption of 1,352,800 cubic feet. A great portion of this increase was attributable to the gas being used for trade purposes, and therefore not charged at the same price as if employed for illumination. On the expenditure side of the account, it would be seen that the gross expenditure for the year was more than for 1890. This was partly made up by the extra cost of coal, partly by the use of more canal coal, and by the rise in wages. Turning to the profit and loss account, he said it showed that, after paying debenture interest, &c., there remained a sum of £2297; and by having recourse to the reserve fund to the extent of £300, they obtained the sum of £2597, which was sufficient to pay the statutory dividend. Referring to the question of the assessment of the works and plant, he said that it had been considerably increased, and the Directors thought it advisable to appeal against it. But he was sorry to say without any good result. He was of opinion that it would be advisable to again appeal against the assessment; and if then the Assessment Committee would not give them the relief sought for, they should take the question by way of appeal to Quarter Sessions. This matter would be brought before the Directors at their next meeting. The report and accounts were adopted.

The Directors of the Walker and Wallsend Union Gas Company report to the proprietors that the operations of the past year have proved even more favourable than in the year 1890. The accounts show that the revenue amounted to £16,109; and, after deducting the expenditure, a balance of profit remains of £4818. The Directors state that they have lost no time in proceeding with the necessary alterations and extensions mentioned in their last report. They have laid new 8-inch and 4-inch mains in Walker a distance of 1620 yards. At the Willington works, some of the old plant has been removed and replaced by a large gasholder, new pumping-house, engine-house, condenser, &c. The removals have been charged to depreciation account; and it is proposed that the amount be written off, over a period of seven years. The Directors, therefore, suggest that the amount to be deducted from profit and loss for the depreciation fund for the past year be £500. An interim dividend of 3½ per cent. for the first half year was declared in August last, less income-tax; and the Directors now recommend that a dividend be declared at the rate of 4½ per cent. for the second half, making 8 per cent. for the year.

The half-yearly meeting of the Wolverhampton Gas Company was held last Tuesday. The report and balance-sheet showed that the total receipts amounted to £35,871; and the expenditure to £29,551—leaving a profit of £6320. A dividend of 5 per cent. upon the consolidated stock and 3 per cent. on the preference shares was proposed, leaving £48 to be carried forward. Great regret was expressed by the Directors, in their report, at the death of the former Chairman (Mr. John Underhill), who had been a member of the Board for 35 years. The Chairman (Mr. H. W. Owen), in moving the adoption of the report, said he considered the balance-sheet was satisfactory. Although the cost of coal and other materials, and also the price of labour, had increased greatly, they would not be compelled to raise the price of gas. They were extending their means of production so as to meet the increased business brought by the growth in the number of customers and the more general utilization of gas for domestic purposes. Mr. Ward seconded the motion, which was carried, and the dividends as recommended were sanctioned.

Water Companies.

The shareholders of the East Worcestershire Water Company held their half-yearly meeting at Birmingham last Thursday. The Secretary (Mr. P. W. Walker) read the report of the Directors, which stated that during the half year supplies had been laid on to 171 premises, making the total on Dec. 31 last 2693. The water pumped from the Burcot Well had been, on an average, 356,924 gallons daily. Extensions of the mains had been made at a cost of £916. An agreement for the supply of Droitwich was sealed on Sept. 17 last; and contracts were entered into for the supply of the necessary mains with Messrs. Cochrane and Co., and for the main-laying with Messrs. Jones and Fitzmaurice. The work was commenced without delay; and up to the end of the year, there had been laid 5320 yards, leaving 3480 yards to complete the main to Droitwich. The cost incurred to Dec. 31 was £1772, which amount had been brought into the accounts. To provide for this and other extensions, agreements had been entered into for a loan of £4000, at 3½ per cent. per annum. The half-yearly accounts were also submitted to the shareholders. The profit shown was £508, which was added to the balance left from the previous six months, after payment of the dividend; making a total to credit of revenue account of £1302, which it was proposed to carry forward to next account. There had been a small increase of expenditure for the maintenance of works, and the pumping charges had also increased. The whole of the machinery, plant, and mains were in a state of efficiency. On the motion of the Chairman (Mr. C. P. Noel), the report was adopted.

The half-yearly meeting of the South Staffordshire Water Company was held last Thursday at Birmingham. In moving the adoption of the report, which was noticed in the JOURNAL for the 16th ult., the Chairman (Mr. F. James) remarked that the progress made by the undertaking during the past year had been very satisfactory, although the increase in the amount of water-rates had not been quite so large as was expected. The amount received from service laying was rather less; while the rents and interest were a little more. The engine

charges amounted to a very large sum—£4722, as against £3788; but this increase was mainly accounted for by the greater quantity of water pumped. An addition of upwards of 84 million gallons of water had been pumped from the main sources; and besides that there were something like 184 million gallons in excess re-pumped at the Wood Green and Coney Green stations. In one sense this was satisfactory; yet, notwithstanding the increased quantity of water, there was a diminished revenue from the meters. The amount due to the Company by persons for water-rates and service accounts was less than at the corresponding period—£9868, as compared with £10,220. The value of stock and materials was £2012, against £1695; and the cash at the bankers amounted to £17,830. It was out of this balance at the bank that the dividend proposed on the ordinary stock would be paid. The report stated that the cost of the new works would exhaust the amount of capital available under the Company's existing Acts of Parliament, and that it would be necessary to apply for further powers next year. Out of a total of nearly £17,000 expended on capital account in the half year, £15,000 had been spent on the new works and pumping-stations. In 1883, when first the Company went to Parliament, they asked for power to raise only £160,000; since then their powers had been increased to £950,000. Hitherto the fresh capital had been allotted to the shareholders at par, so that they had the benefit of the interest on it, or they could sell the shares at a premium. But this could not be done in the future. The report was adopted; and it was then agreed that a dividend for the half year should be declared on the preference stock at the rate of 5 per cent. per annum, on the Dudley preference stock at the rate of 4 per cent. per annum, and on the ordinary stock at the rate of 5½ per cent., and that interest at the rate of 3 per cent. per annum be paid on the instalments of the new ordinary stock.

The annual general meeting of the Sunderland and South Shields Water Company was held last Thursday, when the accounts presented showed a balance of £35,807 available for division. This was sufficient to enable the Directors to recommend a dividend at the rate of 4½ per cent. on the ordinary and preference stocks of the Company for the half year ending Dec. 31, 1891; making, with the interim dividend paid in September last, 9 per cent. for the year; and also to pay interest at the rate of 5 per cent. per annum on the amount called up on the shares allotted on Sept. 3, 1875. The Bill which was before Parliament at the last annual meeting duly received the Royal Assent; and the Company are now empowered to raise such an amount of additional capital as will be amply sufficient to meet any demand for water which may arise for many years to come. One of the sites, however, selected by the Engineer on which to erect a pumping-station and other works did not receive the sanction of Parliament; and, in consequence, the Directors have been advised to apply for power to purchase other land suitable for the purpose.

The half-yearly general meeting of the West Surrey Water Company was held at the Chief Office, No. 38, Parliament Street, S.W., last Thursday—Mr. A. T. Simpson, M. Inst. C. E., presiding. The report of the Directors stated that the income in the six months ending Dec. 31 last was £2718, and the expenditure £1002. As compared with the corresponding period of 1891, there was an increase of £227 in the former, and a decrease of £15 in the latter. The amount available for division was £1699; and the Directors recommended the payment of a dividend at the rate of 4 per cent. per annum. After the payment of this and the dividends upon the preference shares, there would be a balance of £464. During the half year, 1203 yards of new mains were laid, and 58 new supplies connected, representing a future rental of £115 per annum. The Engineer and Manager (Mr. J. K. Hill) reported that the whole of the works were in good order. The Chairman moved the adoption of the report; and the motion was carried. Dividends at the rates of 5 and 6 per cent. per annum were declared on the preference shares, and of 4 per cent. per annum upon the ordinary shares.

The half-yearly meeting of the Woking Water and Gas Company was held at the London Offices, last Tuesday. Lieut.-Col. Galt, J.P., presided, and moved the adoption of the report and accounts, which were noticed in this column last week. He first congratulated the shareholders upon the fact that the Directors were able to recommend a dividend of 4 per cent., which was ½ per cent. in excess of any dividend previously declared. The revenue showed an addition of about £360; and if the building operations in the locality went on in the same way as hitherto, the revenue would continue to increase. Having reminded the shareholders that the Directors had purchased the Company who had power to supply water in the Farnborough and Frimley district, he said that he hoped in time the Act of Parliament they had thus obtained would become very valuable. They had entered into negotiations with the local authorities of those places, who were anxious that the Company's water should be brought into their districts; but the Directors had tried to safeguard the interests of the Company so far by not entering into any large expenditure, unless they received a guarantee of a substantial character. The inhabitants of Farnborough, through a deputation, had placed before them a list of gentlemen who had agreed to pay altogether £500 a year for water; and he had no doubt Frimley would do the same when the Company were in a position to say they would take steps to give them a supply. Their Engineers (Messrs. J. Quick and Son) had estimated that the entire cost of laying mains from Woking through Farnborough and Frimley, including the service-pipes, would be, in round figures, £20,000. The Board did not propose asking the shareholders at present for power to raise new capital; but the day he hoped would come when they would do so. It would depend in a great measure as to how much capital would be subscribed in the district; and some of the leading inhabitants said that there was no doubt they could get a large sum—say, £10,000—from the neighbourhood. Now that the Company were paying 4 per cent., there would not be so much trouble in issuing the capital as when they were paying a smaller dividend. Mr. Charles Horsley seconded the motion. A little discussion followed, in the course of which Mr. Randall asked what consideration had been made to them for the right of supplying gas in the district by the Company which had been formed for the purpose; and the Chairman informed him that they had received £500. The motion was adopted; and subsequently the dividend was declared and the retiring Directors and Auditors were re-elected.

HEYWOOD CORPORATION GAS SUPPLY.

The Growth of the Undertaking.

Last Wednesday week, the members of the Heywood Corporation, on the invitation of the Gas Committee, visited the gas-works, for the purpose of inspecting the extensive alterations and improvements which have been completed there, to enable the Committee to keep pace with the increased demand for gas, and to assist them in improving its quality. A goodly number of the members responded to the invitation. The party made a complete inspection of the additions to the plant, which have been in course of construction for many months past, and which comprise a large new gasholder, engine-house, two engines and exhausters, two boilers, and a capacious purifying-house, capable of accommodating another set of purifiers equal to those already in operation. The engine-house is a handsome little apartment in comparison with the one which formerly existed; and the old engine has been erected in another part of the works, and utilized for a different purpose. Over the engine-house is a laboratory, and adjoining is a room for the use of the stokers and workmen. The members of the Council seemed to be well satisfied with the manner in which the capital (amounting to £3000) has been expended. The company subsequently had "high tea" together, after which the Chairman of the Committee (Mr. Lawton) made a statement containing statistics in reference to the extensions, and the increase in the consumption of gas in the town since its incorporation in 1881. In that year the quantity of gas sold amounted to 51 million cubic feet; while last year it had so increased that the figures reached a total of 75 million feet, or an increase of 24 millions in the ten years. In 1886, the Gas Committee commenced to let out cooking stoves on hire. Previous to that, no gas was used in the town for domestic purposes, and very little for motive power. At the present time, however, the consumption for cooking and heating and motive power amounted to more than 3 million feet per annum, which showed that the Gas Committee of that period adopted a principle the application of which had turned out to the mutual advantage of the producers and the consumers and the ratepayers. In 1881, the capital expended on the gas-works amounted to £62,689, or an average cost of £1 4s. 4d. per 1000 cubic feet on the consumption of gas at that date. In 1891, the capital expenditure amounted to £70,744; showing an increase of £8000 on the capital account. This sum had been spent in the period dating to 1889. In that year the Gas Committee decided to close the capital account; and what alterations or additions had been completed since, had been done out of revenue. They had provided the new sulphate plant, and spent £600 upon it, out of revenue; and he hoped that a great portion of the expenditure on the new works which they had that day inspected would also be paid for in the same way, or from the reserve fund. Now, with the capital account still standing at £70,744, it only averaged 18s. 8d. per 1000 feet of gas consumed, or 5s. 8d. less than in 1881. Within the last two years, since the price of gas had been reduced, the consumption had increased by 10 million cubic feet. In 1889, 1,750,000 cubic feet was used for stoves and motive power; while in 1891 the total had reached 3 million feet. In the course of a conversation which followed, many of the members of the Council expressed their satisfaction with the statement which had been laid before them.

Gas-Engines for Electric Lighting in Theatres.—The London County Council have adopted a series of rules and regulations with regard to the electric lighting of theatres and other places of entertainment. One is that gas-engines employed in this connection are to be placed in rooms so adequately and continuously ventilated that no explosive mixture of gas can accumulate by any leakage from the engine in the event of any of the gas-cocks being left turned on. A hood, connected with a pipe carried into the external air, is to be fixed over the ignition-tube, when this is used.

New Water-Works for Marlborough.—At the recent quarterly meeting of the Marlborough Town Council, the Committee appointed to consider the advisability and probable cost, &c., of the proposed water-works for the borough reported that they had made inquiries, and obtained much valuable information; and they were led to believe that works could be provided at a cost of between £4000 and £5000. They therefore recommended the Council to construct and maintain works for the district, and that they should be empowered to employ an engineer to prepare the necessary plans, &c. They also desired permission to make application to the Local Government Board for power to borrow a sum not exceeding £6000 for the purpose. The Mayor (Mr. M. Jeans) proposed that the report and recommendations be adopted and carried into effect. After considerable discussion, Mr. Head moved, as an amendment—"That a census be taken of the town in respect to the water-works, and whether householders would take the water." This was seconded, but finally defeated by ten votes to five; and the original motion was carried by a corresponding majority.

The Liverpool Corporation and the Electric Lighting Company.—At a recent meeting of the Watch Committee of the Liverpool Town Council, a question relating to the electric lighting of the city was under consideration. The Corporation at present have power to purchase from the Liverpool Electric Supply Company the undertaking comprised in the Provisional Order of 1889 at the end of 21 years; they can also acquire the undertaking authorized by the Order of 1891 at the end of 42 years. Some time since the Company applied for the consent of the Corporation to an Order enlarging the time within which the Corporation could elect to purchase the undertaking to 42 years—that is to say, for both undertakings. The Committee decided to recommend the Council to consent to the time being extended to 40 years on condition that the Company agree to power being inserted in the Order for the Corporation to purchase as a going concern both undertakings at any time after Dec. 31, 1897, upon giving twelve months' notice to that effect. If the Corporation do not elect to purchase the undertaking under the proposed new powers, they will still be in a position to purchase the same at the expiration of 40 years without anything for the goodwill.

THE ELECTRIC LIGHTING QUESTION AT CAMBRIDGE.

At the Quarterly Meeting of the Cambridge Town Council last Thursday week, the Electric Lighting Committee reported in the following terms: "That the Town Council has received an official communication from the Local Government Board, in answer to the application of the Corporation for permission to borrow the sum of £35,000 for the purpose of electric lighting, giving the sanction of the Board to the borrowing by the Corporation of £25,840 for the above purpose. This sum is, in the opinion of the Committee, not sufficient to enable the Council to carry out the scheme proposed by Professor Garnett, so far as regards any part of the town outside of the compulsory area described in the Provisional Order. Messrs. Parsons and Co. have made a proposal to the Committee to form a Company for taking over the powers and duties of the Corporation under the Provisional Order. The Committee recommend that they be authorized to negotiate with Messrs. Parsons and Co. on the basis of their proposal, and that, failing a satisfactory arrangement with them, the Committee be at liberty to negotiate with some other firm or company for the taking over of the corporate powers." Alderman Whitmore, in proposing the adoption of the report, said he felt it would have been better if the Local Government Board had given them sufficient money to go on with the work; but they had only granted £25,840—merely the sum required to cover the prescribed area, and not sufficient to carry out Professor Garnett's views. He could not support any resolution which would confine the electric light to the prescribed area; and he thought they ought to have sufficient money, in the event of anyone outside the area requiring the light, to extend it to the whole of the town. Alderman Deck seconded the motion. Mr. Vinter said he had always opposed, and always should oppose, a grant from the rates to light any portion of the town; but he thought the advantage of the light should be within the reach of every inhabitant of the borough. He hoped, therefore, that the passing of the report did not absolutely settle the matter, and that it would be distinctly understood, if the negotiations were commenced, it would be upon the basis, at all events, of the property reverting to the Corporation upon reasonable terms and within a reasonable period. He could not help thinking that the application to the Local Government Board had been considerably "bungled." The Board only granted them a loan of £25,840, which did not admit one shilling for an alteration of plant or extension of mains. Mr. Morley said the report was not worded according to what the Committee had decided. Their idea was to ask the Company for their terms, and then bring forward two reports—one giving the cost for the Council to do the work itself, and the other the terms of the Company. He would be prepared to vote for the report if the mover would allow the following words to be added: "And bring before the Council two schemes—first, for the Corporation lighting the prescribed area itself; and, second, the offer of any company." Mr. Flack proposed, as an amendment, that the report should be referred back to the Committee; and Mr. Huddleston seconded—the latter gentleman remarking that he trusted the report would go back to them with an understanding that as a company was to have the risk, it should have the profits also. It was not to be supposed that any company would accept a contract for only seven years. Several members expressed the opinion that there was no reason for the report being referred back; and the amendment was afterwards defeated, and the report adopted.

St. Helens Corporation Water-Works.—The Local Government Board have written to the Town Clerk of St. Helens (Mr. W. J. Jeeves) sanctioning the borrowing of £2100 for water supply purposes. The works contemplated are the construction of a new 6-inch main from the Sutton pumping-station to the Brownedge large reservoir, and also the enlargement of the supply-pipes from the reservoir to the borough; the present pipes being insufficient.

Birmingham Electric Supply Company.—The ordinary general meeting of this Company was held a few days ago. The report of the Directors stated that the accounts upon which the document was based were only for a period of nine months, which was in consequence of the alteration of the date of the closing of the financial year. The accounts for that period showed a profit of £714, which, after taking into consideration the fact that the period over which the accounts extended included the six summer months, the result was deemed satisfactory. Of the profits, £352 had been applied to the depreciation reserve account; and the Directors recommended that the balance be carried forward to next year's account. The demand for the light had been most satisfactory; and from the very ready way in which it had been taken up, the Directors fully anticipated a large increase in the output of the station, to supply which they proposed putting down further plant.

Railway Carriage Lighting.—The Right Hon. John Young, Chairman of the Northern Counties (Ireland) Railway, at the half-yearly meeting of the shareholders on the 12th ult., referred in his speech to the change which was being wrought in the system of lighting their passenger carriages. It was, he said, a change from oil to gas; and gas had been chosen, after careful consideration and inquiry, as being the best illuminant at present known for this particular purpose. Again, at the recent half-yearly meeting of the Great Northern Railway Company, the Chairman (Lord Colville of Culross) said they were abolishing oil-lamps as fast as they could, and substituting oil gas at a cost, which might appear extravagant, of £100,000. They had had to build gas-works in London, Doncaster, and Leeds, and to alter the fittings. But it would be an economy in the end, as they would get rid of all that lamp-cleaning and so on, which not only cost a good deal of money, but occupied a vast amount of time. The Directors had not taken this course without having well considered it. Electricity had been recommended; and they had tried it, but they had not much faith in it for railway purposes. It was, no doubt, a very good light if it could be trusted. But in oil gas they had full confidence; and, though it cost a great deal of money to supply, he was sure that in the end it would be beneficial and economical to the Company.

METROPOLIS WATER SUPPLY.

The London Water Question and the Birmingham Water Scheme.

In view of the suggestion contained in the report of the Select Committee of last session on the Metropolitan Water Bills, that Parliament should consider, before granting any powers for further encroachment upon the possible fresh areas of supply, "how far provision ought fairly to be made for the possible requirements alike of the Metropolis and of the other large populations upon the lines of supply," an opinion has prevailed that the scheme of the Birmingham Corporation for conveying water to the Midlands from Wales should not receive legislative sanction until the Royal Commission which has been promised to inquire into the question of the water supply of London has completed its labours. As the result of this feeling, a conference of gentlemen interested in the question was held on Monday last week, by invitation of Sir J. Lubbock, Bart., M.P., at the offices of the London County Council, to consider what action should be taken in the interests of the Metropolis. The gathering was essentially a representative one; amongst those present, in addition to members of Parliament for London and suburban constituencies, being members of the London County Council and the Corporation of the City of London, and representatives of the home counties immediately affected. The meeting was private; but the London Correspondent of the *Birmingham Daily Post* forwarded to that paper the following account of what transpired: "After Sir John Lubbock had explained the object of the meeting, a discussion took place as to how the Birmingham Bill should be met; and it was proposed that the measure should be postponed for a month, pending the consideration of the London Water Question by the promised Royal Commission. This was opposed by Sir Guyer Hunter, an authority on the subject, who took a leading part in the inquiry held in 1890 by the Corporation of London, and who is not only, I believe, generally in favour of the Birmingham Bill, but is of opinion that such an investigation as that by a Royal Commission would occupy at least 18 months. It was argued in the course of the discussion, which throughout, I am told, showed no spirit of antagonism towards Birmingham, that your city, upon the admission of Sir Thomas Martineau, was not in immediate need of the proposed additional supply, but wanted to be ahead of London in the matter of going to Wales for water; and that as the capital would certainly want a large extra amount before ten years have passed, it would be adverse to her interests to allow the Welsh watershed to be absorbed by Birmingham. One of the members present, who is also a Director of a Water Company, seemed to suspect that the anxiety of the London Council for a second supply was in order to affect the price at which it hopes ultimately to buy up the Companies; while it was asked by another why, if the matter were so urgent, the Companies themselves did not oppose the Birmingham Bill. The general feeling, however, was that it would be well for London and Birmingham to come to an understanding on the point, and that no further step should be taken in regard to acquiring the Welsh watershed until the proposed Royal Commission, with its reference so broadened as to include (in accordance with the Select Committee's recommendation) an inquiry into the possible requirements of all the large populations upon the lines of supply, had made its report. Ultimately it was proposed by Mr. S. Buxton, seconded by Mr. Bristowe, and carried unanimously, that a Committee, including Sir John Lubbock, Mr. Buxton, Mr. Bristowe, Mr. Dixon-Hartland, Lord Compton, Mr. Murdoch, and Mr. H. L. Lawson, should be appointed to confer with the members for Birmingham and the representatives of your Corporation as to the postponement of the next stage of the measure. The Metropolitan members are all agreed that, although they do not desire to move its rejection at this point, the question is one of national, rather than of local, importance, and ought to be thoroughly and impartially examined before being decided upon. If the postponement asked for is not granted, therefore, strong opposition may be looked for. I may add that Mr. Richard Chamberlain, who was present at the conference as a Metropolitan member, was invited to join the Committee, but declined, on the ground of his old connection with Birmingham. As to the Royal Commission itself, it can be said that it will be a small one, composed of experts, that it will very shortly be gazetted, and that it is expected to report within the year."

At the meeting of the London County Council on the following day, Sir J. Lubbock explained that since the last meeting—in fact, on the previous Friday morning—it had come to their knowledge that the Birmingham Corporation had put down their Water Bill for second reading as for Monday (the 22nd ult.). The Council would remember that they passed a resolution agreeing to petition against the Bill; but he was not quite sure whether the Council would like to oppose the second reading. At the same time, having regard to the importance of the question, he thought that he ought not to allow the second reading of the Bill to pass unquestioned. Under these circumstances, he took upon himself to summon a meeting of members of Parliament representing the Metropolitan and home county constituencies and representatives of the County Councils interested—a course which the Chairmen of the Water and Parliamentary Committees had approved. He also saw Mr. Chamberlain, who courteously agreed to postpone the Bill for a week. A conference was held on the previous day, at which a general opinion was expressed that, after the representation of the House of Commons Committee of last year, it was undesirable that any other areas should be appropriated until the Royal Commission had reported on the whole subject. At the same time, being anxious to meet the views of Birmingham, if possible, a Committee was appointed to confer with the representatives of that city, and see whether any satisfactory arrangement could be arrived at. The Committee included Mr. Lawson, Lord Compton, Mr. Buxton, Mr. Bristowe, Mr. Murdoch, Dr. Evans, and Mr. Dixon-Hartland. In issuing invitations to the conference, he was actuated by the desire to act with the Metropolitan and home county members; and he hoped that he had acted in accordance with the wishes of the Council.

As the outcome of the proceedings above recorded, a conference took place last Thursday at the House of Commons between the Committee representing Metropolitan interests and the members for

Birmingham, who were accompanied by the Mayor (Mr. Lawley Parker), the Chairman of the Water Committee of the Corporation (Sir T. Martineau), and the Town Clerk (Mr. E. Orford Smith). The subject for consideration was introduced by Sir J. Lubbock, who stated, in the first place, that he wished to disclaim the slightest feeling of hostility towards Birmingham; but that, having regard to the report of the Select Committee of the House of Commons last session, he thought it was his duty to take the opinion of the Metropolitan members of Parliament before the Birmingham Bill was read a second time. He had communicated with Mr. Chamberlain, and had been met in the most friendly manner; and, as a result, the second reading of the Bill had been postponed for a week, to enable the conference to be held. He wished to know whether the position of Birmingham as regards its Water Bill was urgent, or whether it would not be possible to delay the application to Parliament until the proposed Royal Commission had reported. Other Metropolitan members having asked a similar question, Mr. J. Chamberlain replied that, in answer to Sir J. Lubbock's inquiry, he must inform him that the wants of Birmingham were pressing, and that a very serious responsibility would rest upon the authorities of the town if they allowed any delay in promoting the Bill that had been so carefully considered, and had occupied so long a period of their time. As to the precise extent of land in Wales proposed to be taken by Birmingham, he pointed out that the area of the watershed suggested to be taken only extended to 70 square miles, while in the immediate locality there were watersheds extending for 700 square miles that would be still available for London. He strongly urged that it was essential for the compulsory supply of water to Birmingham by gravitation that the reservoir site should be at an elevation of something like 800 feet above the sea; and that the Elan district was the most suitable. On the other hand, owing to its lower elevation, London could be supplied from a level of 450 to 500 feet. Thus, while the whole district was available for the supply of London, only a part—namely, that which had been scheduled—was suitable for Birmingham. It was also pointed out that the quantity of water to be obtained from the 70 square miles scheduled on the Elan would only afford sufficient water for Birmingham and the towns *en route*, and would be quite insufficient in itself for the greater population of London; but that from the 700 miles of watershed left untouched by Birmingham, a population of 20 million might be adequately supplied. The result of the discussion was that the representatives of London asked for a short delay, in order to enable them to report; and on this ground, and on the understanding that it would not in any way imperil the prospects of the Bill as regards the time at which it would come before a Committee of the House of Commons, Mr. Chamberlain consented to a postponement of the second reading for one week—viz., to Tuesday, the 8th of March. The conference was throughout of a very friendly character; and it was generally felt that considerable information had been obtained, and that the meeting had been of advantage. After the Birmingham deputation had retired, the London Committee considered their position in the light of the promoters' explanation; and there being an evident disposition to accept this as satisfactory, it was agreed that Sir J. Lubbock should convene another representative meeting to receive the Committee's report. It was decided to draft clauses (1) empowering the promoters of any future scheme for the benefit of the Metropolis to cross the aqueducts erected by the Corporation of Birmingham, and (2) providing that any arrangements for compensation shall be fair to London as well as to Birmingham; also to recommend the abandonment of any idea of opposing the Bill in the event of this compromise being accepted. It was arranged that the general meeting should be held on the following Monday (yesterday).

Gas Exhibition at Blackpool.—An exhibition of gas appliances was held at the Station Coffee Palace, Blackpool, during the whole of the past week. Mr. J. Bickerstaffe performed the opening ceremony, in the unavoidable absence of the Mayor (Mr. H. Buckley); and in the course of his remarks, he referred to the great usefulness of gas-stoves for cooking purposes. Messrs. Richmond and Co., Limited, of Warrington and London, were the makers and exhibitors of the appliances shown. Practical lectures on cookery were given by Miss Golding.

Increased Storage for the Southend Gas Company.—Our readers may remember that this Company, owing to the increase in the population of Southend, are applying to Parliament for a Special Act to enable them to increase their share capital, to adopt the sliding scale, and other purposes. In order to make their works equal to the additional demands upon them, the Company are at present erecting a holder to contain about 400,000 cubic feet of gas. Messrs. J. and H. Robus are constructing the tank, which is of brick and puddle, and Messrs. S. Cutler and Sons have the contract for the holder. The work is being carried out from designs prepared by the Company's Engineer and Manager, Mr. Frank Clark.

The Supply of Hydraulic Power.—The report of the Directors of the General Hydraulic Power Company, Limited, made up to Dec. 31, 1891, states that the working for the year has resulted in a gross receipt for power of £41,724, as against £34,377 in 1890. After providing for interest on debentures, Directors' and Auditors' fees, and setting aside £2467 for depreciation, the available balance is £21,113, including £1424 brought forward. The Directors propose that out of this sum a dividend of $3\frac{1}{4}$ per cent. be paid for the six months ending Dec. 31 last; making, with the interim dividend paid in August, $5\frac{3}{4}$ per cent. for the year. The amount to be carried forward will be £618. While the revenue shows a satisfactory growth during the past year, there has been a very heavy addition to the working expenses; partly owing to the increased assessment of the Company's property at the quinquennial valuation. The Directors appealed against this assessment in the City of London, but without success. The increased charge on this head amounts to about £1300. Another cause of increase has, of course, been the high price of coal during the greater part of the year.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

The Inland Revenue authorities at Somerset House have taken the same view of the question of assessing for income-tax upon the law and parliamentary expenses of gas-supplying bodies as was done by the Income-Tax Commissioners for the Edinburgh district. The subject (mentioned in these "Notes" on Jan. 26 last) was raised by the Edinburgh and Leith Gas Commission, who appealed against the imposition of the assessment, which in their case meant a payment of £70 for the year involved. The local Tax Commissioners decided that such charges were not taxable. Before determining whether appeal should be taken to the Court of Session, the opinion of the heads of the Inland Revenue Department in London was taken. Intimation has now been made to the Department in Edinburgh, and through them to the Gas Commissioners, that no further action will be taken. This is a fortunate decision for gas undertakings; and it should be taken note of by all.

Two matters concerning the gas supply, of considerable interest locally, have been brought before the communities of Edinburgh and Leith this week. The first had reference to the question of the lighting of common stairs, regarding which there have all along been complaints of annoyance and inconvenience. The Magistrates enforce the lighting of all such stairs by gas from dusk till 11 p.m.; and they require the proprietors to fit up the lamps and to provide a supply of gas—the occupier being held responsible for the lighting and extinguishing of the lights. Where the rent of a dwelling-house is £10 a year and over, the proprietor may recover from the occupier the amount he pays for gas; where it is under £10, he adds it to the rent. In the event of a stair-light being burned longer than the time paid for, the Gas Commissioners have two ways of proceeding open to them—either to sue the offending parties in the Civil Court for the value of the excess consumption, or to cut off the supply. The former course is, for various reasons, impracticable; and the Commissioners fall back upon the latter. In this way, at the end of the past week over 700 lights were cut off. One result is a furious newspaper correspondence, in which the Gas Commissioners are being called anything but gentlemen; and another is that notice of motion has been given in the Town Council for an inquiry into whether the Corporation should not take over the whole duties of lighting and extinguishing stair-lights, as is done in other towns. To hand the work over to the Corporation would mean, if the cost of lighting and extinguishing were taken out of the rates, an addition of nearly $\frac{1}{4}$ d. to the police assessment. This would be resented by people who do not live in common-stair tenements; and to throw the extra cost upon those whose premises are lighted, would nearly double the present charge. Judging by the ferment which has been created in Edinburgh by the action of the Gas Commissioners, it is a subject which very closely touches the community. It therefore deserves the best consideration that can be given to it, in order that drawbacks to the sale of gas, arising out of the inconvenience inflicted upon a large section of the populace by the present system, may be removed.

The other matter has reference to internal administration, and is not a very pleasant one. In February, 1889, the Gas Commissioners appointed Mr. Wm. Bauchope superintendent of the surveyors. Mr. Kinloch Anderson at that time objected to the appointment, on the ground that it meant the superseding of 32 men, some of whom had served many years in the department, by one who had been employed as a collector by the Edinburgh Gas Company for only 15 months. Bailie Walcot supported the appointment, and assured the Commissioners that "not only would he (Mr. Bauchope) prove himself an efficient man, but that the Commission would be very free to acknowledge the efficiency afterwards." The appointment was only made by the casting vote of the Chairman. Whatever may have been Mr. Bauchope's efficiency outsiders cannot say; but yesterday the Works Committee were called together specially to consider a series of complaints by Mr. Cockburn, the collector, regarding the manner in which Mr. Bauchope has done his work. These had reference to alleged neglect in the reading of meters and other matters, by reason of which the collector's staff had been brought into conflict with the public. A Sub-Committee which had considered the complaints, recommended that the surveyors' department should be placed under the collector; but the Works Committee did not accept the proposal. They have agreed to recommend rather that Mr. Bauchope should be admonished, and the surveyors who had been remiss in their duties censured; also that consideration of the subject should be postponed till January next, by which time it will be seen whether any improvement in the working of the department has been effected. The subject comes before the Commission on Monday.

Since this day week, I have managed to do a little "interviewing" in respect of members of the deputation of whom I spoke in my last budget of "Notes" as having gone to London to learn if there was any good, solid information that might be relied on in regard to the lighting of the public thoroughfares of the Metropolis by electricity. So far as concerns their inquiries regarding the cost of the lighting, the deputationists seem to have come back to Glasgow without being made very much wiser; and they have been led to understand that they must wait until a financial and working year of the street lighting has been completed before they can get exact and trustworthy data as to the actual or very probable cost. I am told that no person in the Metropolis who was spoken to on the subject appeared to have any reliable knowledge as to the amount of gas that was being superseded in those leading thoroughfares in which electric lighting has been adopted on the understanding that it "has come to stay." From this absence of reliable information on such vital points, it is evident that the resolution which was recently passed agreeing to light a number of the principal streets in the centre of the city by means of electricity cannot fail to be a sort of "leap in the dark." In respect of the supply stations, however, it is said that in one or two cases much was seen that was worthy of admiration, and even of imitation; and some very valuable data have either been obtained or have been promised. It will be some months yet before street lighting in Glasgow by electricity will be possible; but there

are indications of some progress being made. Professor A. B. W. Kennedy, F.R.S., who is the chief adviser to the Glasgow Corporation Sub-Committee on Electric Lighting, was seen in London by some members of the deputation; and I understand that his drawings and specifications for the boilers, engines, dynamos, steam piping, &c., required for the new central station which is to be erected for the Corporation in Waterloo Street, Glasgow, have been handed over to the Committee and their local experts, who have been authorized to adjust the specifications, and advertise for tenders for providing and fitting up the machinery and electrical and other plant. When that central station has been erected, it will be rendered available alike for street lighting and for the large demands which are expected from private consumers. From what some of the members of the deputation have seen and heard in London in regard to electric lighting, they are big with hope as to the extent of the local demands upon the new station. Nothing has been said yet as to whether or not the Board of Trade unit is still to be charged at 8d.; but I certainly do anticipate that if the price per unit is materially lowered, the consumption of electrical current will become very great, with the almost inevitable result that the supply of gas will no longer increase by the "leaps and bounds" that have hitherto been known in connection with the Glasgow Corporation gas-supply undertaking. All the same, the indebtedness of the Gas Trust will remain; and the annuitants will continue to look for their annual dividends.

Up to the present, the income for gas-rental in Glasgow and its suburbs shows a great increase over so much of the financial year as has now gone. When the Treasurer reported his revenue a few days ago, he was able to say that he had collected almost £227,000 since the beginning of the financial year, as compared with rather over £189,500 at the corresponding time last year—the increase shown being practically £35,400. The increase in the revenue from the sale of residual products is not on the same grand scale.

Mr. M'Crae, of Dundee, has submitted a statement to the Works Committee of the Gas Commission, specifying a number of things which he suggests are necessary to be done at the gas-works, in consequence of the ever-increasing demand for gas in Dundee. These include a prospective addition to the retort power of the works; the construction of a cooling-main to the condensers; the provision of two exhausters of 100,000 cubic feet capacity per hour, to take the place of two of antiquated type; enlarged station meters; the repair of two gasholders; and the extension of the chemical works apparatus. Some of the works suggested are not urgent. The Committee are to meet on an early day to consider Mr. M'Crae's statement.

The Aberdeen Corporation are under the necessity, in consequence of the recent extension of the city boundaries, as well as of the increased demand for gas within the city, of facing an expenditure of over £100,000 upon the extension of their gas-works. Bailie M'Kenzie, the Convener, brought the subject before the Works Committee on Monday. He stated that the space available for retort extension would all be utilized within, at the outside, three years; and that they would then have to find room for an extension of the retort-house. They would also require a great enlargement of their gasholder accommodation without any delay; because at present they had not storage for one day's consumption in winter. Last year, ground was purchased at Gallowhill upon which to erect gasholders. Then their workshops and offices were in a dilapidated condition, and would require to be rebuilt. These, with the outlay upon new mains in the extended district, would entail the expenditure of the sum above mentioned. As their borrowing powers are nearly exhausted—the Corporation are within £11,000 of their limit—it would be necessary to go to Parliament pretty soon to get additional borrowing powers. A Sub-Committee was appointed to consider and report on the subject. The capital account of the gas-works at present is £129,776.

In consideration of the fact that Mr. James Fleming (who was promoted to the post of Treasurer to the Glasgow Gas Trust about three years ago) has had considerable additional responsibility put upon his shoulders during the past year, by the acquisition of three fresh gas-supply undertakings, and by the additional work which will fall to his lot in connection with the local electric light undertaking, on and after March 1, it is not unlikely that a material increase will shortly be made to his salary; indeed, I am told that there is a recommendation from the Finance Sub-Committee for an increase to be laid before the Town Council at the next meeting of that body. Mr. Fleming is certainly a very worthy man, as also a most efficient and painstaking public servant; and he has become quite a favourite with the gentlemen of the Committee whom he has specially to serve.

The great decline in the price of residuals is likely to have a very serious effect upon the contractors who take these commodities from gas-works. I have already mentioned the difficulties into which the Glasgow Alum and Ammonia Company have fallen. In the Court of Session to-day, answers were lodged to both of the petitions relating to that Company which were presented last week. The Company state that the petition of the Barrhead Gas Company is unnecessary; and that at the meeting at which it was resolved to go into liquidation, the Barrhead Company, whose debt they say is £277, were the only dissentients out of creditors representing £8553. A statement of the affairs of the Company, which was submitted at the meeting, showed the liabilities to be £11,136, and the assets, £8014; and they maintain that the value of their stocks very largely depends upon their being sold as part of a going business. The Barrhead Company, replying to the petition of the Alum and Ammonia Company, state their claim at £350, for £140 of which they hold an extracted decree. They consent to the winding up being under the supervision of the Court; but suggest that Mr. John Gourlay, C.A., Glasgow, should be appointed joint liquidator with Mr. Thomas M'Lintock, C.A., Glasgow, in place of Mr. Thomas Robinson. The petitions and answers were sent to the roll for discussion. It is announced this afternoon that Mr. John Dobbie, chemical manufacturer, of Leith, has issued a circular to his creditors intimating that he is unable to meet his engagements. Mr. Dobbie's firm of John Dobbie, Sons, and Co., is a well-known one in the residuals world. They hold, among others, a contract with the Arbroath Gas Corporation for five years, from May, 1889, at the rate of 6s. per 100 gallons. The firm own a chemical works at Elliot, four miles from Arbroath, as well as at Leith.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, Feb. 27.

Sulphate of Ammonia.—There is no change as far as prices are concerned; but there seems rather more inclination to buy on the part of consumers, and with milder and brighter weather it would not be surprising to see considerable movement very soon. This is not simply a figure of speech; for it must be palpable that when parcels are taken off the market readily, and the shipments are fully up to the mark (over 20,000 tons this year up to date), that the production of sulphate is being consumed—it being immaterial in which manner or by whom consumers are being supplied. The largest portion of the deliveries has since the beginning of the year been absorbed by the dealers; and assuming that they have also their sales for March delivery to cover in, the simultaneous competition from consumers, to complete spring requirements, this is likely to put the market on a different basis to what it is at present. Sulphate still remains considerably the cheapest commodity of nitrogenous fertilizers.

LONDON, Feb. 27.

Tar Products.—A very considerable fall has taken place in the value of tar; tar distillers having wakened up to the fact that the immediate future of tar products is of a most discouraging character. The firmness which characterized benzol a few weeks ago has entirely disappeared; and the article may be said now to be "going a-begging." There seems to be no sale for common oils; and stocks in makers' hands are troublesome. There is no inquiry for anthracene; and the little spurt in carbolic seems to have died out. Pitch is the only article for which there is any demand; and it is being shipped very largely. Buyers seem disposed to book contracts forward at a shade below to-day's value. Several important contracts for tar have been made at prices ranging from 15s. to 19s. The average prices for the week are: Tar, 17s. 6d. Pitch, 32s. Benzol (nominal), 2s. 6d. for 90's; 50's, 1s. 9d. Toluol, 1s. 5d. Solvent naphtha, 1s. 3d. Crude benzol naphtha, 30 per cent., 1s. Creosote, 1d. Naphthalene salts, 25s.; pressed, 45s. Carbolic acid, crude 60's, 1s. 1½d.; 70's, 1s. 4½d.; crystals, 5d. Cresol, 8½d. Anthracene (30 per cent.), "A" quality (nominal), 1s.; "B," 8d.

Sulphate of Ammonia.—Transactions have been noted in this market during the week as low as £10. This is exceptionally low; but the average business done during the week will not exceed £10 5s., less 3½ per cent. There seems to be no demand; and stocks are seriously accumulating. It is most remarkable that sulphate continues so flat, whilst nitrate of soda is decidedly firm, with a nitrogen value very much below that of sulphate. Gas liquor (10-oz.) sells at 6s. to 7s. 6d.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—That there will be some more or less general stoppage of the collieries as the result of the resolution passed at the recent Miners' National Conference in Manchester, would seem to be quite inevitable, as the notices to cease work on March 12 have now all been sent in, and no further conference of the Miners' Federation will be held until after these notices have expired. It is, however, still open to question whether the cessation of work will be of any protracted character; and certainly it will not be participated in by one or two important districts. Notwithstanding this, there has necessarily been a gradually-increasing pressure of demand on the part of merchants and consumers to get in extra supplies, to carry them over any stoppage of the pits. For house-fire coals, there has been a very brisk inquiry; and in some instances prices have been slightly advanced; but practically quotations, although very firm, remain at about 12s. 6d. for best Wigan Arley, 10s. 6d. to 11s. for Pemberton four-feet and second qualities of Arley, and 9s. to 9s. 6d. for common house-fire coals. The lower qualities of round coal continue in not more than moderate request for general purposes; and in the present unsatisfactory state of trade, it is more than probable that many works will be closed rather than submit to any appreciable advance in prices, or any difficulty in getting supplies. At the pit's mouth, steam and forge coals do not average more than 8s. to 8s. 6d. per ton; and for shipment steam coal can be readily bought at 10s. to 10s. 3d. per ton delivered at the ports on the Mersey. All descriptions of engine fuel have been in considerably increased request, and this has necessarily given a hardening tendency to prices, which, in a great many cases, have stiffened up quite 3d. to 6d. per ton upon recent minimum quotations. At the pit's mouth, burgy averages 6s. 3d. to 6s. 9d.; best slack, 5s. 3d. to 5s. 9d.; medium, 4s. 3d. to 4s. 9d.; and common, about 3s. 9d. to 4s. 3d. per ton.

Northern Coal Trade.—There has been a better demand for certain kinds of coal during the past few days; because of the fears of a stoppage, to some extent, of collieries. In consequence of this, many large users are stocking coal; and this has in some degree counterbalanced the effect of the strike of the engineers, which has thrown much coal on the market. Best Northumbrian coal has been in fair demand, there being no fear of an interruption of its supply. The price is steady at from 9s. 9d. to 10s. per ton, according to place of shipment. Small steam coals are more abundant at 3s. 3d. to 3s. 6d. per ton, also f.o.b. Gas coals are firmer, though some contracts have been concluded at very low prices. For single cargoes and for prompt delivery about 8s. 6d. to 8s. 9d. is now the prevailing price; and should there be a growth of the demand to the extent expected, a further rise in the price seems certain. The home demand for gas coals is, however, decreasing; but the exports must be expected to be larger as the spring draws on. A large contract for Rotterdam is near conclusion; and it is expected that low prices will prevail. Bunker coals are extremely dull; the prices varying from 7s. 3d. to 8s. 9d. for unscreened qualities, and up to 11s. per ton for screened. Manufacturing coal is flat—the strikes lessening the consumption. Household coal is also very quiet. In coke there is little movement; the price for best blast-furnace kinds being about 16s. f.o.b. in the Tyne—a lower price ruling at West Hartlepool. Gas coke is dull, though the output is now less.

West of Scotland.—The coal trade in this district is reported quiet. There is some forward business offering; but the rates are considered

too unremunerative to be accepted, and any exporting at all is in working off old contracts. In steam coal there is a fair business doing, and the price is very steady. The quotations are: Main, 7s. 9d.; ell, 8s. 6d.; splint, 8s. 9d. to 9s.; and steam, 10s. 3d. to 10s. 6d.—all for best sorts f.o.b. Glasgow. The shipments of Scotch coal from all parts amounted last week to 98,415 tons—a falling off of 10,520 tons as compared with the previous week; while as against the corresponding week last year there was a decrease of 11,926 tons.

Gas Cooking in Infirmaries.—The Davis Gas-Stove Company, Limited, have just fitted up a large gas apparatus for the Guardians of the Poor of St. Leonards, Shoreditch, at the Infirmary in Hoxton Street, N.

Proposed Extension of the Rainhill Gas and Water Works.—The Directors of the Rainhill Gas and Water Company have decided to extend their works, and have called in Mr. J. W. Buckley, Engineer and Manager of the Formby Gas Company, to examine and report upon the plant, and advise them generally on the matter.

Bristol Gas Company.—At the half-yearly general meeting of this Company, held last Friday, the report and accounts, which were noticed in the JOURNAL last week (p. 350), were adopted, and the dividend recommended—at the rate of 5 per cent.—was declared. Sanction was given to the Bill now being promoted by the Company to enable them to extend their works. A report of the proceedings will appear next week.

Sale of Stock in the Cambridge Gas and Water Companies.—Last Tuesday, Mr. J. C. Jonas submitted for public competition £410 of original stock of the Cambridge Water Company, which realized at the rate of £270 4s. 10d. per cent., and £674 of 10 per cent. consolidated stock, which was knocked down at £256 per cent. On the same occasion, he put up £234 of 10 per cent. stock of the Cambridge Gas Company, for which an average price of £218 16s. per cent. was paid; also £210 of 7 per cent., which realized an average of £142 17s. 1d. per cent.

Yorkshire Water Gas Company.—An extraordinary general meeting of the Yorkshire Water Gas Company, Limited, was held last Thursday at Leeds. Mr. J. Mitchell presided; and, in opening the proceedings, he explained that some of the shareholders seemed to fear that their Articles of Association did not enable them to legally enter into contracts for work in Lancashire. The Directors were advised that they did; but it had been deemed expedient to make their position perfectly clear, and he therefore proposed—"That the Memorandum of Association of the Company be altered, by inserting after clause 3 (a) of the present Memorandum of Association the following clause: (a a) 'To acquire and to exercise and enjoy the right to use and vend within the county of Lancaster, and to grant licences for the using and vending within the said county of Lancaster, of all or any of the inventions herein mentioned or referred to.'" Mr. A. S. Kirk seconded the resolution, which was adopted unanimously. The Chairman then moved that the name of the Company be changed to the Yorkshire and Lancashire Water Gas Company, Limited. Mr. Whitehead seconded the proposal, which was carried.

Tottenham and Edmonton Gas Company.—The half-yearly meeting of this Company was held last Saturday. The chair was occupied by Mr. Corbet Woodall, who, in the course of his remarks, expressed the regret of the Directors that their Chairman (Mr. G. Gripper) was unable, through illness, to preside over them that day. Commenting upon the report and accounts (which were noticed in the JOURNAL last week), he said he felt that the figures were eminently satisfactory, and such as they might well congratulate themselves upon. He thought it was a matter of great satisfaction to them all that they had been able to tide over the past two or three years without either raising the price of gas, reducing the dividend, or taking a penny from the invested reserve fund. Since Christmas, 1888, they had only once managed to earn their dividend; and each half year they had had to withdraw something from the undivided profits to pay the dividends, but the reserve fund had not been touched. He moved the adoption of the report; and Sir H. Cartwright seconded. After a short discussion, the motion was carried. Dividends at the rate of 11½ per cent. per annum on the "A" stock, and 8½ per cent. on the "B" and "C" stocks, were declared. A resolution was also passed expressing sympathy with Mr. Gripper in his illness, and hoping that he would speedily be restored to health; and afterwards the services of the Directors and officials were acknowledged. A full report of the proceedings will be given in our next issue.

A New Coast Light.—A new beacon or coast light, the invention of Professor Schirm, of Berlin, has just been tested by the German Navigation Society, of Hamburg, with eminently satisfactory results. According to *Iron*, the experiments were conducted on the coast near the mouth of the Elbe, where the new method of illumination is said to have literally put the electric lighthouses in the shade; and as the cost of the light is stated to be insignificant, the experts present had no hesitation in prophesying a successful career for the invention. The apparatus, with all the accessories, is barely 7 feet high, and is about 3 feet in diameter. In the interior of the apparatus which is best adapted for giving an intermittent light) there is a blast-engine, by which benzene gas is produced; while air is driven through pumice-stone strongly impregnated with benzene. The benzene gas is carried through very fine magnesium powder, and, saturated therewith, proceeds upwards through a pipe, and is consumed in a small flame, yielding a light of 400,000-candle power. The apparatus is controlled by clockwork, and is enclosed by glass, with a view to protection from wind and weather. The consumption of magnesium is very small; varying, according to the power of the light required, from 4 to 10 centigrammes of magnesium powder per flash. The consumption in an hour would therefore amount to from 14'4 to 36 grammes of the powder, equal for a 10-hour working, to from 144 to 360 grammes, which would cost about 6s. and 13s. respectively. Professor Schirm has, of course, patented his invention; and as a proof of its value, he quotes the fact that the London Trinity House has purchased the apparatus, with the object of testing its capabilities at a provisional beacon station at Folkestone.

Gas, Water, and General Investment Trust, Limited.—The fourth general meeting of this Company was held last Friday, at Winchester House, E.C., under the presidency of Mr. T. Salt, M.P. In moving the adoption of the report, which was noticed in the JOURNAL last week, the Chairman said the past year had been a difficult and anxious one; but they had been able to hold their own, to offer the same dividend as on the previous occasion, and to increase the reserve fund from £50,642 to £64,341. Their investments had risen since the beginning of 1891 from £810,000 to £855,000; and they had a new item in advances on loans amounting to £26,687, which represented satisfactory business when good advances could be made. The balance carried forward in 1891 was £2539, while now the amount was £1321. The average of their investments was £4800, compared with £5600 a year ago; and they endeavoured to spread them as much as possible. They were steadily reducing their holdings where uncalled capital existed. They occasionally borrowed from their bankers; but they only used them for the sake of convenience. At the present time they owed their bankers nothing. The Directors suggested that an issue of debenture stock should be made to the amount of £50,000 at the price of 101 per cent. When this was done, the share capital would be very nearly double the amount of the debenture stock. He did not like to say much about the prospects of the undertaking in such times as the present; but he thought he might venture to state that they were as satisfactory as could be expected. He concluded by also moving the payment of the dividends recommended for the half year—viz., at the rate of 4½ per cent. per annum on the preferred stock and 10 per cent. per annum on the deferred stock; making the distribution on the latter 7½ per cent. for the year. Mr. J. Boustead seconded the motion. In reply to questions, the Chairman stated that the Directors had provided for any actual loss that had been made. Some of their investments were depreciated, while others were appreciated. He regarded the depreciation as temporary. If in the course of their transactions actual losses occurred, they would write them off. The motion was carried; and the proceedings closed with a vote of thanks to the Chairman.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 386.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon invest. ment.
£			p. c.					£ s. d.
GAS COMPANIES.								
590,000	10	15 Oct.	10½	Alliance & Dublin 10 p. c.	10	16-17	..	6 3 0
100,000	10	"	7½	Do. 7 p. c.	10	11½-12½	..	6 0 0
300,000	100	2 Jan.	5	Australian (Sydney) 5% Deb.	100	105-107	..	4 13 5
100,000	20	27 Nov.	8	Bahia, Limited	20	12-14	..	11 8 6
200,000	5	12 Nov.	7½	Bombay, Limited	5	6½-6¾	-½	5 11 1
40,000	5	"	7½	Do. New	4	4½-5½	..	5 14 1
380,000	Stock.	26 Feb.	12½	Brentford Consolidated	100	205-215*	+1	5 14 1
150,000	"	"	9½	Do. New	100	153-158*	+½	5 17 1
220,000	"	16 Sept.	11½	Brighton & Hove Original	20	40-42	..	5 9 6
888,500	Stock.	16 Sept.	5	Bristol	100	98-103	..	4 17 1
320,000	20	15 Oct.	11½	British	20	43-45	..	5 0 0
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	10	19-20*	+1	5 15 0
51,510	10	"	8½	Do. 7 p. c.	10	14-15*	+1	5 13 4
328,750	10	"	—	Buenos Ayres (New) Limited	10	5-6	..	—
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	93-96	..	6 5 0
150,000	20	26 Feb.	8	Cagliari, Limited	20	24-26*	..	6 3 1
550,000	Stock.	15 Oct.	13½	Commercial, Old Stock	100	240-250	..	5 4 0
165,000	"	"	10½	Do. New do.	100	190-195	..	5 2 7
130,000	"	30 Dec.	4½	Do. 4½ p. c. Deb. do.	100	118-123	..	3 13 2
800,000	Stock.	30 Dec.	13	Continental Union, Limited	100	225-230	..	5 13 0
200,000	"	"	10	Do. 7 p. c. Pref.	100	185-195	..	5 2 7
75,000	Stock.	16 Sept.	10	Crystal Palace District	100	190-200	..	5 0 0
486,090	10	29 Jan.	10	European, Limited	10	19-20	..	5 0 0
354,060	10	"	10	Do. Partly paid	7½	14-15	..	5 0 0
5,470,820	Stock.	12 Feb.	12	Gaslight & Coke, A, Ordinary	100	214-218	..	5 10 1
100,000	"	"	4	Do. B, 4 p. c. max.	100	94-97	..	4 2 5
665,000	"	"	10	Do. C, D, & E, 10 p. c. Pf.	100	245-250	..	4 0 0
30,000	"	"	5	Do. F, 5 p. c. Prt.	100	116-121	..	4 2 9
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	169-174	..	4 6 2
1,300,000	"	"	7	Do. H, 7 p. c. max.	100	148-153	..	4 11 6
463,000	"	"	10	Do. J, 10 p. c. Prt.	100	241-246	..	4 1 3
476,000	"	"	—	Do. K, 6 p. c. Prt.	100	145-150	..	4 0 0
1,061,150	"	11 Dec.	4	Do. 4 p. c. Deb. Stk.	100	113-116	+1	3 9 0
294,850	"	"	4½	Do. 4½ p. c. do.	100	118-123	..	3 13 2
908,000	"	"	6	Do. 6 p. c. do	100	163-168	..	3 11 5
3,800,000	Stock.	12 Nov.	12	Imperial Continental	100	222-226	+1½	5 6 2
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4-4½	..	6 13 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p. c. Deb.	100	108-110	..	4 10 11
541,920	20	27 Nov.	6½	Monte Video, Limited	20	15-16	..	8 2 6
150,000	5	27 Nov.	10	Oriental, Limited	5	8½-9	..	5 11 1
60,000	5	30 Sept.	7	Ottoman, Limited	5	4-5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited	10	2½-3½	..	—
420,000	100	3 Nov.	6	People's Gas of Chicago—	100	100-105	..	5 14 3
500,000	100	1 Dec.	6	1st Mtg. Bds.	100	100-105	..	5 14 3
150,000	10	15 Oct.	10	2nd Do.	100	9½-10½	..	9 10 6
500,000	Stock.	26 Feb.	15½	San Paulo, Limited	100	266-271*	+1½	5 14 5
1,350,000	"	"	12	South Metropolitan, A Stock	100	221-226*	+1	5 6 2
200,000	"	"	13	Do. B do.	100	232-237*	+½	5 9 8
725,000	"	30 Dec.	5	Do. C do.	100	138-143	..	3 10 0
600,000	Stock.	16 Sept.	11½	Do. 5 p. c. Deb. Stk.	100	—	..	—
729,331	Stock.	30 Dec.	10	Tottenham & Edm'nton, Orig.	100	—	..	—
1,720,560	Stock.	15 Oct.	8	Chelsea, Ordinary	100	256-261	..	3 16 7
544,440	"	30 Dec.	4½	East London, Ordinary	100	204-209	..	3 16 7
700,000	50	11 Dec.	8	Do. 4½ p. c. Deb. Stk.	100	136-140	..	3 4 3
708,000	Stock.	12 Feb.	10½	Grand Junction	50	99-103	..	3 17 8
1,043,800	100	30 Dec.	9½	Kent	100	263-268	..	3 18 4
406,200	100	"	7½	Lambeth, 10 p. c. max.	100	225-230	..	4 2 7
260,000	Stock.	30 Sept.	4	Do. 7½ p. c. max.	100	189-194	..	3 17 4
500,000	100	12 Feb.	12½	Do. 4 p. c. Deb. Stk.	100	120-123	..	3 5 0
1,000,000	Stock.	29 Jan.	4	New River, New Shares	100	330-335	-2½	3 2 4
902,300	Stock.	30 Dec.	6½	Do. 4 p. c. Deb. Stk.	100	123-126	..	3 3 6
126,500	100	"	6½	S'thwk & V'xhall, 10 p. c. max.	100	146-150	..	4 6 8
1,155,066	Stock.	11 Dec.	10	Do. D 7½ p. c. do.	100	140-145	..	4 9 8
				West Middlesex	100	244-249	-1	4 0 4
						*Ex div.		
WATER COMPANIES.								

a Next dividends will be at this rate.

Smokeless London.—Writing on this subject, Mr. T. Fletcher says: If your correspondent "C. A.," who last week wrote such a sweeping condemnation of gas coke as a fuel, will use it mixed with coal in about equal proportions, he will very soon alter his opinion. A mixture of gas coke and coal is as near an ideal fuel as we are likely to get; and if the gas companies would persistently make this known, coke would no longer be a drug in the market.

A Large Steel Pipe Contract.—Tenders were some time ago invited for supplying 82 miles of steel main piping (5200 tons) in connection with the great water-works at Beetaloo, in South Australia; and the tender accepted, amounting to £130,000, is £21,900 below the official estimate. The water-works in question supply the important mining townships of Moonta and Wallaroo, and the piping will convey 600 million gallons of water from the Beetaloo reservoir every year.

The Worcestershire County Council and the Birmingham Water Scheme.—Two reports dealing with the Birmingham Corporation Water Bill recently came before the Worcestershire County Council. The General Purposes Committee recommended that a Special Committee should be appointed to consider the Bill; while the Sanitary Committee, in the course of their report, said they had ascertained from inquiry that the water supplies of the following places might be greatly improved by recourse to the Birmingham scheme: Tenbury, Bewdley, Blakedown, Lower Hagley (near the railway station), and Adam's Hill, Clent Hill and Quinton, Bristnall Fields, Warley, and certain places within the Kidderminster and King's Norton Rural Sanitary districts respectively. They were of opinion that provision should be made in the Bill to compel the Corporation

to supply all sanitary or other authorities with water within a distance of (say) 15 miles of the aqueduct, at a fixed charge for the water, to be named in the Bill; and that the Corporation should also be compelled to supply any sanitary or other authority within 20 miles of the aqueduct who were willing to pay the cost of the necessary connecting work at the same rate for the water supplied. The Committee also considered that the terms as to the compensation water to be given by the Corporation should be so liberally framed as not to be used as a precedent in any future proposal to take water from the Severn watershed that would injuriously affect the sanitary interests of the county. While the Committee did not in any way pledge themselves to the details or figures, they thought that some such basis of compensation as that suggested by the Chairman of the Severn Fishery Board to the Chief Inspector of Fisheries, would be a convenient one (*ante*, p. 78); and they recommended the Council to authorize the General Purposes Committee to take such steps as may be necessary to secure these objects. The Committee had learnt that a Royal Commission was about to inquire into the water supply of London, and to report on the available sources of supply for the Metropolis. They recommended that a letter be addressed to the Local Government Board inquiring whether this was correct; and, if so, whether the inquiry would extend to the Severn watershed as a possible source of supply. Should this be the case, they thought that some representative of the Severn watershed should be placed upon the Commission; and they recommended that this should be brought to the notice of the Local Government Board. It was ordered that the General Purposes Committee should watch the Bill till the new County Council came into being.

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams:
"GWYNNEGRAM LONDON."

GWYNNE & CO.,

TELEPHONE No. 2698.

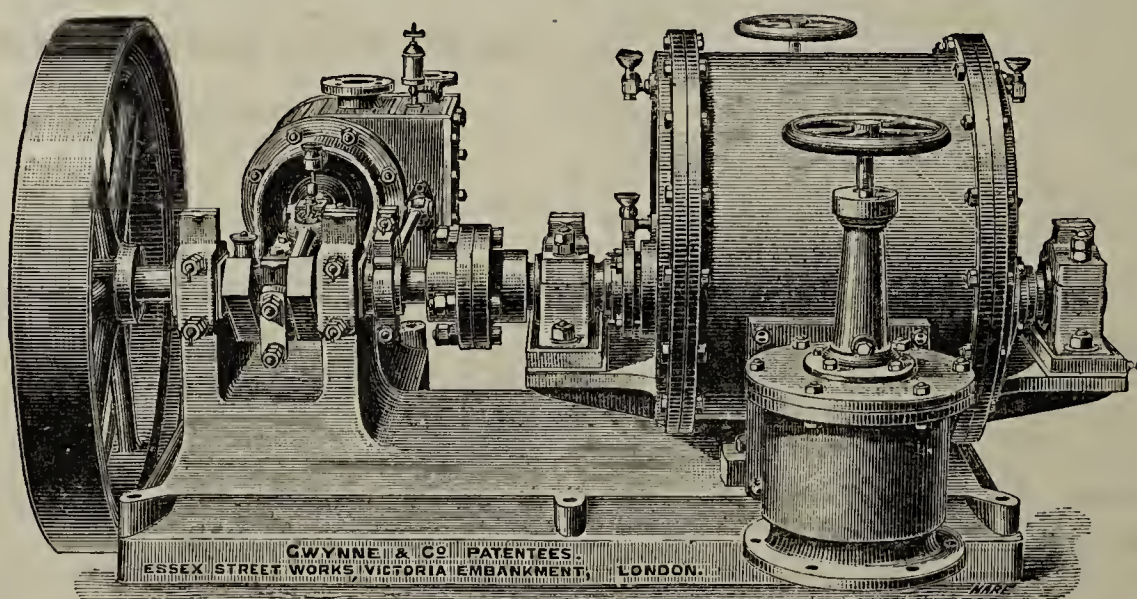
HYDRAULIC AND GAS ENGINEERS, ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C.

Thirty-three Medals
at all the Great Inter-
national Exhibitions
have been awarded to
GWYNNE & Co., for
Gas Exhausters, &c.

They have never
sought to make price
the chief consideration,
but to produce Machin-
ery of the very highest
quality.

The result is that in
every instance their
work is giving the full-
est satisfaction.

They have completed
Exhausters to the extent
of 30,000,000 cubic feet
passed per hour, which
are giving unqualified
satisfaction in work, and
can be referred to.



Engine and Exhauster Combined on One Bed-Plate.

GWYNNE & Co.'s Exhausters are constructed of large size to pass the required quantity of Gas at very slow speeds; the wear and tear being reduced to a Minimum.

Catalogues and Testimonials sent on Application.

Their Exhausters
can be made, when
desired, on their New
Patent Principle, to
pass Gas without the
slightest oscillation
or variation in pres-
sure.

**NO OTHER MAKER
CAN DO THIS.**

Makers of GAS-VALVES,
HYDRAULIC REGULATORS,
VACUUM GOVERNORS,
STEAM-PUMPS for Tar,
Liquor, or Water; PATENT
SELF SEALING and CLEANS-
ING RETORT-LIDS AND
MOUTHPIECES; CENTRI-
FUGAL PUMPS and PUMP-
ING ENGINES specially
adapted for Water-Works,
raising Sewage, &c.

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THE

JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MARCH 8, 1892.

The Blunder of the Miners.

THE coal miners have not begun their threatened week's "play;" but, at the time of writing, the rashly-advised conspiracy between the coal-owners and the Unions has already had the worst effect predicted of it in our last week's issue. The idiotic schemers who control the miners' organizations, have succeeded in making the most stupendous blunder in the annals of Trade Unionism; and this is saying a great deal. The Social Democrats who have from time to time ordered "universal strikes"

were foolish enough, in all conscience; but since their hare-brained orders were never obeyed, they did little real mischief. When the gas stokers were caused to throw up their livelihood for the sake of Trade Union principles, their leaders incurred a moral responsibility which few honest men who desire to sleep soundly at night would care to incur. But these mistakes shrink into insignificance, and their consequences, bad as these were, are completely dwarfed, beside the *fiasco* perpetrated by the Miners' Federation officials. For what do we see? Coal actually stacked in the dealers' yards has been forced up in selling value by 50 per cent. The unreflecting public have been alarmed for the continuance of coal supply, at a time, moreover, when all the worst rigours of winter have returned, and have demanded fuel at any price. The merchants and retailers have cleared out their stocks at exorbitant premiums, not one penny of which will ever reach the coal-owners, to say nothing of the miners. When the stocks were sold out, the merchants had to go to the pits for more; and, of course, they paid something in advance of the former rates—which makes the coal-owners' gain. Meanwhile, the miners have been getting up coal for the old rates of wages; and when their "play-time" comes, the owners will see them go out with all the resignation which ensues upon having the best of the bargain. By the time "play" is over, the season will be further advanced; the panic-stricken public will have stocked enough coal, at fancy prices, to last into the warmer days; and the pits will be required only to yield coal bought long ago at contract rates.

Well may *The Times* remark that "these magnificent results of Federation strategy, aided by public panic, are doubtless very satisfactory to coal-owners and to dealers whose stocks have been sold off at a high premium." But what about the lot of the working miner, for whose presumed benefit the whole scheme was conceived by his Union leaders; and how does he fare under the conditions artificially created in his name, which, whether or not they have enriched the owners and middlemen, have inflicted untold misery upon the struggling poor of the cities of greatest consumption? "It is they (the poor) who feel most severely the pinch of dear coals in weather like the present. But they feel even more acutely the loss of work inevitably entailed upon them by the blowing-out of furnaces, the stoppage of steel-works, alkali-works, and minor industries of a score of kinds. These working-class vagaries indulged in usually at the bidding of some irresponsible 'executive,' fall with crushing severity upon the working classes themselves." Meanwhile, what have the Labour leaders—the Burnses, Manns, Tillets, &c.—to say about the folly of the miners, which their dear dockers have to pay for? Well, most of them are discreetly silent, lest between the two stools of Miners' Unionism and Coal Consumers' Unionism they should come to the ground. Truly, those who have subscribed to the notion that a Trade Union can do no wrong are not to be envied in the circumstances. One Labour organ, however—the *Trade Unionist*—tells its readers that they had better have "cold hands and nipped noses," if the miners, in their wisdom, imagine they can take a week's play without dislocating the trade of the country. It is so easy to be hardy when one eats well and lies warm!

The cue has gone forth, however, that the big, foolish, unwieldy public are to be blamed for everything. Is anybody foolish enough to believe that the rise in coal prices "on the spot" benefits the dealers? He is wrong. Plenty of plausible gentlemen in the trade will convince him that the increased price which the consumer indubitably pays for his coal is of no real benefit to anybody. If the London public *will* pay 35s. for a ton of the "Wallsend" which they could have had a week before for 25s., it is quite fallacious to suppose that the dealer is gratified thereby! And as to the responsibility of the Unions in the matter, it is apparently considered sufficient by their spokesmen to disclaim all intention of creating a coal panic. Why will the stupid public play into the hands of the middleman? Why, indeed! It is ascribed by *The Times* to "the amiable peculiarity of the outsider, from which the Stock Exchange reaps a golden harvest—his mania for buying on a rising market." Be this as it may, the fact remains that the Trade Union muddlers have sown for others to reap, and have taught the world another expensive lesson upon the practical impossibility

of ensuring, in regard to human affairs, that actions shall have their intended effects.

Those of us who have wisdom enough to take heed lest, when we intend one thing, we do another, are perpetually caused to marvel at the rashness of modern Sciolists, who are ready to hazard everything on the efficiency of their own fancy remedies for all the ills of the body politic. Think of men like Mann and Tillett pretending to a certain knowledge of the way to abolish poverty—to have reduced the problem of humanity to a solution upon which a candidate for a parliamentary seat or a place in a County Council can base his appeal to a constituency! One is lost in admiration, in the old sense of the word, at such stupendous impudence, which would be impossible if it were not supported by fathomless ignorance. A wise man has said: "When I was a boy, I held many opinions, and was quite sure of the validity of every one of them. Now I am old, I have few convictions; and these I hold with fear and trembling, lest, after all, I shall find myself self-deceived." We shall be told that this doubting spirit was not that of the old martyrs and leaders of enslaved men out of darkness into light and liberty, and that the man who waits to assure himself that he is entirely right about a debateable line of conduct, in his solicitude to make no mistakes renders himself incapable of making anything else. There is something in this, of course; but it is difficult to acquiesce in the comparison of a modern wire-puller to an ancient martyr, if only because, whereas the latter testified to the sincerity of his views at the cost of his own blood, and of all that man holds dear, the other, as a rule, takes particularly good care to "stand from under" when he gets his supporters into trouble. When we see a self-appointed Labour leader manifestly worse for a strike that has ruined his dupes, we shall begin to believe in him. In regard to the threatened miners' strike, it presents the world with the peculiarity of having secured its own failure in advance; but the London coal merchants ought to pension off the Union leaders who have served them so handsomely, and who would have no power for further mischief if the Unions were really managed in the interest of the men.

The Condition of the National Gas Industry.

IN the last few numbers of the JOURNAL there have been given, according to custom, a variety of abstract reports of Gas Companies' working for the past year, which contain a mass of valuable information respecting the actual position of the gas industry of the United Kingdom. Speaking generally, these reports tell a tale of steadily growing business, with the peculiarity of dividends maintained by larger or smaller dips into accumulated profits. The statutory gas undertakings of the country may, indeed, be separated into the two grand classes of those which have earned their dividends and those which have not—the latter being in the majority. This is not by any means a circumstance to grieve over. It amounts, on the contrary, to an indisputable proof of the fact that modern Gas Companies are sailing very close to the wind in their efforts to balance their income and expenditure. It used to be said, by people who ought to have known better, that Gas Companies always made such enormous profits that the Directors hardly knew what to do to get rid of the money, and so avoid reductions in the price of gas. It was an amiable delusion of that easily-beguiled person, the writer of letters to the newspapers with a fondness for signing himself "A Constant Reader," "Subscriber from the First," or some such pet name, that the one thing which directors had the greatest disinclination to do was to sell cheap gas. The experience of the last year or two must have taught this person, if he is teachable, that most gas directors have, in sober truth, the greatest disinclination to raise the price; and that sooner than take this abhorrent course, they will draw heavily upon the reserves which they and their predecessors put aside for a "rainy day." It should be obvious to critics of gas administration in town and country, moreover, that the process of draining reserves to avoid or to minimize increases of price must have its limitations. It is very false economy to weaken a gas company by exhausting the reserves, because the chances are great for the same company being perpetually in want of fresh capital wherewith to carry on its growing business; and this capital will always be most readily and cheaply raised by the undertakings which are financially strongest.

It is therefore cheaper in the long run for the consumers to pay a little more when a passing pinch occurs, and so clear themselves, than to weaken the undertaking permanently or for any length of time.

The phenomena of a business which is continually growing, and yet does not always pay its way, is sufficiently curious to attract more than passing notice. It is quite possible, although it is not to be understood that we think it likely, that such derangements of the coal and labour markets as have ushered in the last decade of this nineteenth century may recur more rather than less frequently as the coal-fields grow old, and social politics grow more agitated through the spread of smattering book-learning among the poor. So long as the gas industry needs an open capital account, however, the opportunity will also be open for good management and administration to save money by prudent reconstructions of old undertakings upon new bases. The questions for every gas manager careful for his credit, and for every conscientious director, are: Where are we tending? What are we getting for our money? Ten years, twenty years, thirty years ago we stood *thus*. How do we stand to-day? Thanks to the perpetual ebb and flow of technical knowledge, it is possible for every engineer to determine with the greatest nicety what the new manufacturing, purifying, storage, or distributing plant required for his expanding works ought to cost. The days ought to be over when a gasholder in one town could cost half as much again as one of the same capacity in the next district, merely on account of the different idiosyncrasies of the two designers. We ought to leave all this kind of uncertainty to our good friends the electricians.

It is, by the way, a significant circumstance that, so far as can be seen, the gas undertakings of the kingdom are not only growing fast, but are growing faster than the towns which they supply. Gas is not merely holding its own; but it is greatly improving its position. When, for example, we hear of any gas company increasing their output at the rate of 12 per cent. per annum, it does not mean that the district, but only that the undertaking, will be doubled in six years. How many gas undertakings have doubled their sale of gas during the last ten years? Why is it that no "light of the future" has been able to render this expansion unnecessary? The fact remains that Gas Companies everywhere have been left to "take up their own slack," until in many places they have become very tightly fitted indeed. Some timid gas directors—although we believe the charge applies more especially to members of corporation gas committees—have feared for years to spend money boldly and economically upon necessary extensions, and have condemned their engineers to eke out plant by all sorts of "skimping" expedients. This must be reconsidered. To disgust consumers with dirty gas and low pressures, is the surest way to convert imaginary competitors into real rivals. The evidence from all parts of the country which we have now collected ought to convince the most chicken-hearted of directors or of corporators that the crying need of the gas industry is not coddling, but more growing-room in its clothes.

The London County Council Election.

LONDON provided itself with a fresh County Council last Saturday; and it is now known that the new body is composed in the main of so-called "Progressives." We only notice the election here because in the "program" issued in the name of the latter party, albeit disavowed by its more prominent members, the acquisition of the gas and water supplies figures very conspicuously. With regard to the imagined "municipalization" of the gas supply, as the term is, the folly of the "dreamers" of the old Council in aspiring to run the full length of the course permitted to old Corporations like Manchester and Birmingham, before they have learnt to walk even under the burdens inherited from the Metropolitan Board of Works, should hardly require serious denunciation. Yet it is a remarkable fact that, not content with bearing responsibilities still undischarged which have killed two Deputy-Chairmen and one Chief Engineer, there are people in and out of the County Council—probably more of the latter than the former—who prattle of taking over the gas undertakings as though it could be done with a turn of the hand. If a thing is only repeated loud and long enough, somebody will believe it in the end, however

absurd it may be; and therefore it is as well to notice the grounds upon which the acquisition of the gas supply is advocated as a right and easy thing for the County Council to take in hand—that is to say, when it has the time. It is all for the sake of plunder. The County Council gave up the coal dues, and now some of our “advanced” municipal politicians are hankering after the gas profits to help pay the rates. A correspondent writes to the *Pall Mall Gazette* to urge that if the London County Council were to do by the gas supply what “the seven ‘Municipalities of Manchester, Leeds, Nottingham, ‘Bradford, Leicester, Oldham, and Bolton’ do, they might make a reduction of rates by as much as 14 per cent. Glorious prospect! To realize it, however, the Metropolitan gas undertakings would have to be bought up for 19 millions. It is admitted that “at present values” the property might be worth even 25 millions; “but,” the ingenious valuer remarks, “it is unlikely that we would ‘pay more than 19 millions for our gas.’ That is to say, by hook or by crook, the Companies’ property is to be depreciated in value by a fancy amount so as to suit the ‘Progressist’ book, and everybody who has bought a gas share upon the faith of a statutory guarantee is to be robbed for the supposed benefit of the ratepayer. Progress, of course, is a Shibboleth of the day, as Mr. W. S. Lilly says, and it is popularly supposed to mean everything that is good and desirable. The truth still holds, however, that there are at least two parties to every bargain. In regard to transfers of gas undertakings, there are three—buyer, seller, and Parliament, which stands by to “see ‘fair;’” and it is queer wisdom to assume that everything in a settlement of this nature is to be ordered in accordance with the views of one of the parties. He who reckons without his host was never looked upon as a prudent person; but it is apparently of such that some people think County Councils should be composed.

A Little Jest in the Lords.

THE House of Lords had their little joke again last week over Lord Stratheden and Campbell’s Smoke Prevention Bill. The noble legislators seemed to enjoy themselves immensely while discussing, in serio-comic vein, the possibility of preventing the pollution of the air of London by the smoke from private chimneys. Mention was made, in the course of the debate, according to the newspaper reports, of a mysterious compound called “sulphite of ammonia,” which was stated to be recoverable from coal smoke. Some noble lords waxed very scientific in their references to what might be done with this remarkable constituent of smoke. They even thought that it might pay the cost of carrying out Lord Stratheden and Campbell’s ideas. The Prime Minister, however, rather dashed these growing hopes by confessing to an acquaintance with sulphite of ammonia, “which,” he said, “has a vile odour more nearly resembling that of a drain ‘than anything else he knew.’” This statement from the head of the Government sadly perplexed noble lords, as indeed it does us. Of what was Lord Salisbury speaking? Sulphate of ammonia we all know; but supposing, as we have no right to do, that the noble Marquis pronounced the name of this useful chemical product like a Cockney costermonger, to whom the sounds of the first and third vowels in the English language are identical, where is the drain-like odour to be discovered? However, the subject has been referred to a Committee, to whom the truth about sulphate or sulphite of ammonia may perhaps be unfolded. The frequency and pungency with which the Premier has spoken on the subject of London smoke and fog has inspired *Punch* with the burlesque notion that the pending appeal to the country will be fought upon this issue—a (Hearth and) Home Rule question, in short. Unfortunately, there is but too good reason for believing that, while Administrations and Parliaments may come and go, smoke and fog will endure as long as any points of the British Constitution.

Mr. George Garnett, M. Inst. C.E., Engineer and Secretary of the Ryde Gas Company, has been again elected Chairman of the Ryde School Board. Mr. Garnett has not only earned the good opinion of his fellow-burgesses by the way in which he has discharged his public duties, but also their gratitude for many acts of benevolence. The latest example of his kindly consideration is the distribution, during the present sharp weather and the prevailing high price of coal, of tickets entitling the holder to 1 cwt. of coke at the gas-works. These tickets are given to the parents of the school children requiring assistance.

WATER AND SANITARY AFFAIRS.

THE second conference of the Metropolitan and Home County Members of Parliament, held at the beginning of last week under the auspices of Sir John Lubbock, in reference to the Birmingham Corporation Water Bill, resulted in no distinct resolution; but elicited an expression of “much regret” at the possibility of any further appropriation of water-bearing areas being agreed to by Parliament pending the report of the Royal Commission. The question is made to turn on the degree of urgency which attaches to the Birmingham scheme. The London County Council, by a resolution adopted on the day following this second conference, asks that Parliament will not pass the Birmingham Corporation Water Bill before the case for the Metropolis has been presented to the Royal Commission, unless it be shown that the need of Birmingham for an enlargement of its supply is so pressing as to admit of no delay. It is also understood that, should the Bill go forward, certain clauses will be introduced to prepare for a supply being furnished to the Metropolis from the same region as that to which Birmingham will have recourse. Thus the Royal Commission will be left out of the reckoning, if Birmingham is able to prove that its present supply is running short, and if the London County Council can keep its hold on the headwaters of the Wye. Yet the question may prove to have other issues connected with it. Wales has something to say about the matter, as well as Birmingham and London. Whether the Birmingham Corporation have devised a really good scheme is also open to doubt. As remarked by Sir John Lubbock, in his statement to the County Council last Tuesday, there is considerable opposition to the Bill in Birmingham itself. A curious question is also raised as to the rights of the commoners who are to be dislodged by the scheme—a point concerning which Mr. Shaw-Lefevre will have something to say in the House of Commons. But why should London trouble itself about the Birmingham Bill? There is no proof as yet that the Metropolis will have any need to go to Mid-Wales for a supply of water. This interference with Birmingham has an air of unreality about it, and looks like a piece of fussiness rather than anything else; except that it helps the County Council to look big, and suits the tactics by which it is sought to scare the Water Companies.

The water supply of London has been the subject of frequent reference both by speakers and writers, during the campaign of the candidates for the new County Council. On the one hand, the bait has been held out that, if the water supply were “municipalized,” it would be very much cheaper; and, for some occult reasons, there would be no more fear of cholera or typhoid fever. Another view of the question shows that the real object of those who hold out this tempting prospect is to get an enormous amount of patronage into their hands, and to proceed to the “municipalization” of a mass of undertakings, such as would place the County Council in command of an industrial army of the most formidable and even dangerous proportions. Lord Rosebery, whose views are not generally deemed extravagant, has been telling the electors in the City: “We have long dealt with land; ‘we are always dealing with land as one of the ‘necessities of the nation. We would deal with the air ‘if we could, as one of the necessities of life. It is water ‘alone which is sealed in this great Metropolis—sealed ‘to us largely by the action of Her Majesty’s Govern- ‘ment.’” Here is assuredly a mistake. The “sealing” of the London Water Supply for the last eleven years is due to Sir William Harcourt and his allies, who threw over the Purchase Bill introduced by the present Lord Cross. What might be accomplished by means of a fair bargain is shown by a morning paper which may be looked upon as the organ of the County Council. In its columns we read that the water supply, yielding an average of 7 per cent. to the shareholders, would be made profitable, “even at the full market price,” to a municipality borrowing at 2½ per cent. or less. To think otherwise, we are told, “is a fiction which imposes on no ‘man of business;’” and Sir Henry James is rebuked for supposing that the purchase of the water supply by the County Council would be a burden to the ratepayers. It is a pity that the fiction was not exposed a little earlier. But still we find the notion entertained, as expressed in a communication to the *Pall Mall Gazette*, that London—

or rather the County Council—is by some means to get possession of the Metropolitan Water Supply for an amount far beneath the “market value.” A new supply, it is said, can be obtained at a cost of 14 millions. But let the cost be what it may, supposing the supply to be in the hands of the County Council, financial success will mainly depend on good management; whereas if the policy of the past is to be pursued in the future, there is too much reason to apprehend that the water supply will be managed on other principles than those of a commercial character. A spirited reply to the *Pall Mall Gazette* contribution just mentioned appeared on the following day; showing that the scheme in hand was either to “wipe out the water undertakings without any compensation, or compel the Companies to sell for what is much less than half the market value of their “stock to-day.” This is the real answer to Sir Henry James and Sir Richard Temple, who have ventured to show the “rash and hazardous” nature of the speculations into which the Progressive Party desire to plunge. The risk is to be diminished by the amount of the sacrifice to be enforced on other people—that is to say, on the unlucky possessors of the coveted property. The composition of the new County Council, on which there will apparently be three Progressives to one of the Moderate Party, also points to a sustained and vehement attack on the Water Companies.

The Gas-Meter Testing Staff of the London County Council.—At the meeting of the London County Council last Tuesday, the Public Control Committee reported respecting certain communications they had had before them from Mr. C. E. Mills, the Chief Inspector of Gas-Meters, and the inspectors at the several meter-testing stations, asking the Council to re-consider their positions and salaries. The result was, in the case of Mr. Mills, a recommendation of an increase of £20 per annum, as from the 1st of April next, with an annual increment to commence from September, 1893, instead of after ten years' service, and, in the case of the other inspectors, the raising of the salaries to the maximum of their class as from the 1st prox. The report was adopted.

Death of Sir J. Coode.—We regret to record the death, at the age of 76, of Sir John Coode, K.C.M.G., the eminent engineer. Sir John was President of the Institution of Civil Engineers in 1889 and 1890, and received, on behalf of the Institution, the large number of American engineers who visited Great Britain in a body during the summer of the former year. He was one of the Royal Commissioners for the Colonial and Indian Exhibition of 1886; and was President of the Engineering Section of the International Congress on Hygiene, which held its sittings in London in August last. He received his knighthood in 1872, on the completion of the Portland harbour and breakwater, on which he had been engaged since 1847; and he was made a K.C.M.G. in 1886.

Increases in Salaries in the Manchester Corporation Gas Department.—The Manchester City Council agreed last Wednesday to a recommendation of the Gas Committee that the salaries of several of the officials in their department should be increased as follows: Mr. C. Nickson, the Superintendent, from £500 to £600; Mr. W. C. Waddington, the Superintendent of Street Mains Department, from £350 to £400; Mr. F. A. Price, Principal Bookkeeper, from £250 to £300; Mr. T. Vosper, Chief Clerk, from £225 to £250; Mr. J. Whittingham, Principal Rental Clerk, from £170 to £180 per annum; Mr. G. Whittaker, Chief Meter Inspector, from £190 to £200 per annum; Mr. H. Lyon, Manager of the Gaythorn station, from £210 to £250 per annum; and Mr. E. Williams, Chemist, from £164 to £180.

Telephone Companies and Gas and Water Mains.—Mr. W. Livesey writes to call attention to the position of gas and water companies in regard to the powers now being sought by the National Telephone Company and the New Telephone Company, in the two Bills they are promoting. Of course, these Companies will have to be placed under uniform regulations, whereby gas and water mains will be duly protected; and already six petitions from gas, and four from water companies have been presented with the view of securing this protection. The time has now expired for lodging petitions; and altogether 112 have been deposited against the Bills, so that the opposition will be formidable. Mr. Kimber has given notice of his intention to move the rejection of the Bill of the first-named Company on its second reading; but should it pass that stage, Mr. R. G. Webster will move its reference to a Hybrid Committee, to whom are to be referred all petitions presented against the Bill three clear days before the Committee meet. If this motion is carried, it will enable all persons, whether they are interested or not, to appear if they think fit. Mr. Livesey points out that gas and water companies are, in these cases, masters of the situation, as there is no law, or ever likely to be, requiring a company to stop their supply in order to accommodate third parties who have no interest in the matter.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 456.)

THERE was some slight improvement to be discerned in some of the markets last week; but the general features were not changed. Progress towards that restoration of confidence which alone can produce a revival of business made scarcely any perceptible advance; and the resulting restriction in the volume of transactions followed. The coal scare also had a share in depressing rails. The demand for first-class securities, however, for investment kept well up, fostered by the further tendency of money to cheapen. The discount houses are giving only $1\frac{1}{2}$ per cent. for money at call. In the Gas Market, there was a good deal more activity, especially in the issues of the Metropolitan Companies; but prices on the whole tended downwards. As the business of these Companies must have been improving lately, in point of sales of both gas and coke, the tendency to flatness was probably produced by a fear that the Companies might get pinched for coals in the course of the little game that is being played at the collieries. If so, we think the alarm is premature, and, in all probability, will not be justified in the end; but it is difficult to prophesy without knowing. Gaslight issues were active, especially “A.” We noted last week some sign of a disposition to give way; and this quickly developed—a fall of $1\frac{1}{2}$ on Monday being followed by another drop of 2 on Tuesday. The lowest point was reached on Wednesday, when 211 $\frac{1}{4}$ was marked twice. A vigorous struggle the next day concluded more in favour of the stock; the last mark being 214, and no further change supervened before the close. Less business was done in the debenture and preference issues; but prices kept steady, and the “H” 7 per cent. limited improved $1\frac{1}{2}$. Transactions in South Metropolitan were more extensive than of late. The “B” was put down 1, but held on very firmly afterwards, and would not go any lower. A few transactions in Commercial presented no special features. The quotation of the old stock has at last been drawn in closer, working out $1\frac{1}{2}$ higher; but prices marked remain about the same. Suburbans and Provincials continue steady, and very quiet. Dealings in the Continentals have also been considerably below the average; and the tendency was downwards. Imperial fell back 1; and Union, 3. All the rest of the Foreign division have been but little dealt in; and the only change was in San Paulo, which has dropped to par. The Water Companies are all weak; and nearly all have receded in quotation. The election has returned many of their enemies to the County Council; and they must again prepare to fight vigorously in defence of their rights.

The daily operations were: The Gas Market opened with an easier tendency, and prices generally were lower. Imperial Continental fell 1; San Paulo, $\frac{1}{2}$; and Gaslight “A,” $1\frac{1}{2}$; but ditto “H” rose $1\frac{1}{2}$. The tendency was the same on Tuesday—Gaslight “A” receding 2; and South Metropolitan “B,” 1. In Water, New River debentures rose 1; but Lambeth fell 2. On Wednesday there was no change either way in Gas; but Water continued to fall. Kent receded 3; Chelsea, 2; Southwark, $1\frac{1}{2}$; and East London, Grand Junction, and Lambeth, 1 each. Prices for Gas stocks on Thursday were mostly steady; but Continental Union relapsed $1\frac{1}{2}$. Water remained unchanged. On Friday there were many transactions in Gaslight “A” with a favourable tendency. Commercial old rose $1\frac{1}{2}$; but Continental Union receded to a similar extent. Chelsea Water fell 4. On Saturday nothing in Gas was touched but Gaslights, which were unchanged. Water quotations also were left standing.

ELECTRIC LIGHTING MEMORANDA.

Rivalry among Electricians—The Troubles of the City of London Company—Professor Forbes on Cheap Electricity.

It is pretty to see, as Samuel Pepys would say, how touting electricians, like well-trained actors, can change their tone in accordance with the part they may happen to be playing at the moment. We are continually in receipt of newspaper cuttings, &c., from correspondents in various parts of the country, which display the versatility of well-known advertising electricians in adapting their propaganda to local tastes. It is rarely necessary to mention these communications here, because the statements which the electricians who cultivate the provincial trade prepare for consumption on the spot, are usually based upon previously published observations of men like Sir David Salomons, Mr. W. H. Preece, and other leading hands in the manufacture of plausible partizan arguments, which are generally dealt with in these columns at first hand. There is usually the best fun when rival tradesmen undertake to expose each other for the edification of a local authority known to be contemplating the carrying out of an Electric Lighting Order. Let a local agent of the Brush Company, for instance, fall foul of a House-to-House man, and then the home truths soon begin to fly about both parties! We will only cite one illustration of such proceedings; but many of our readers will recognize the circumstance as reflecting their own experience. Portsmouth is thinking of electrically lighting itself; and consequently the local press is full of disinterested communications

from representatives of different systems of electrical supply and distribution, all breathing intense anxiety lest the townspeople should be misled by designing persons. The arc men make heavy play with the aid of "French measurement;" until the incandescent partizans "expose the trick," and so the controversy rages amain. It is vastly edifying to receive these repeated assurances that it is necessary to extract the square root from the figures given in a certain class of electricians' estimates, in order to arrive at an approximation to the truth. But it is understood that the electrical profession has a sort of governing or representative body of its own, and we are moved to ask whether the respectable members of this organization cannot do something to stamp out this Anglo-American scandal, which is so constantly reappearing all over the land.

The City of London Electric Lighting Company are priming the newspapers with statements explanatory of the wonderful work they are doing in order to fulfil their engagements by something near the specified time. They declare that they are actually completing over a mile of trench-work every week; thus "beating the record" of similar work in any city, and, as they fondly imagine, placing themselves beyond the reach of hostile criticism. Coincident with the street work, it is claimed that great progress has been made with the generating stations. Buildings have been erected, and machinery is already running having a capacity of many thousands of lamps. In addition, it is pleaded that additional buildings, machinery, &c., are in hand, and that the Company's stations are "gradually developing into the largest and most complete in existence." All this means that the Company will not be in a position to fulfil their engagements with the City by the time specified; and they want that indulgence which the Commissioners of Sewers have already once refused. As we understand the case, the Company will have no other course than to throw themselves upon the mercy of the City authorities, and plead their own endeavours during the past year in extenuation of the just condemnation of the jobbery attendant upon their creation, for which they will seek to disclaim responsibility. We notice that the history of the floating of this Company by another, which did no work, but took a profit of £50,000 for placing contracts that had been going begging for years, is being used by a speculative concern having the Duke of Marlborough for its titular head as a bait for the investing public. This is the sort of thing which, in view of recent transactions that need not be more specifically mentioned, the City authorities are likely to take offence at just now; and it would only be in accordance with the wrong-headedness of public bodies in general if the Commissioners of Sewers were to wreak vengeance on the wrong parties.

Professor Forbes has completed his Cantor Lectures at the Society of Arts on the modern developments of electrical distribution; and these will be accepted, until superseded by yet later information from some source equally entitled to respect, as the best available information upon one of the most important points of electric lighting practice. The most remarkable feature of the concluding lecture was the author's treatment of the crucial question of the discrepancy between the average and the maximum power required for central lighting stations. Arguing from the example of Geneva, where water is first pumped from the Rhone by means of turbines to a reservoir some miles distant, and is then brought back through pipes to within a short distance of the intake, where it passes into the river again through turbines which drive the lighting dynamos, the lecturer said that there are places in this country where the conformation of the land favours a similar arrangement, only with steam pumping power for raising the water in the first instance. He put the case in this way; supposing a maximum of 1000-horse power to be required for lighting a certain town, then the average requirement would be represented by 150-horse power per hour. If now, instead of laying down steam plant to supply the maximum output direct, which would be needed for a short period of the day, and could only be produced very wastefully, a 150-horse power steam pumping-engine is kept in regular work—the most economical way of employing steam power known—the whole energy required could be stored up in a high-level reservoir at the lowest possible cost. Of course, it would need to be taken out again; but the loss by the turbines and the cost of the reservoirs, pipes, &c., would, in Professor Forbes's judgment, be much more than covered by the saving in the coal bill, in irregular attendance, &c., as compared with an ordinary steam station. It is a striking idea; and, according to the lecturer, there are hopes of its being tried in Edinburgh. It is quite possible that by this means the cost of the unit of electricity may be reduced in certain favoured localities; but it is not every town that enjoys the advantage of an elevated loch in the vicinity, that can be converted at small expense into a high-level storage reservoir.

The Release of Hunter.—According to the Manchester papers, Samuel Hunter has been liberated, and is at present in the Metropolis, where, in all probability, he will in future reside. It will be remembered that the 18th inst. was the day named in the intimation received from the Home Office, as mentioned last week; but it is stated that the release took place on the 26th ult. The sentence was for five years; and of this term nearly four years were served—the first two being spent in Strangeways Gaol, and the rest of the time at Chatham and Portland.

THE CRYSTAL PALACE ELECTRICAL EXHIBITION.

FIFTH NOTICE.

GREAT prominence is just now being given by the Crystal Palace management to the visits to the electrical exhibition of deputations from Municipalities, which are now becoming frequent. Whenever possible, these official visitors are announced some time in advance by placard and advertisement; so that the undistinguished public may elect between the possibility of sharing the atmosphere of the Palace with the august Corporation of Derby, the Local Board of Chowbent, or any other municipal magnates. Not all itinerant corporations, however, like to see themselves advertised in this way; but many—perhaps the majority—prefer to visit the Palace unannounced, and look through the exhibition like ordinary mortals. There is a certain advantage, of course, for local authorities who are interested in electric lighting in being able to see the exhibits of the leading firms of electrical engineers and contractors collected under one roof. They can thus form a shrewd opinion respecting the standing and style of the different competitors in this kind of trade—opinions, we may add, which are not always controlled by the mere bulk of the exhibit. For if an exhibition of this class serves no other useful purpose, it gives the rising men a chance of appealing to the impartial eye upon the merits or the price of their goods. In the electrical branch, as in other departments of the world of commerce and industry, it is by no means to be taken for granted that the biggest people are necessarily the most deserving of patronage. How is an astute trader to pay for his advertisements, if he cannot therewith persuade purchasers that it is to their advantage to give him half as much again for the same goods as other dealers supply?

Unfortunately, the one thing that municipal deputations cannot learn by visiting the present exhibition, is precisely the thing that generally concerns them most—we refer to the question of the system of generation and supply best suited to particular cases. Every system has the one object of "showing a light;" and there are plenty of lights shown at the Palace as the results of every known system. Here may be seen primary-battery lighting; lighting by direct driving from gas-engines and from steam-engines; lighting through storage batteries of all sorts; lighting by low-voltage currents with two or three wires; lighting by high-voltage currents and transformers. All these and other systems are on view, from the generating plant to the lamps; and the partizans of every one are ready to offer any desired guarantees that their own methods are absolutely the best. How is a municipal deputation to decide upon this knotty question? It is at least certain that quite as much, if not more, information upon this subject can be gleaned from the quiet perusal of Professor George Forbes's Cantor Lectures, at the Society of Arts, as can be picked up in the course of a tour of inspection of the Crystal Palace exhibits. If a municipality are predisposed, through the counsel of their professional advisers, to pin their faith to Mr. Crompton, or to the Brush or the Woodhouse and Rawson Company, they will see nothing at the Palace to shake their good opinion of the work turned out by these firms. If, on the other hand, they have allowed themselves to be drawn in opposite ways by entertaining too many equally trustworthy, but divergent authorities, they will come away from the exhibition as perplexed as ever. For let us state once for all that, whereas in the Crystal Palace one system of electric lighting looks just as good as another, this is only because the result is obtained in every case by the rigid suppression of those economical considerations which are of paramount importance to those who are asked to put their money into central station electric lighting undertakings.

To return now to the exhibits of lamps and lighting. We notice that the enterprising firm of Messrs. Rashleigh Phipps and Dawson have been so eager to publish favourable press notices of their exhibits, the high and peculiar merit of which they point out with all the insistence of a showman at a fair, that they have reproduced in a little handbook of newspaper extracts one line from our article of the 16th ult. in which we are supposed to be commending "the high-toned work shown in this wonderful stall." A judicious neglect of context is the rule with abstractors of press notices; but the words quoted would strike any reader as having been wrenched from some sarcastically-written passage. Now, we by no means desire to deprive this pushing firm of the credit which is their due for a good deal of beautiful work in metal and glass, applied to the setting-forth of the incandescent electric lamp. There is much that is worth looking at in their stall in the Nave, and in the so-called Italian dining-room in the South-West Gallery, which has a set of light fittings to illustrate the solar system; the centre pendant over the table representing the sun, and the eight forged-iron wall-brackets symbolizing the principal planets. We respectfully decline, however, to take all those things at the valuation set upon them by the exhibitors, who need to cultivate more reserve in their treatment of this class of productions. When art-work is in question, interested invitations to admire it should surely be superfluous. Things really good will make their own way in time, without the help of puffery. For the present, the style of Messrs. Rashleigh Phipps and Dawson must be characterized as too exuberant. It needs

chastening, and the elimination of the *café orné* element; and then there will be little to find fault with.

For good honest fittings which, although occasionally reminiscent of gas and lamp fixtures, still preserve the domestic character, and do not suggest stagey effects, we are greatly disposed to commend the exhibits of Messrs. Faraday and Son, Messrs. Benham and Froud, Messrs. Evered and Co., Limited, Messrs. Sharp and Kent, Messrs. Shirley and Co., and Messrs. Barclay and Son. As a rule, the simpler fittings are the best. When the decorator attempts anything elaborate, he only too frequently goes astray through neglect or ignorance of first principles. He seldom remembers that the slavish imitation for novel applications of Louis Seize, Dutch seventeenth century, or so-called Queen Anne models, may serve chiefly to remind the spectator of the poverty of contemporary design; but he seems possessed with the erroneous notion that copying can take the place of creation. Will it be possible, we wonder, for the social historian of the twenty-fifth century to reconstruct a picture of a characteristic nineteenth century mansion of a good class, as we can, after a fashion, a Louis Quinze chateau?

This consideration leads up to a few remarks upon the furnished show-rooms in the galleries of the Palace, which repeat, upon an enlarged scale, the experiment first tried in 1882. Taking these upon the whole, the furniture and decoration are likely to strike the observer more than the lighting, which leaves a good many unsatisfied questions in the mind. The first suite of rooms to be entered from the Picture Gallery are lighted by Messrs. Rashleigh Phipps and Dawson. We enter them by a hall decorated in the Late Tudor style by Messrs. Godfrey Giles and Co., which is a really effective representation of a gloomy apartment such as our ancestors either deliberately loved or were compelled to put up with. There is no reason why we should do so; but "for those who like this sort of thing, this is just the sort of thing they like." Here, as elsewhere, the curious visitor may be recommended to count the lights, which just render the darkness visible. The adjoining dining-room, also by Messrs. Godfrey Giles and Co., apart from the lighting, is really very nice. It is decorated in smoked mahogany and deep blue, with a handsome panelled ceiling. The remarkable feature of these two rooms is that the whole decorative effect is produced by inexpensive means—Lincrusta Walton instead of carved wood and plaster mouldings, paper instead of tapestry, and removable parquetry. The result is to show that pretty room decorations are at last brought within the means of leaseholders. The dining-table here is a device of Dick Radclyffe, Limited, and Messrs. Rashleigh Phipps and Dawson. It has down the centre a water-tank in which little fountains play, edged with artificial arums, &c., containing small incandescent lamps. The effect is more tricky than comfortable. The drawing-room is strikingly decorated with bamboo by Mr. C. S. Walker, who does wonders with this unyielding material. The conservatory adjoining is by Dick Radclyffe, Limited, and is of the regulation exhibition pattern, with incandescent lamps shining from artificial palms, &c. In the middle is a perfectly hideous sham chandelier, with 15 glaringly false candles displaying incandescent filaments in all their nakedness.

Next we come to the so-called "Princess Christian" suite of furnished rooms, by Messrs. H. and J. Cooper, comprising a dining-room with old oak fittings and wall paintings let in; the table sumptuously, but not fantastically laid, and well lit by a shaded lamp. Here also the sham candles spoil the effect; but, with this reservation, the application of electric lighting in this suite is as good as anything in the Palace. The bed-room is very pretty, in the French style, with painted ceiling and lunettes; the hangings of the bed and windows being of old rose-silk and lace. Most of the lighting fittings here are by Faraday; and they do this firm great credit. The lights are sensibly disposed with regard to the dressing-table and the bed, which is not always the case. And here let us admit that the most satisfactory use of the special quality of the incandescent electric lamp to be seen at this exhibition is in some of these show bed-rooms, where a light is fixed inside the head of the bed, under the control of the occupant. In cases of sickness, or where the occupant desires to read or work in bed, the safety of the incandescent electric lamp gives it pre-eminence over every other known means of artificial lighting; but it is equally true that, with this exception, the incandescent lighting at the Palace shows no valid new departure whatever from the established uses of gas, oil, or candles.

Messrs. Allen and Mannoch have a pretty suite of rooms in the South Gallery, furnished regardless of expense, and without too much respect to fitness. By the way, it would be a good thing if the decorators and the sanitarians would take counsel together, and tell us whether or not we should hang our living and sleeping rooms with tapestry, chintz, ceiling stuffs, &c. It is easy to understand that parquetry flooring must be good for both reasons; but there is evidently room for discussion on the subject of wall and ceiling hangings. Scarlet fever does sometimes invade the abodes of the rich, who can afford to patronize West-end decorators; but it is hard to imagine one of these elegant apartments turned into a sick-room. Of the show made by Messrs. Frank Giles and Co., we have spoken in a previous article. It is very big, and expensively furnished with real and sham antiques; but the scheme of lighting is atrocious, and the general effect is more peculiar than inviting.

Messrs. Wallace and Co. have furnished a suite of rooms in

an eminently pleasing and "come-at-able" style, which are lit by Messrs. Crompton and Co.; the fittings being the productions of Messrs. Taylor and Tucker. We also like the work of Messrs. Poole and Messrs. T. and W. Aldridge; the rooms being well lit directly from a gas-engine situated in the Machinery Annex. Favourable mention is also due to Messrs. J. and S. Bowyer, for a very pretty suite of rooms. It cannot be denied that all these decorators and upholsterers have afforded every opportunity for the incandescent electric lamp to distinguish itself. They use it in all sizes and patterns—from the 50-candle lamp over the dining-room table, to the sham candle-flame lamp. It is shown in rooms panelled with black oak, and in boudoirs finished in shining white paint. It is used naked, and also heavily shaded. It is stuck up in the ceiling upon plaster bosses. It is brought down to the writing-table in the form of portable lamps. Everywhere the same observation may be made upon it—there are more lamps required to do the work than would be needed in the case of gas or oil, and they are pushed to a greater brilliancy than is usual in private lighting. The statistics as to the cost of current and cost of lamp renewals for these exhibition rooms will never be published; but the consideration is one that can hardly be overlooked by those who visit the display, not merely to be amused, but also for the purpose of learning lessons for application elsewhere.

The Management of the Rotherham Gas and Water Works.—The Rotherham Town Council, at their meeting on Wednesday, confirmed the appointment, mentioned last week, of Mr. Charles B. Newton as their Gas and Water Engineer. Mr. Newton is at present Superintendent of the Effingham Street station of the Sheffield Gas Company.

Institution of Civil Engineers.—At the meeting of this Institution last Tuesday, Dr. Werner von Siemens, of Berlin, was elected an honorary member, and the following as associate members: Mr. G. W. Anderson, Manager of the Upper Warlingham (Surrey) Gas-Works; Mr. J. R. Crook, Stud. Inst. C. E., of the Water and Drainage Department, Hong Kong; and Mr. J. F. Simmance, London representative of Messrs. Richmond and Co., Limited.

Mr. Bertram Ellis (son of Mr. H. D. Ellis, Secretary of the Commercial Gas Company) has been appointed by the Directors of the Oriental Gas Company Assistant-Engineer and Manager of the Company. Mr. Ellis was a pupil of Mr. Frank Livesey; and, among other work, he superintended, on behalf of the South Barracas Gas Company, the erection of their works in Buenos Ayres, which were completed last year. Mr. Ellis sailed for Calcutta in the P. and O. steamer *Chusan* last Friday.

Eastern Counties Gas Managers' Association.—The seventh general meeting of this Association will be held to-morrow week, in the Town Hall, Sleaford (which has been courteously placed at the disposal of the Association by the County Council), under the presidency of Mr. C. E. Jones, Assoc. M. Inst. C. E., of Chesterfield. According to the programme of arrangements issued by the Honorary Secretary and Treasurer (Mr. H. Wimhurst), the members will assemble at the gas-works shortly after noon, and after having partaken of refreshment, will proceed to the Town Hall, where the business will commence at half-past one. It will consist of the election of Mr. G. F. Cutting, of Downham Market, Mr. J. A. Fielding, of Waterbeach, and Mr. F. Kent, of Worksop, as members; the delivery by the President of his Inaugural Address; and the reading of a paper on "Consumers' Fittings," by Mr. J. H. Troughton, of Newmarket. The place for holding the autumn meeting will then be fixed; and the proceedings will close. The members will afterwards dine together at the Bristol Arms Hotel; and, for the convenience of members desirous of returning home the same day, the Great Eastern Railway Company have (on the suggestion of Mr. Wimhurst) consented to allow the 5.46 express from Lincoln to call at Sleaford about 6.10 p.m.

Waller's Patent Combined Exhauster and Gas-Engine on One Base-Plate.—Actuated partly by the discussion which took place in our columns some months ago, on the subject of working exhausters by means of gas-engines, Messrs. G. Waller and Co., of Park Street, Southwark, have been led to design a combined engine and exhauster on one base-plate, which is specially suitable in works where space is limited, as it can be fixed either on the ground or on an upper floor. It comprises disc-valves for the exhauster, an automatic bye-pass valve, and a throttle or relief valve, with regulator or governor; and the entire machine—say, one for a 500 cubic feet per hour exhauster and a 1-horse power gas-engine—occupies a space of only 6 ft. by 4 ft. 6 in., and 6 ft. high. With the exception of the fly-wheel and governor or regulator, the machine can be sent away in a case; and it only requires to be connected to the gas inlet and outlet mains to be ready for action. No skilled labour is needed, beyond what is necessary for connecting the gas and water supplies to the engine. With this machine, belts, countershafting, and fixing bye-pass, governor, valves, &c., in or above ground are obviated; and, though compact, every part is readily accessible. The engine is specially made with the crank below, which not only suits the arrangement better, but ensures steadier running. One of these machines has already been made for a colliery in Durham; and another for a Government gas-works.

NOTES.

A Smoke Recorder.

At a recent meeting of the Manchester Section of the Society of Chemical Industry, Mr. W. Thomson described an ingenious instrument, designed by himself, for automatically recording the density of smoke passing in chimney flues. In a number of experiments, Mr. Thomson found that by exposing pieces of paper in smoky chimneys, and withdrawing them after a few seconds, he obtained dark marks corresponding in depth with the amount of smoke passing up. He also ascertained that it is essential, in order that the paper should be properly marked, that it should be kept cold. His apparatus therefore consists of an arrangement whereby a strip of paper is exposed for a definite time in the interior of a chimney, being changed by clockwork after a period of exposure, while it is kept cool all the time by water circulating through the tube on which it is wound. The experimental apparatus pulls about 4 inches of the paper strip past the registering orifice during each hour. This orifice is merely a slit in a tube through which the smoke gases may impinge upon the paper within. Comparative diagrams of the actual performance of a chimney at different times are obtainable in this way; and some specimens of them were exhibited by Mr. Thomson to the meeting.

Advances in Pyrometry.

The progress of pyrometry is to be noticed in connection with Professor Roberts-Austen's recent Royal Institution lecture upon metals at high temperatures. In fusing iridium by the electric arc, in which the highest temperature yet measured by any instrument— 2000°C .—was reached, the thermo-couple employed in the Le Chatelier pyrometer consisted of a rod of iridium and a rod of an alloy of the same metal with 10 per cent. of platinum. It is worthy of remark that within a few weeks the Royal Institution lecturers have publicly measured temperatures so widely separated as -200° and $+2000^{\circ}\text{C}$.—a triumph of precision which would have been impossible a few years ago. Even before the introduction of M. Le Chatelier's instrument, as Professor Roberts-Austen admitted, a very considerable advance in pyrometry was made by Mr. Callender with his improvement of the Siemens apparatus, in which the alteration of the resistance of a platinum coil as the temperature rises, is used to measure the temperature. In this way temperatures up to 1500°C . can be determined with an error of not more than 0.1° . For the measurement of temperatures below that of melting iridium, M. Le Chatelier uses a thermo-couple consisting of two wires—one of platinum, and the other of an alloy of this metal with 10 per cent. of rhodium—simply twisted together. For the purpose of his lecture, Professor Roberts-Austen connected the ends of these wires in a circuit with a suitable reflecting galvanometer, which threw a spot of light upon a large scale fixed to the wall of the room. By means of this instrument, the lecturer was enabled to exhibit before a large audience the phenomenon of the recalcination of iron.

Sulpho-Cyanides in Gas-Works Residuals.

Some instructive remarks bearing upon the proposal to treat gas-works residuals for the recovery of cyanides were appended to a paper on the production of cyanides read by Mr. D. J. Playfair before the Glasgow and Scottish Section of the Society of Chemical Industry. After discussing the decomposition of sulpho-cyanides by the agency of various reducing media, the author stated that the sulpho-cyanides may be manufactured directly, or may be obtained as bye-products in gas manufacture. Dr. Lunge states the amount of sulpho-cyanide of ammonia in English gas liquors at about 25 lbs. per 100 gallons. Mr. Playfair declares that in no gas liquor of which he has been able to procure samples has the quantity reached anything like this figure. In Scotch gas liquor, after it has been treated for the extraction of ammonia, he has only found about 1 lb. of sulpho-cyanide of lime per 100 gallons. The refuse lime from gas purifiers contains sulpho-cyanides in larger proportion; but even this gas lime, from Scotch gas-works, contains less than 20 lbs. of sulpho-cyanide per ton. Moreover, in gas lime there is a large amount of hyposulphite of lime, which would require to be entirely removed from the sulpho-cyanide, as the presence of oxygen compounds is prejudicial to the formation of cyanides from sulpho-cyanides. The small quantities, as above mentioned, occurring in gas residuals are not, in Mr. Playfair's opinion, worth the cost of recovering; so it is preferable to make the sulpho-cyanides by direct processes.

A Smoke-Sewerage System.

It is sometimes urged, in connection with the smoke abatement movement, that black fogs will never be abolished in London and other congested centres of a bituminous coal-burning population until all smoke-flues, instead of discharging into the open air, are exhausted into trunk mains collecting the smoke in the same way and for the same collective treatment as is now applied to sewage. As a contribution to the facts of the question, mention may be made here of the experiments actually in progress on the Metropolitan Railway, at Neasden, with Mr. C. Anderson's system of exhausting smoke from railway tunnels. The freeing of the air of a tunnel from smoke produced by locomotives is a very different thing from collecting the smoke of a whole town; but there is still so much connection between the two problems that the successful solution of the one can hardly

fail to throw light upon the other. Mr. Anderson's plan consists in laying between the metals in tunnels a horizontal trunk, with which the smoke-boxes of passing locomotives are to be placed in temporary connection, so that the smoke of the latter may be drawn off for discharge at some distant point. The provision of the main and of the exhausting arrangements would seem to be easy enough; but the connection of the former with the locomotive running up to 40 miles an hour would appear to be very difficult. In reality, however, it is easily made through a "slipper," or sliding box on the main, into which the smoke gases are discharged, and which is made to open valves placed in succession on the upper side of the main. The arrangements are stated to be so perfect that the fires burn better when discharging into the main than when the locomotive is running in the ordinary way. The exhauster maintains a 2-inch vacuum; and the smoke is washed before being finally discharged into the air. Some complicated calculations had to be made before the dimensions of the various parts of the Anderson apparatus could be fixed.

Death of Mr. W. Hammond.—The death is announced of Mr. William Hammond, formerly Secretary of the Hampton Court Gas Company. He was in his 71st year.

The Late Mr. W. H. Michael.—The late Mr. W. H. Michael, Q.C., whose sudden death at Meran, in the Tyrol, on the 15th ult., was briefly recorded in the JOURNAL recently, was called to the Bar of the Middle Temple in 1864, was made a Queen's Counsel in 1878, and was elected a Benchman of his Inn in 1882. He was a member of the South Wales Circuit, and a Justice of the Peace for Glamorganshire. In addition to the important work on "The Law of Gas and Water Supply" already mentioned (by which, of course, he was best known to our readers), he collaborated in the production of the "Manual of Public Health," and was the author of "The Sanitary Acts." The deceased was for many years one of the leaders of the Parliamentary Bar.

Modern Gas-Engines.—This was the title of a lecture delivered at the last ordinary meeting of the Leeds Association of Engineers, by Mr. W. Morris, of Lincoln. Commencing with the discovery of coal gas, the lecturer rapidly traced the progress of the gas-engine from the earliest types, including that known as the Barber engine. He said the makers of it introduced compression of the explosive mixture before explosion, in 1838—i.e., 38 years before Dr. Otto. The Lenoir gas-engine, patented in this country in 1842, was very fully explained and illustrated by diagrams. The Otto-Langen free-piston gas-engine was described; and results of several practical tests were given, with diagrams. The Otto gas-engine next came under notice; and it was copiously illustrated with full-sized drawings and diagrams. The Atkinson engine was also described, and spoken of as the most economical engine in the market as regards its gas consumption. The Robey gas-engine (Messrs. Richardson and Norris's patent) was next referred to, and illustrated by complete full-sized drawings and diagrams of a 9-horse power (nominal) Robey engine. An example of the smallest engine made of this type was also shown in motion. With regard to the gas-engine of the future, the lecturer said he looked for economy in a hot cylinder and a regenerator.

Improved Public Lighting in Paris.—Reference has already been made in the JOURNAL to the successive improvements which have been effected in the public lighting of Paris by the employment of new types of gas-burners. Some months ago a project came before the Municipal Council to substitute 188 recuperative burners for a similar number of high-power burners for the lighting of the Place and the Boulevard St. Michel. The initial expenses attending the alteration were estimated at 37,400 frs.; but as a superior light would be obtained, with a saving of upwards of 21,000 frs., it was decided to carry out the project. By the 14th of July, the majority of the burners were in use, and giving admirable results. Since then, more than 150 new burners have been set up; the Municipality being convinced of the economy of the recuperative system of gas lighting for the public thoroughfares. Our contemporary the *Journal des Usines à Gaz* recently issued a map of Paris, showing the location of the "Industrial" recuperative burners in different parts of the city, and in an article in the same number, some particulars were given as to the progress made by this system of lighting. The first trials were conducted in the years 1886 and 1887; and they extended over a period of three years—the Municipality being desirous of thoroughly satisfying themselves before adopting any one of the systems submitted to them. On the occasion of the International Exhibition in 1889, some new types of burners were brought into service; and the results having been in every way convincing, it was decided, as from 1890, to modify the public lighting by substituting for the "Quatre Septembre" burners, passing 50 cubic feet of gas per hour, recuperative burners consuming exactly half as much gas, and giving a greater amount of light. "Industrial" burners, by which this economy is effected, have been installed in the Place des Victoires, the Place de la Bastille, the Avenue de l'Opéra, and the Rue du Quatre Septembre—the latter being the street in which the earliest efforts at improved public lighting were made in Paris; and there are now upwards of 800 of these burners in use in different parts of the city.

COMMUNICATED ARTICLES.

LIGHTING.

By W. H. Y. Webber.

PART IV.—THE PHOTOMETRY OF LIGHTING.

(Concluded from p. 390.)

Mr. Ralph Richards, whose *Electrical Review* articles upon photometrical subjects have been several times referred to in this investigation of the matter, has made an ingenious attempt to reduce to exact arithmetical expression the element of perception which enters so largely into all practical considerations of lighting effect. He calls this measurement of visual perception by the name of "optometry," and defines it as the experimental determination of the facility with which individuals are able to see the details of objects while the rays from a brilliant light-source are exercising a disturbing influence upon their eyes.

He starts with a brief discussion of what is meant by the term "brilliant" as applied to light; observing that gaslight, electric light, and sun light are all popularly described as brilliant, while it is evident that the word cannot mean the same thing in all three instances. He proceeds to draw a distinction between brilliancy and luminosity, as exemplified in the ordinary conversational expressions, "a brilliantly-lighted room," and "a brilliant star." It is then pointed out that a room is not necessarily brilliantly illuminated by a brilliant light; for it is plain that while, speaking optically, a light-source is just as brilliant to look at from a distance of 100 yards as it is from one of 10 yards, its useful effect in lighting will be very different in the two cases. Now both Mr. Richards and Mr. Varley have shown (see also Professor Tait, in Vol. LVIII., p. 710) that the law of lighting bears a remarkable resemblance to the electrical law $W = EC$. This becomes apparent if W is taken to represent the effective illumination; E , the brilliancy, or surface radiation per square centimetre; and C , the area of the light-source in square centimetres. Whence it appears that the efficiency of any luminous source depends upon two factors, and not on one alone. In order to render these considerations more intelligible, and also to clear up any doubt respecting the meanings of the terms employed in connection with them, Mr. Richards has essayed to define with precision the words frequently employed so vaguely in regard to lighting and light-sources. Thus, he says, let the term—

Brilliancy, or intensity = the luminous radiation per square centimetre of the surface of a luminous body.

Luminosity = the total luminous radiation of a light-source.

Softness = a property of luminous bodies when the brilliancy is sufficiently small to cause but slight contraction of the pupil, and consequently to enable bodies to be seen more perfectly when the eye encounters at the same time the direct rays from the illuminant.

Diffusive power = a term practically implying the same as the preceding word, but which is thoroughly unscientific, because light-rays of all intensities travel at equal velocities for the same colour.

Luminous power = a term implying the same as luminosity.

Mr. Richards hopes that these definitions may help to extricate the terminology of photometry from the peculiarly illusive condition into which it has been brought by vague speakers and writers.

The problem in lighting is to secure the greatest possible amount of dispersion of light from the source employed, by the use of devices suitable for this purpose. Unfortunately, Mr. Richards admits, this is a difficult matter, because of the existence of a popular idea that a room must be poorly illuminated if the brilliance of the light-source is not great. If the necessities of lighting were the only things to be regarded, the best illumination a room could have, according to this author, would be obtained by making the ceiling a huge parabolic mirror, in the focus of which a light-source could be placed. Although this idea cannot be realized in practice, a little consideration of it will convince the student that, so far from a light-source of theoretical efficiency needing to be as brilliant as possible, in reality it is desirable that the contrary should be the case, provided that the light is confined to the required area.

It follows, from this way of stating the question, that theoretically the final emissive source—meaning the surface of the reflector or globe required to diffuse the light of an unbearably brilliant point—should be of infinite extent; but this, of course, is impossible. Since dispersive agents of limited size must be employed in practical lighting, it becomes important to ascertain the best sizes of these appliances for different purposes. For this end Mr. Richards has been led to devise an instrument which he proposes to call an "optometer." This apparatus, a diagrammatic sketch of which is here given (fig. 10), is intended to measure the final efficiency of a light-source, or, rather, to be used in conjunction with the photometer in arriving at the final result. The author remarks that "it is one thing to have a naked arc giving 1200-candle power, but quite another for this high efficiency to be utilized in a manner proportional to its great luminosity." This is the problem of all lights of intense brilliancy and high concentration. Mr. Richards's optometer consists of a tube J , preferably furnished with the object-glass and eye-piece of a telescope, to which are added a pair of smoked-glass wedges ZF , which can be adjusted so as to cut off

any desired quantity of the light passing through them. The arc light or other luminous source under examination is removed to a distance of about 10 feet. A screen CD is interposed between the observer and the light, which passes through a small perforation at its centre. A mirror B is so disposed that, while it is out of the field of view of the telescope, it reflects a fair amount of light upon the screen CD , the surface of which

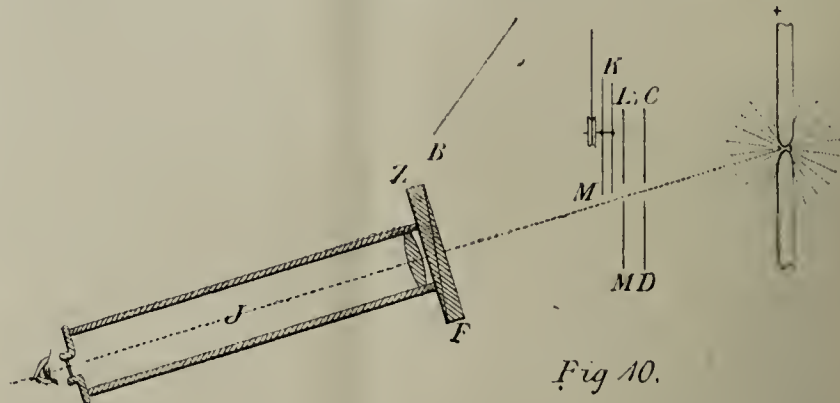


Fig 10.

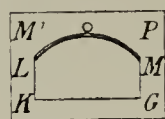


Fig 11.

bears several dull black painted lines, about $\frac{1}{4}$ inch wide. All being thus arranged, an observation is taken, by means of the telescope, of the light-source as it appears through the hole in the screen. A diaphragm of blackened card LM is now interposed between the screen and the telescope, having in it a hole so shaped that only a piece of the screen, of the form shown in fig. 11, is visible. A section disc KM is now placed before the screen, so that its outer circumference falls on the line LM , which coincides with the circumference of the aperture. "The portion LM , PM , of the screen CD is then blacked out; leaving merely the aperture and the portion of the disc visible through the opening KGM open to view. The sector disc is then rotated and adjusted until the painted lines upon the screen CD are no longer distinguishable, and the adjustment is noted. The disc is now reopened, and the aperture in the screen CD closed. It will be seen, when the disc is again rotated and the adjustment necessary to extinguish the black lines upon CD noted, that two data are at hand. The first gives the apparent luminosity when the light-source is visible; the second, when this is not the case. Means are therefore at hand whereby it is possible to judge the efficiency of a light-source in relation to its brilliancy; and thus it is possible to judge the relative efficiency of modified and unmodified light-sources."

Mr. Richards's language might be clearer; but his words must stand for themselves. He appears to be desirous of conveying the meaning that his suggested instrument supplies the possibility of determining, with reference to some fixed scale, the range of visibility of objects when the light by which they are perceived is itself visible and when it is obscured. This power of perception largely depends upon the condition of the iris, which varies in different circumstances and with different individuals. Writing from his own observation, Mr. Richards remarks that "the ability with which one is enabled to perceive the detail of surrounding objects, while the direct rays from the radiant are entering the eye, depends greatly—very greatly—on the brilliancy, but also on the luminosity; and it seems probable the latter has a great deal to do with the question."

In the practical investigation of this matter, a vast number of luminous sources of different kinds and intensities will come under observation. Mr. Richards has reduced some light-sources to a common standard, by observing them through smoked-glass wedges. He tabulates his results as follows; the term "brilliance," in the third column, being the quotient of the luminosity divided by the estimated radiating surface:—

Light-Source.	Candle Power.	Brilliance.
Union-jet gas-flame	10	0.2
Oil-lamp	12	0.5
Incandescent electric lamp	16	20.0
Arc lamp	1000	about 100.0
Magnesium tape burning 1 inch per second	150	50.0
Lime-light	300	50.0

Observation also shows that the pupil of the eye is dilated in proportion to the luminosity, supposing the brilliance to remain constant; but if the brilliance is increased, the luminosity remaining constant, then the iris will be contracted proportionately to this increase.

Here then, Mr. Richards remarks, we come face to face with a very important fact, the due consideration of which implies the whole knotty question of the final efficiency of all artificial light-sources. It has been emphasized that while the *total luminous radiation* cannot be too great in order to attain the best result, it is equally certain that the *brilliance* should be as low as possible, provided that the effect is confined to the area required to be illuminated.

This statement sums up the whole case against lighting by the electric arc. Mr. Richards wishes to remove the objections to this method of lighting by using a system of double parabolic reflectors for breaking up and diffusing the light of the arc, and at the same time for keeping it out of direct view. He regards the ordinary means of increasing the luminous surface in connection with arc lamps by the use of opal or wavy glass globes

as wasteful and generally unscientific. This may be so; but practical experience in lighting proves that the use of reflectors is much more objectionable unless they are made of a material so translucent as to permit of the passage of at least sufficient light to avoid the projection of a shadow, which is a consideration that does not seem to occur to Mr. Richards.

The truth of the matter is that lighting by arc lamps is rendered ineffective by the unmanageable brilliance of the sources. The opal globes have a very brilliant appearance at first sight; but the eye that takes them into its field of vision cannot well distinguish anything else. Mr. Richards admits this, and cites a trial which he made upon his own visual perception at the Hastings concert-room, when, notwithstanding the fact that the lighting was practically equal to that of daylight for reading purposes, "he found it perfectly impossible to distinguish the details of objects in its immediate vicinity, when looking at the arc at the same time." A similar observation has been made in regard to the electric arc lighting at the Crystal Palace. At the first glance, the impression produced by this example of the lighting of a large interior area is that of brilliancy in a high degree. The lamps here are of the Glcher type, and their performance leaves nothing to be desired by way of steadiness. It is soon discovered, however, by promenaders under these lamps, that if one desires to see objects near the floor-level by their light—as the countenances of other people, articles exhibited, &c.—it is necessary to keep the eyes bent downwards, and to avoid, even at the cost of some inconvenience, direct vision of even distant lamps. Moreover, the effect of these brilliant lights upon the pupil of the eye is exhibited in the unpleasant phenomenon of the *visual impenetrability of the plane of the lamps*. This phenomenon may be otherwise described as the effect which renders it impossible for observers below the plane passing through the lamps, which is about 25 feet above the floor, to distinguish clearly any object above this plane; and it similarly prevents an observer in an elevated position above the lamps from seeing anything upon the floor. Thus the electric lamps make the vault above them appear as dim as though the lanterns were opaque at the top, which is not the case. It is possible to conclude from these observations that the electric arc will never be made a really good illuminant unless far more effective means for reducing its brilliancy and enlarging the radiant surface are introduced. Its unmanageable intensity is the great obstacle to the popularity of the electric arc light; and whosoever recommends its adoption, for either indoor or outdoor use, on the assumption that its illuminating efficiency, as practically tested by the human eye, is to be expressed in terms of its gross candle power, ignores the fundamental distinction between *light* and *lighting* which it has been the main purpose of these articles to emphasize and explain.

In conclusion, the reader's attention may be profitably directed to the description of a portable photometer devised by Mr. Carl Hering for measuring street lights and illumination in general, which is to be found in the paper read by him before the Engineers' Club of Philadelphia, and given in the JOURNAL for the 16th ult. (p. 293).

COAL GAS: ITS MANUFACTURE, DISTRIBUTION, AND CONSUMPTION.

A Series of Articles for Gas Students.

INTRODUCTORY.

The following series of papers have been prepared with a view to the assistance of intending candidates for the City and Guilds of London Institute Examinations in Gas Manufacture. They are addressed more especially to the younger students entering for the ordinary grade, than to those who, more advanced in the profession, and already grasping many of the details of successful gas management, have access to the various standard works, and other sources of information bearing on the subject, that are denied to many of their juniors. Such processes and inventions of recent introduction as bear upon the subjects under consideration, but are hardly beyond the sphere of experimental investigation, will therefore not be dealt with, further than by a mere passing reference.

The science of gas manufacture is eminently practical; and the student will truly find his best "works of reference," so to speak, in the works with which he may be connected. The preparation for an examination, the examination itself, and possibly the results of that examination, are but means to an end—*i.e.*, the complete mastery, in all its details, of the matter under study. Thanks to the management of the City and Guilds of London Institute, the papers set to the candidates are such as to induce to a practical preparation that shall be most helpful in the attainment of this end; and it is useless for the student to think that he will win honours at these examinations when fortified merely by study, however exhaustive, of the best books on the subject, to the exclusion of any *experience* of practical work.

This is as it should be. The student should make it his first business to master all the details of his own works. He should consult the every-day returns of his manager's report-book, and ascertain, as far as possible, the why and the wherefore of the constant variations in these returns. He should take every opportunity afforded, by the temporary shutting off of apparatus for repairs and by other means, of thoroughly investigating the

construction and working of the various appliances in use, from the retort to the gasholder. He should also keep a sharp eye on general every-day working operations, and the various methods employed for duly carrying them on; and "when found make a note on't."

By such means, an intelligent and inquiring student may amass a stock of information that will eventually prove to him of much practical value. He is then in a position to consult, to the best advantage, the various authoritative writers in "King's Treatise on Coal Gas," and other standard works. Such information *must*, however, be supplemental to, and not substituted for, a practical acquaintance with every-day work.

COALS.

Of coals suitable for the production of illuminating gas, there are two chief kinds—cannel, found principally in Scotland as well as in Northumberland (Newcastle), North Wales, and Lancashire; and bituminous coal, found in numerous districts throughout the country. Many of the best coals of the latter class are raised in Northumberland and Durham, Lancashire and Yorkshire, North and South Wales. Lignite, or brown coal, and anthracite, are of no use to the gas maker, being practically destitute of the heavy hydrocarbons which are the light-giving properties of coal gas.

The approximate proportions of carbon, hydrogen, and oxygen present in these four classes of coal have been given as follows:—

	Carbon.	Hydrogen.	Oxygen.	
(1) Lignite . .	396.01	15.00	25.93	100.00
(2) Caking coal .	90.56	3.40	6.04	100.00
(3) Cannel . .	90.84	4.11	5.05	100.00
(4) Anthracite .	80.89	1.13	17.98	100.00

Later analyses of good working samples of the second and third classes of coal, drawn from Lancashire pits, have given the following:—

	Coal.	Cannel.
Carbon	77.90	79.23
Hydrogen	5.32	6.08
Oxygen	9.53	7.24
Sulphur, ash, &c.	7.25	7.25
	100.00	100.00

Lignite is coal in its early stages of development. As the formation proceeds, carbonic acid (CO₂), moisture (H₂O), and carburetted hydrogen or marsh gas (CH₄), are, by the forces of Nature, gradually evolved; and the caking coal, the cannel, and finally the anthracite, are produced—the last-named having parted with nearly all its hydrogen and oxygen. Of bituminous coals, we have caking coal, just referred to, and so called because when heated it fuses into a pasty mass. It is a good gas coal; it does not require such high heats for distillation as cannel, nuts, or slack; and it produces a soft but good coke. Cherry, or soft coal, is similar to the foregoing; but it does not fuse in the retort. Splint, or hard coal, with few exceptions, is not used by gas makers. It is chiefly employed in smelting furnaces; and it yields a good hard coke.

Coal, like coal gas, has no definite chemical composition. Samples taken from the same district, and even from the same pit, will be found to vary considerably. This especially applies to pits of long standing, where old seams have been worked out, and new ones opened up. Then, again, dissimilar conditions of working produce varying results from coals drawn even from the same seam. What might well suit the methods of carbonization at one works would give very different results at another, owing to variations in the temperatures employed, and to other vital conditions. Laboratory tests, too, are exceedingly liable to error. The smallest error on a test of a few pounds becomes magnified many hundred times when calculated to the ton. For these reasons, while the laboratory analysis may give some idea of the capabilities of a particular coal, the best, and, to the writer's mind, the only means of ascertaining the commercial value of a coal to a certain gas undertaking is by making a practical test of it under conditions of every-day work.

Mr. Thomas Newbigging, in his "Gas Managers' Handbook," gives the average yield of Wigan cannel and coal and Newcastle coal as follows:—

	Wigan Cannel.	Wigan Coal.	Newcastle Coal.
Gas	10,900 c. ft.	9980 c. ft.	9700 c. ft.
Illuminating power . .	24 candles	15 candles	15 candles.
Coke	1436 lbs.	1517 lbs.	1540 lbs.
Tar	17 gals.	11 gals.	9 gals.
Ammoniacal liquor . .	18 "	20 "	10 "

Average Percentage Yield of Good Bituminous Coal.

Gas	18 per cent.
Coke and breeze	68 "
Tar	5 "
Ammoniacal liquor.	9 "
	100

By dint of good management—every care being taken not only to prevent undue waste of crude gas, but to work on conditions best adapted for the particular class of coal in use—and also by arresting all traces of ammonia before the gas reaches the purifiers, some undertakings have secured the following yield per ton from good Newcastle coal:—

Gas (15 sperm candle)	9830 c. ft.
Coke	1500 lbs.
Tar	10 gals.
Ammoniacal liquor (5° Twaddell)	30 "

Many managers, however, are now constantly getting considerably higher results than the averages just quoted.

Cannel, rich in illuminating hydrocarbons, is almost universally used, in quantities varying from 2½ to 10 per cent. of the total bulk of coal carbonized, for raising the illuminating power of the gas in accordance with the requirements that may be imposed on various gas undertakings. For instance, the addition of (say) 5 per cent. of a cannel, yielding as per figures given above, to a coal giving (say) 10,000 cubic feet of 15-candle gas, would result in about 10,045 cubic feet of 15·48-candle gas per ton of the total quantity carbonized, or 10,000 cubic feet of 15·5-candle gas. The addition of 10 per cent. of cannel under similar conditions should give about 10,000 cubic feet of 16·1-candle gas.

The following rules bearing on the relation of quantity to quality of coal gas, are extracted, by permission, from Mr. Newbigging's "Handbook," and they may be helpful to the student :

To Find the Relation between Quantity of Gas per Ton and Illuminating Power. (Farmer.)

If a coal yields a known volume of gas of a known illuminating power, to ascertain how much it will yield of another value :

Rule.—Multiply yield of gas by illuminating power, divide by the *required* power, and the quotient is the quantity.

Example.—A coal yields 10,000 cubic feet per ton of 15-candle gas. How much will it yield of 14 and 16 candle gas respectively.

$$\frac{10,000 \times 15}{14} = 10,714 \text{ c. ft., and } \frac{10,000 \times 15}{16} = 9375 \text{ c. ft.}$$

To Find the Value of Gas in Grains of Sperm per Cubic Foot from the Given Illuminating Power.

Rule.—Multiply 120 (the grains allowed per hour for the consumption of the standard sperm candle) by the illuminating power, and divide by 5 (consumption of gas in cubic feet per hour by the standard burner). The answer will be the value of the gas in grains of sperm per cubic foot.

To Find the Value of any Coal per Ton in Pounds of Sperm; the Yield of Gas and Illuminating Power being known.

Rule.—Multiply the cubic feet produced per ton by the value of the gas in grains of sperm per cubic foot (ascertained by the previous rule), and divide by 7000 (the number of grains in 1 lb. avoirdupois). The answer will be the value of the coal in pounds of sperm per ton.

The ash or mineral matter in gas coal varies considerably, both as regards quantity and composition. The following analysis of a good Newcastle coal is given in "King's Treatise on Coal Gas" :—

Silica	59·56
Alumina	12·19
Peroxide of iron	15·96
Lime	9·99
Magnesia	1·13
Potash	1·17
	100·00

Brasses.—Some coals contain a considerable quantity of sulphur, chiefly in combination with iron as bisulphide of iron (Fe S₂), iron pyrites, readily detected by its brassy appearance on the fractured surface. Such a coal should be neither stored nor distilled in a wet condition. In the first case, it is much more liable to spontaneous combustion than if stored dry ; in the second case, the steam produced in the retort, and there decomposed, tends to accelerate considerably the formation of sulphuretted hydrogen (HS₂) and carbon bisulphide (CS₂), and other compounds of sulphur, much of which might, had the coal been dry when placed in the retort, have remained in the coke.

The Retort-House.

Here it is that the dividends of a gas undertaking may be made or lost ; hence the necessity for special care being exercised in this department. Having been selected and brought into the house, the coal has now to be subjected to a process of destructive distillation ; all the volatile portions—gas, tar, ammonia, water, &c.—being expelled by heat, and every care taken to ensure that none escape. The solid residue—coke, ash, &c.—is periodically extracted from the still (the retort), and fresh coal put in its place.

In the successful extraction of these volatile constituents of the coal, it is necessary to ascertain certain conditions which may materially affect the results to be obtained. The chief of these conditions are the time allowed for the period of distillation, and the temperature at which the operation is to be carried on. Both conditions will depend, in part, upon the class of coal in use. Reckoning, in estimating the weight to constitute a charge (*i.e.*, one retort full of coal), for any swelling of the coal which may take place on heating, the usual plan is to allow six hours for the complete working off of all the volatile matter that will be of use to the gas maker. Some engineers prefer four-hour charges. The best gas—*i.e.*, that which is most rich in light-giving hydrocarbons—comes off during the third and fourth hours of the charge.

The matter of temperature is perhaps more difficult to decide. Some engineers prefer very high heats, with a resultant high yield of comparatively poor gas and little tar. Others go to the other extreme ; obtaining a low yield of rich gas and much tar. But most gas makers strike a mean between the two, and prefer to work at a temperature varying from 1750° to 1900° Fahr.

The following temperatures are taken from a table prepared by M. Pouillet: Cherry red, 1650° Fahr. ; bright red, 1830° Fahr. ; orange, 2010° Fahr. ; bright orange, 2190° Fahr.

(To be continued.)

TECHNICAL RECORD.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

The Annual Meeting in Manchester.

We complete to-day our report, commenced last week, of the proceedings at the above meeting, by giving the following paper, prepared by Mr. T. Newbigging (which, in his absence, was read by the Secretary), with the discussion thereon :—

MANAGEMENT.

I do not care to be thought ambitious of playing the rôle of patriarch. I know very well that advice when it is cheap is often of but little value ; and sometimes when it is unsought we are tempted to tell the giver to " save his breath to cool his broth." And yet " a word spoken in season how good it is ! " The goodness of the advice is the test of its value. Advice may be bad as well as good ; and discrimination is necessary before accepting it. The subject I have chosen to dilate upon is that of " Management "—the management of gas-works.

There is a great deal in managing workmen. Some managers can do this naturally ; they have a genius for it. It comes to them by nature. With others, again, it is difficult. Their natural temperament is against them. They are perhaps too self-conscious, which is usually a defect, leading them readily, and on the slightest occasion, to take offence. Or they are liable to abstraction, which is another defect. It prevents a man from having his eyes open and taking a wide view. Such a one is an absent-minded man. He may possess more intellect, and be a deeper thinker, and have greater experience, than his more successful brother ; but he lacks the knack or tact of the other. An objective turn of mind should be cultivated by a man who aspires to be a manager of men. That is the working mood. As a rule, perhaps, men are inclined to be subjective ; and if this mood is strong upon them, they may be inventors or philosophers, but they will only be indifferent managers.

Whilst with some to manage men is a natural instinct, with others it is an art to be learnt. Happily, the art can be acquired ; and, in a less or greater degree, every manager should study to acquire it. Indeed, it is indispensable to success in the position he holds. The ability to manage men, and the exercise of it, smoothes the thorny path of management. The wheels of the machinery run with less noise and friction ; there are fewer " back-lashes " to endanger the cogs, and throw the pinions of life out of gear.

A judicious mixture of firmness, fairness, and urbanity is needful for success in managing men. To be fair whilst you are firm secures confidence in your judgment, and in your character for straightforwardness. One can be firm without bluster. Urbanity is not a sign of weakness, and it sugars the pill of command. Our greatest generals have been men of quiet demeanour—not given to superciliousness. The order to do a thing should be given with a due sense and knowledge or belief that the person ordered is able to perform the duty imposed upon him. An unreasoning and unreasonable order secures its own defeat ; and it is more discreditable to the person in command than to the incompetent servant.

A bond of sympathy should unite the manager and his workmen ; and it is the manager who must weave it. Sympathy may well flow downwards, like water ; but it also rises as water does when the tide is coming in. When the waters meet, there is peace and a great stillness, and a full sense of satisfaction. Where there is indifference, the sympathetic waters recede, and there is a barren strand—or worse, for it is littered with a noxious growth that poisons the air.

In the management of men, a display of partiality and favouritism should be avoided. This does not imply that a good workman and a willing should not have the special recognition which his services deserve. To reward merit is not to show favouritism ; it is simply to pay for value received.

A drunken workman is a pest and a nuisance to a manager. He may be handy and useful, and even a genius when sober. But he is never to be depended on ; and the irritation and anxiety which his unsteady conduct induces, more than outweigh his good qualities. A sober man, if more commonplace and less competent, is infinitely to be preferred.

Get rid of a spy and a tale-bearer. Such a one is nearly always the bringer of bad news ; and not unfrequently his story is false. A story can be false and fiendish, and yet founded on fact. There are often extenuating circumstances that alter the colour of a man's conduct, or an apparently bad action. A tale-bearer, in the recital of his story, takes no account of these, but rather keeps them in the background. The wound which he inflicts on his master is often greater than the ill he intends for his fellow-workman. Get rid of him. If notice of dismissal is required, pay him a week's or a fortnight's wages, and let him go—consoling yourself with the reflection that his absence is cheap at the price.

A gas manager has to manage the consumers as well as his workmen ; and that is sometimes as difficult a task as, and frequently a more delicate task than, the other. To do this with success requires the play of another set of qualities. He stands in altogether a different relation to the consumers to what he does to his employers. The lever and fulcrum of command are out of place here. His straightforwardness of character is still to be manifest—that is a *sine quâ non* at all

times and under all circumstances. But an equable temper and a patient persistence are required. Prompt attention is expected of him; his persuasive powers have to be brought more into requisition; and a certain courtesy of demeanour has to be exercised even under aggravating conditions.

The first and chief duty of a gas manager, as such, is to aim at making the business under his charge a successful one. To that end, he will use all proper endeavours to conciliate and satisfy his customers. But he will at the same time be slow to listen to the whispers, or even the shrieks, of malignant tongues, who, without justification, and in the face of proof to the contrary, bring charges of extortion against the undertaking over which he exercises his care, and of the vileness of the commodity which he dispenses. The very success of gas enterprise makes it a mark for envy and detraction.

There is no better criterion of good management than a works kept in a state of neatness, orderliness, and method. To use a trite expression, there should be "a place for everything, and everything should be in its place"—not squandered and littered over the premises. Heavy stores, such as cast-iron pipes and castings in the storage yard, should be arranged in order, according to their sizes. So with fittings of every kind in the covered stores. Old metal should have its corner assigned; and rubbish of all descriptions, if necessary to retain it, should be in a place apart. It is a mistake to choke a yard with coke. To store and hold coke is an expensive and generally unwise policy. Better clear it out at a low price than stack it like a mountain in expectation of a higher. The fact that you have a big stock defeats your object. Besides, when you sell it low, you get many people into the habit of using it. You manufacture customers; and in time there is such a wide-spread and steady demand as to justify a reasonable rise in price. How common is it to see the furnace ashes dumped out in a heap containing possibly 20 per cent. of good coke. This is a waste that should not be tolerated; and, generally, it would pay to have the coke hand-picked from the mass.

Keep your buildings—both walls, roofs, and woodwork—in a state of decent repair. A free use of paint over ironwork is economical, and a frequent coat of limewash to the inside of the walls brightens and sweetens a retort-house. In a word, take a pride in your works, and determine that, so far as the means at your command will admit, they shall be conspicuous both as to equipment and general results—remembering that disorder and dirt mean waste; and orderliness and cleanliness, economy.

But "I am hampered by my committee," says one. A committee is often what the manager wills. If he, by integrity and assiduity, proves his competency for his position, he will win the regard, the confidence, and the support of his committee, or the sensible majority of them; and an obstructionist member will in the long run have the ground cut from under his feet, and will either be turned into a friend or retire discomfited.

The manager of a small or moderate-sized gas-works has often spare time on his hands. I would advise such a man not to be gadding off on every opportunity, but to employ his precious leisure usefully in the study of practical chemistry or some other branch of physical science. In elucidating the processes of his own special work, there is yet much to be done. With all that has been said and written on the distillation of coal, the process is one about which we have a vast deal still to learn. I do not for one moment believe that we have attained to anything like perfection in that very first of the processes of gas manufacture. It is not without warrant that I say we are far from making the most of that wonderfully complex mineral—that most wonderful of all the minerals—coal. I fear we are not getting the quantity, and certainly we are not getting the illuminating value from it, that it is capable of yielding. I wish some of our young and active spirits would go into a retort when it is in action and the lid closed, and observe what is going on inside. I earnestly wish they would put their brains into it, that they would project the eye of their intelligence into it, and unravel to us the mysterious operations that are taking place there. That will be done some day by someone. If you feel that this is a task beyond your power, and that you must be content to labour on a lower plane, at least you can determine to do your "utmost best" according to your capacity; and in doing this, you will find unhappily that the way to truth is often through a certain amount of error. In the course of our investigations, it is not always possible to hit the mark at first; and we may at times be wrong both in our theory and practice. But if we pursue our studies, we shall get on to the right track in the end. It requires great courage to state one's views when they run counter to the current and orthodox and almost universal opinions that are held by high authorities; and to be heterodox in science or in art (no less than in theology) is to invite a certain amount of obloquy, and even persecution for a time. Nevertheless, to express one's views fearlessly, is to assist at arriving at the truth. If they are wrong, they can be confuted; and if right in the main, they will not want for consideration.

Finally, in the words put into the mouth of Polonius, I would say to every gas manager: "To thine own self be true, and it must follow, as the night the day, thou canst not then be false to any man."

Discussion.

Mr. C. E. JONES (Chesterfield) said this was the first time in his experience that gas managers had been recommended to commit suicide by carbonization. However, they were very

much obliged to Mr. Newbigging for an interesting paper; and he proposed that their heartiest thanks be given to him for it.

Mr. T. B. BALL (Rochdale) regretted that Mr. Newbigging was not present at the meeting. There was nothing in the paper to which anyone could take exception; but he fancied he could see the smile which lurked about the corners of the author's mouth when he penned some of its phrases. It reminded him of the Book of Proverbs. Mr. Newbigging, whose experience dated some time back, took a too roseate view of the position of the gas manager to-day. He fancied most of those who were in actual charge of works would agree that the manager's position now was very different from what it was a few years ago. Certainly his (Mr. Ball's) experience was that the difficulty of conducting gas-works was considerably greater than when he first became acquainted with the duties; and this, he feared, was the experience of the majority of managers. Notwithstanding the concessions which had been made to the men, and the shortened hours of labour, the work was not so well done as it used to be; and one's relations with the men were not so cordial and so close as they formerly were. Perhaps this might be due as much to faults of temperament on his own part as to other causes; but he fancied this was not confined to his own works, and that others would have experienced the same thing. Indeed, he did not see how the relations of manager and men could be as of old, for they had now to deal with outsiders instead of with their own men. Mr. Newbigging also referred to the subject of storing coke, and held that this was an expensive and unwise policy. This statement should be taken with a reservation. To clear out the coke as produced would, in his opinion, not be wise, because in certain districts there was a demand for coke in summer time; and it was desirable that, if people acquired the habit of using it, gas managers ought to be able to supply it all the year round. It might be unwise to store more than would supply this demand; but a certain quantity was necessary. He had much pleasure in seconding the motion.

Mr. W. SEVERS (Lymm) said, in reference to the storage of coke, he was asked a short time ago by one of his consumers to reserve about 30 or 40 tons. He did it, and then the customer said he had obtained it at a cheaper rate from Rochdale; and he (Mr. Severs) was consequently "left in the lurch." Afterwards he was glad the bargain was off, for the coke became thoroughly wet; and when he did sell it, it weighed so much heavier on account of its drenching.

Mr. BALL said the story did not apply to Rochdale, for, as a matter of fact, they never sold a ton of coke out of the town.

Mr. T. DUXBURY (Darwen) remarked that there was not a great deal in the paper that could be criticized, as Mr. Ball rather suggested; but he (Mr. Duxbury) quite agreed that the difficulties of a manager's position were greater at the present day than when Mr. Newbigging occupied it. As a matter of fact, the workmen in their combinations looked upon the manager with great hostility; he was also regarded with hostility by the consumers; and even some of his own Committee were frequently against him. Under circumstances like these, it was very difficult for him to discharge his duties and keep a pleasant face. As to the storage of coke, he (Mr. Duxbury) was situated like Mr. Severs, with the difference that he was close to another and competing gas-works. He had that day 5000 tons of coke in his works. In the neighbourhood of Darwen, coke was an article which was sold at a certain price in the town, and at a lower figure if taken outside. As a consequence, people bought coke at a neighbouring works, and came to Darwen to sell it. With reference to another remark by Mr. Newbigging, no doubt works should be, as far as possible, kept in good order; but this was not always an easy thing to do.

Mr. G. SMEDLEY (Buxton) endorsed the remarks of previous speakers as to the members' indebtedness to Mr. Newbigging, who was perfectly correct in almost all the observations in his paper. He (Mr. Smedley) was sorry to hear his neighbours say that their relations with their consumers and their workmen were not what they used to be. He was in the happy position of being right with both. He did not know that, in the whole of his experience, he was in a better position with his men. This, he believed, arose from the fact that he had in operation the principle on which Mr. George Livesey had more recently acted, of having the men directly interested in all they did. The stokers were paid according to the production of gas. He had men who had been with him ten years; and only the previous day one said he had never spent a happier time than that which he had passed at the Buxton Gas-Works. All the men were doing their work willingly and well. As to coke, he agreed with Mr. Newbigging that it was better to get rid of it than to stack it at the risk of depreciating 25 per cent. Here again he was perhaps in a better position than most of his fellow-members, for it was his greatest difficulty to store enough coke in the winter to supply his customers in the spring.

Mr. J. HUTCHINSON (Barnsley) remarked that in his town they were quite cleared out of coke, in anticipation, no doubt, of the closing of the coal pits. The circumstance was unprecedented at the Barnsley works at this period of the year.

The motion was then put and carried.

Alderman J. R. Foord has been appointed a Director of the Brompton, Chatham, and Gillingham Water Company in succession to his late brother, Alderman W. Foord.

THE PARKINSON CONDENSED GAS COMPANY.

Under the above title, a Company has been formed in Manchester for the introduction of a new patented process for the extraction of oxygen from the atmosphere, and supplying it, compressed in steel cylinders, in a high state of purity, for commercial and other purposes, for the use of comparatively small consumers, and for the erection of complete plants on which a royalty would be charged, when large quantities are regularly required. With the view of demonstrating the process, and also of manufacturing the oxygen gas, a complete plant has just been erected at Stretford, near Manchester; and a representative has had an opportunity of inspecting the system employed, and the various appliances which have been put down.

Before describing the plant itself, it may be mentioned that, in conducting the experiments which have resulted in perfecting the present process, Mr. J. H. Parkinson, the inventor, aimed at finding, if possible, a substance which would be unaffected by moisture or carbonic acid, and which being in a highly porous state, would readily permit the air, when passed over it, to permeate the mass thoroughly, and come in contact with every possible portion of the chemicals. Hitherto baryta has been largely used for the preparation of oxygen. In connection with the employment of this material, however, several serious disadvantages sometimes arise, which Mr. Parkinson desired to avoid; and he found out that the conditions he aimed at were best satisfied by the use of permanganate of potash specially prepared. It is well known that, when quick-lime comes in contact with moisture, a great quantity of heat is generated, in consequence of the lime absorbing the moisture, and passing from the state of oxide to that of hydrate. So much heat is produced, in fact, that it has been known to cause organic substances to char, or even to take fire; and hence, when required to be conveyed in large quantities from place to place—whether in ships or by other means—special regulations have to be made so as to overcome the risk of fire. The oxide of baryta, as used for the production of oxygen, possesses the same characteristics as lime in this respect, though in a much greater degree; and in consequence of its avidity for moisture being so intense, the utmost precautions have to be taken, where it is the substance employed, to extract all possible moisture from the air previous to its passage over the baryta. The resulting effect, if this is not thoroughly done, has been that the lumps or fragments of baryta gradually unite or solder together into large masses of considerably less porosity than they originally possessed; and they are chemically spoiled in the same proportion as they have imbibed the moisture. Even when the greatest care has been exercised, this drawback is experienced more or less. By making permanganate of potash the agent employed to effect the separation of the oxygen from the atmosphere, it has been found entirely unnecessary to take any precautions to dry the air before passing it over the chemicals, as the moisture in no way deteriorates them. As it is of the greatest importance that the active reagent should be in as porous a condition as possible, Mr. Parkinson found, as the outcome of numerous experiments, that an excellent result could be obtained by intimately incorporating the very finely-powdered permanganate of potash with from 12 to 15 per cent. of its weight of a good quality of kaolin, or china clay, then working up the mixture into a suitable consistency with water, and dividing the mass into pieces about the size of a walnut, which are then carefully dried by the aid of a vacuum in a vessel, the temperature of which is very gradually raised at first, and slowly increased till it reaches 100° C, or even somewhat higher. By this means the composition assumes a highly porous and spongy state, combined with a solidity and firmness which enable it to be readily handled and transported as required, without falling to pieces or crumbling.

To accomplish the effectual operation of the process, the chemicals, prepared in the way described above, are put into a series of special retorts, which are suspended from the roof of a gas-furnace. The chamber in which they are placed in the present plant has a capacity for, and contains five retorts, one of which, however, serves as a superheater for the air, as will be presently explained; the remaining four being charged with chemicals. The design chosen is a new departure, the capacity of each retort being probably twelve times that of those adopted in other processes. The retorts are made of cast iron; and each forms practically a large U-tube, having an internal pipe or flue in each limb of the U in a vertical direction, extending from the lower end to the upper. The hot gases of the furnace have free passage through this flue, and so ensure the heat of the furnace being readily communicated to the whole of the chemicals contained in the retort. The conduction of the heat into the heart of the chemicals is further facilitated by having a number of parallel projecting belts or rings at suitable distances apart, round the circumference of the retort, and also a number of other projecting or conducting metal pieces, which assist, by conveying the heat, in keeping the whole at a uniform temperature, and also in strengthening the retorts. The temperature required in the furnace to ensure good results is found to be not higher than a dull red, and insufficient to cause the retorts to be injuriously affected, either by the heat or by the oxidation consequent thereon, during long periods of time. The whole process of causing the chemicals to absorb the oxygen

from the atmosphere, and to subsequently evolve them, is automatic in its action, with the exception of the firing of the furnace and steam-boiler.

The arrangements and machinery employed to effect the results are as follows: On the top of the furnace, and resting on substantial girders, which also form the support from which the retorts are hung, are fixed, on opposite sides, two sets of compressing and vacuum pumps. These pumps, being so placed, are in close proximity to their work; thus dispensing with a large quantity of communicating piping, and therefore in like proportion diminishing the risk of dilution of the oxygen produced by residual nitrogen in the piping. But the one great advantage is gained by the use of the large retorts, as only sixteen lids and pipe-joints at the mouths of the retorts have to be made and kept perfect, against twelve times this number, for a similar quantity of chemicals, with small retorts. All the joints are placed so as to be accessible and readily examined; and the quantity of piping used is reduced to the greatest possible extent, to ensure a rich product. Each set of pumps (which may be worked alone or in unison with the other) consists of a series of three cylinders, placed vertically side by side, and having a 2-feet stroke. The exterior ones form the pumps for delivering the air under pressure to the retorts, and the central cylinder in each case acts as the vacuum pump. The air is drawn by the pumps through a vessel containing lime, as, while moisture has no deleterious effect on the chemicals, it is found desirable to extract any acids there may be in the atmosphere, before allowing the air to pass through the retorts. As, however, the carbonic acid in the atmosphere amounts only to about one part in 10,000 parts, half a ton of lime, either in the form of hydrate or as quick-lime, will do duty for an indefinitely long period. The pumps then deliver the air (which, in consequence of the compression it has received, has had its temperature considerably augmented) into the first of the five retorts; passing in its way, however, after leaving the pumps, through a vessel containing caustic soda in lumps, which purifies it from any oily matter with which it may have become contaminated in its passage through the pumps. As before mentioned, the first retort to which it passes does not contain any chemicals, and simply does duty as a superheater; enabling the oxygen to be produced with a much lower furnace temperature, and therefore more economically, than if it were absent. The remaining four retorts are arranged in a series of two pairs, and are so connected that while one pair is absorbing oxygen from air under pressure, the other is evolving oxygen, due to the operation of the vacuum cylinders. There is, therefore, practically a continuous, and not merely an intermittent, flow of the gas. Air under pressure is constantly being delivered to the superheater, and is directed by a valve into one pair of the retorts for about two minutes; the other two giving off oxygen during this period, at the end of which time the air is automatically directed to the other pair of retorts, and those just relieved from pressure at the same time become connected with the vacuum cylinders, and so on, as long as desired. The pressure at which the air shall pass through the retorts is regulated by two small valves, operated by springs, which open, and allow the nitrogen to escape into the atmosphere, at any pre-determined pressure—5 to 10 lbs. per square inch being found, in practice, to give good results.

In order to test the strength of cast-iron vessels, under pressure, when at a red heat, and thus obtain some guide for allowing a good margin of safety, an experiment was made with a specially constructed cast-iron pipe. This was brought to a red heat, and an attempt made to burst it—the experimenters, of course, taking up their positions for observation at a safe distance. A gradually accumulating pressure, up to 450 lbs. per square inch, was reached (this being as high as the particular gauge used would register); but the tube, which was only $\frac{1}{2}$ -inch thick, did not burst, or give way in the least. The safety of well-constructed cast-iron retorts was therefore placed beyond doubt. When drawing off the oxygen, all that is evolved passes through an apparatus known as the separator, which allows it and the nitrogen to escape into the atmosphere, until a vacuum of about 25 inches is indicated, when the gas is turned automatically into the holder.

As the plant above described has only very recently been brought into working order, and two out of the four retorts charged with chemicals have exhibited defects, which rendered it necessary to throw them out of action for a time, it is scarcely possible to give any really exact figures as to its capabilities. It may, however, be stated that the two retorts which have been working have yielded a quantity of oxygen, with only one set of pumps in operation, amounting to 7500 cubic feet per 24 hours; and it is reasonably anticipated that with a double set of pumps the production could be increased to 15,000 cubic feet daily. The expenses of the plant, including depreciation, are set down at £1 per diem, assuming the price of coke on the premises to be 7s. 6d. per ton. One labouring man is capable of taking entire charge, as the only work required of him is attention to the fires and the oiling of the machinery—all the other operations being absolutely automatic. Allowing a considerable margin for exigencies, the inventor claims that the cost of production per 1000 cubic feet of gas may be set down at 1s. to 1s. 6d. in the holder for oxygen in a high state of purity; but for commercial purposes, where so great a degree of purity is not essential, the cost might be very materially reduced.

THE LUMINOSITY OF COAL-GAS FLAMES.

At the Meeting of the Chemical Society last Thursday, Mr. W. Foster, M.A., Professor of Chemistry at the Middlesex Hospital, furnished a further contribution to the literature on the above subject. He took exception to some of the conclusions drawn by Professor Vivian B. Lewes in his recent paper before the same Society; and, in particular, to the latter's assumption that luminosity is due mainly to the combustion of acetylene formed in the inner zone of the flame by the incomplete oxidation of heavier hydrocarbons. Mr. Foster said he had examined the carbon particles (or soot) obtained on cooling a portion of the flame, and had found that they invariably contained hydrogen to the extent of about 1 per cent. This observation had been previously made; but the author differed from earlier investigators in asserting that the hydrogen was not occluded. He pointed out the close similarity in composition between these carbon particles and coke from cane sugar and starch, which likewise contains about 1 per cent. of hydrogen. From the soot obtained on cooling a flame, the hydrogen could, he said, be removed only with difficulty; and its occurrence could scarcely be accidental. From these premisses, Mr. Foster concluded that acetylene could not be the only hydrocarbon present in flame; it being improbable that it could yield on combustion a body in which 8 molecular proportions of carbon were associated with 1 of hydrogen, as was the case with the soot containing approximately 96 parts of carbon to 1 part of hydrogen. An attempt was made to prove the preferential combustion of hydrogen to carbonic oxide; and to this end results obtained on passing mixtures of hydrogen, carbonic oxide, oxygen, and nitrogen (as a diluent) over palladinized asbestos, were quoted. But they were altogether insufficient to give tangible support to the author's contention.

GAS FOR LIGHTHOUSE ILLUMINATION.

At the Meeting of the Institution of Civil Engineers last Tuesday week, a paper on "The Illumination by Gas of Tory Island Lighthouse, County Donegal," was read by Mr. D. C. Salmon, Assoc. M. Inst. C. E. After giving a brief account of the lighthouse as it originally stood, the author proceeded to describe the works which have been carried out in substituting gas for the old oil-light, which was extinguished on the 6th of April, 1887. The new illuminating apparatus is a Wigham trifurc gas-light of the latest construction, formed by three superincumbent tiers of lenses. In the focus of each tier is placed a 108-jet gas-burner; making, when full on, a total of 324 burners—practically equal to 9000 candles. The hyper-radiant long-focus lenses used are capable of making the light from the three burners equal to about 7,000,000 candles, according to Allard's formula. The construction of the lenticular apparatus was described, as also the devices for producing "group flashing." Groups of flashes are produced by breaking up the full beam from the lens by continually shutting off and turning on the gas. This is accomplished by a cam, fixed on the rotating clockwork placed under the lens-table, from which a connecting rod rises up through the lantern, shutting and opening the valves of each burner at the same moment. The result is that the mariner sees a group of shorter flashes instead of one long flash. A detailed account was given of the various operations rendered necessary in removing the old lantern. This was done without causing any interruption in the light—a temporary lantern, similar in arrangement to those used in lightships, having been employed in the interval between the extinction of the oil-lamp and the illumination by gas. A salient feature of the light station on Tory Island is the gas-making plant. This comprises a bench of seven cast-iron Δ -shaped retorts set in fire-bricks and tiles built in fire-clay. The mouthpieces of the retorts project 10 inches, and have faucets cast on them to take the ascension-pipes. These are of $\frac{3}{4}$ -inch metal, and tapered from 4 to 5 inches in diameter; being connected with a 12-inch hydraulic main over the bench. The gas from the hydraulic main passes into a condenser, and then by a 4-inch pipe to the vertical scrubber. From the scrubber the gas proceeds to two dry lime purifiers, and thence to the meter, which is capable of passing 1000 cubic feet per hour; and it finally reaches the gasholders—two in number, each 25 feet in diameter and 10 feet deep, with a rise of roof of 1 ft. 9 in. The framing of the holders consists of four cast-iron columns 12 inches in diameter and 9 feet high, bolted down to piers in the walls of the tank. In case of breakdown of the gas apparatus, an arrangement is provided whereby, in a few seconds, a six-wick oil-light can be substituted for the bottom gas-light. The oil-light can be shut off by clappers made to open and close round the light, so that the group-flashing system is retained.

Honorarium to Mr. H. Willis Smith.—The shareholders of the Caterham Gas Company, at their recent general meeting, voted to Mr. Henry Willis Smith an honorarium of 25 guineas, on his leaving the Company's service, to take the supervision of the Singapore Gas Company's works, as mentioned in the JOURNAL a few weeks ago.

* Also in the paper read at the London Institution on the 18th ult. (*ante*, p. 338).

REGISTER OF PATENTS.

Gas Motor Engines.—Williams, H., of Stockport. No. 1299; Jan. 24, 1891. [8d.]

This invention relates to improvements in gas motor engines with the "Otto" cycle of operations; and it consists chiefly in certain combinations and arrangements of parts, particularly in the timing or setting of the ignition-valve relatively to the other valves.

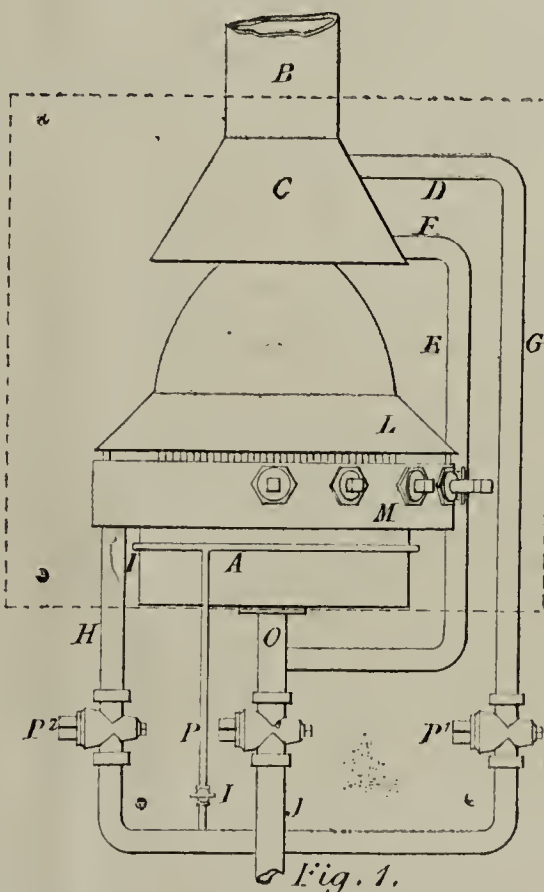
In an "Otto" engine, the piston on its outstroke draws in a charge of explosive mixture, which it compresses on its instroke; the charge being then ignited and the piston receiving an impulse during its next outstroke, and on its instroke the waste products are expelled. It is obvious, says the patentee, that an important feature is the opening and closing of the several valves at the proper time respectively; and one part of the present improvements consists in so setting and timing the ignition-valve that it is opened, and a charge fired, at the moment when the engine is at or about its dead centre. To accomplish this and to work the other valves, a side shaft is employed, driven from the crank-shaft of the engine; and upon this side shaft four cams are secured, each of which operates one of the pivoted levers, of which there are four—one for each of the four valves: *i.e.*, the gas admission-valve, the air admission-valve, the ignition-valve, and the exhaust-valve.

Another feature of the improvements consists in the application of a starting-valve in connection with the combustion chamber. This valve is controlled by hand, and is opened when the engine is to be started, so as to permit the unexploded charges of combustible mixture to be discharged through it instead of through the ordinary exhaust-valve. The valve is so arranged as to close automatically, and so prevent air being drawn into the cylinder on the outstroke of the piston; and the valve is closed, and kept closed, after the engine has been started.

Lamps for Increasing the Illuminating Power of Lighthouses.—

Wigham, J. R., of Dublin. No. 2247; Feb. 7, 1891. [8d.]

The patentee proposes to encase lighthouse burners—either Argand burners with concentric rings or groups of fishtail burners, ring-burners, Argand burners, and the other burners like those described in patents Nos. 945 of 1865, 2871 of 1866, 3771 of 1869, 1015 of 1872, and 1160 of 1879—in cylindrical or polygonal annealed glass frames or globes or frames partly of glass and partly of iron or other metal (this description not including what are generally known as chimney glasses). These frames or globes are surmounted with regenerating apparatus constructed upon any of the well-known plans for transmitting hot air, automatically heated by the products of the combustion of the burners, into the frames, so as to feed the combustion with pure air heated to a high temperature, in order to give to the light great intensity and steadiness.



Below the casing a receiver A (made of copper or other metal) is placed containing solid naphthalene or other hydrocarbon. The gas enters by the pipe J; and, through the cock P¹ and the pipe G D, is led to a double chamber (of copper or other metal) of conical or other shape C, divided internally so as to compel the gas to travel round it to become thoroughly heated by the flame and products of combustion. From this chamber the heated gas is conveyed, by the pipe F E, through a central pipe O, to the surface of the naphthalene, from which it is conveyed by three-way cocks M to the burner. These cocks also communicate with a narrow chamber K, placed immediately above the chamber A, and filled with ordinary gas fed into it, by the pipe H, through the cock P². By these means naphthalized gas, or ordinary gas, or a mixture of both in such proportion as may be required, can be admitted to the burner. The naphthalene or other hydrocarbon is vaporized either by the hot gas above mentioned or by an external application of heat arranged for the purpose (shown by the letter I in fig. 1); and the flame thus increased in illuminating power is used either with or without the casing indicated by dotted lines in fig. 1, and by Z in fig. 2.

In the drawing A is the receiver for solid naphthalene or other hydrocarbon; B, the flue to carry off the products of combustion; C, a double copper cone divided internally so as to compel the gas entering it, by the pipe D G, to travel round it to be evenly heated; E F, the

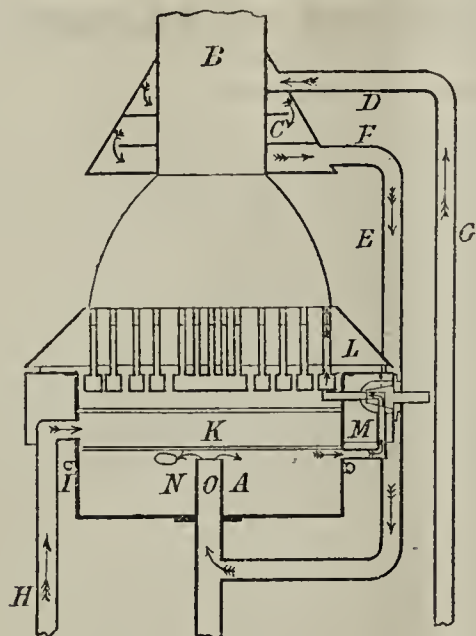


Fig. 2.

pipe to convey heated gas from the chamber C to the receiver A; H, the pipe for allowing ordinary gas to enter the chamber K; I, a pipe for the external application of heat, the jets of which pointing inward do not show; J, a general inlet-pipe; L, a cone of copper, nickel, or other material placed round the burner for the purpose of equalizing the supply of air thereto; M, five three-way cocks, by which naphthalized gas or ordinary gas or both can be admitted at pleasure to the burner; N, a feeding-screw; and O, the central tube by which heated gas is admitted to the receiver, and when necessary a certain proportion of cold gas by means of the central cock P, which cock, however, is under ordinary circumstances kept closed, the other cocks P¹ and P² being open.

Condensing and Utilizing the Residue of Gases Exploded to Form a Vacuum in Engines Propelled by Gas or other Explosive Material.—Trehwella, J., of Wargrave. No. 3948; March 5, 1891. [6d.]

In order to carry out his invention, the patentee proposes to construct an encased cylinder, the outer casing enclosing which has compartments, some filled with water, others with non-conducting material, and with passages controlled by valves and arrangements for working them, and leading to the eduction-pipe of the motor cylinder. To the condensing cylinder is fitted a piston displacer, which is moved by a suitable arrangement with each or every alternate revolution of the crank, as desired, for producing a partial vacuum, which may act on the piston of the motor alternately or simultaneously, as may be best adapted to the construction of the engine to which it is applied. The objects of this invention are to economize the explosive material, and to render the explosion more effective.

Gas-Engines.—Lanchester, F. W., of Bedford Row, W.C. No. 4222; March 10, 1891. [8d.]

This invention relates to improvements in the type of gas-engines described in patent No. 19,868 of 1889; and it consists in various details applicable to that type of engine, and in some cases to other types of engine.

One part of the invention relates to improvements in the governing-valve described in the 1889 patent. This valve acts by change in the rate of flow of the compressed gases which, passing into a chamber, causes the valve to cut off flame communication between the contents of the cylinder and the igniter tube. The improvement is intended to make the valve more rapid and sensitive in its governing action, by reducing its weight and increasing the rate of its fall under the action of gravity, by adding to or aiding the pull of gravity by the pull of a permanent or other magnet. In one mode of carrying the invention into effect, a permanent magnet of the double bar or horse-shoe type is attached under the valve in such a manner that the magnet attracts the valve, which is then made preferably of soft wrought iron; and the pull of the magnet upon the valve is varied either by adjusting and changing the distance of the poles from the valve, or by sliding between the poles (in contact with both bars) a wrought-iron keeper-piece. The position of this keeper-piece relative to the poles determines the amount of attraction which the magnet is allowed to exercise; and suitable graduations and stops are provided to enable the speed of the engine to be varied by altering the position of the sliding keeper-piece. When the engine is out of action, it is preferred to place the keeper-piece at the extremity of the magnet poles, so as to enable the magnet to retain its intensity without change.

Another part of the invention relates to the construction of an automatic inlet gas and air valve in the following manner: The valve is of the conical seated type with gas-holes in the seat; and instead of constructing the valve-seats in the ordinary manner, with a uniform upper and lower seat below the gas-holes, the seat is cut away at its lower part, leaving only sufficient valve-seat face around each hole to keep gas-tight when the valve is closed. The valve face thus consists of an upper face with lower projections or reticulations in which the gas-holes are placed. This arrangement of valve-seat prevents inconvenience from leakage back from the engine cylinder by allowing any such leakage free access to the air inlet-pipe without any undue tendency to blow back into the gas-supply pipe. In some cases a groove is cut round the upper part of the seat above the gas-holes; and apertures, opening from this groove to the passage, are provided, so as to entirely prevent, if desired, any leakage from the cylinder from finding a passage into the gas-pipe. This method is also applicable to any seat dividing the gas-supply pipe or channel from the explosion chamber.

Another part of this invention relates to the automatic exhaust-valve described in the earlier patent; and it consists in the addition

of a blow-off valve attached to the exhaust chamber, from which the exhaust-valve piston is operated. This valve is intended to relieve any undue pressure produced in that chamber by leakage from the cylinder through the exhaust-valve, and which leakage, if considerable, might open the exhaust-valve at a wrong time. The blow-off valve is loaded by a spring, lever, weight, or in any other suitable manner.

Purification of Water and Producer Gas from Sulphur Compounds.

—Claus, C. F., of Hammersmith. No. 4279; March 10, 1891. [6d.]

These improvements relate to the purification of water gas and other producer gas from sulphide of hydrogen, bisulphide of carbon, and other sulphur compounds, in the following manner: When the gas, as it leaves the "producer" (that is to say, at a temperature of about from 500 to 700° C.), is passed through or in contact with pieces of hot metals, such as copper or iron, the sulphur compounds contained in it are decomposed, and sulphides of these metals are formed; and this fact is made use of in this purification process. The metals may be employed in the form of granules or scrap; the form preferred being the finely-divided state in which they are produced by the action of hydrogen or water gas on their oxides—that is to say, in the form of metallic sponge, in which condition they present the largest amount of surface to the gas passing through or in contact with them. The metals, in either of these forms, are placed in receptacles of iron (such as cylinders or boxes) set in brickwork, so that they can be heated from the outside, or they may be cylinders or boxes lined thickly with brickwork, so that they may be heated by hot gases internally; this heating being necessary when first starting the process. When once in full operation, the heat required for the process is maintained by the hot gas passing through and by the action taking place within them. Of these "purifiers" at least two are required. It is better, however, says the patentee, to employ a greater number; and gas-connections from the "producer" to and through them are made in such a manner that, according to requirement, the gas can pass through either one or other of them. The water gas passing hot through these receptacles or purifiers is deprived of, or purified from, the sulphur compounds contained in it; and after a certain quantity of hot water gas has passed through the iron sponge or copper sponge contained in either of the purifiers, and the metals have thereby to a considerable extent been converted into sulphides and spent, this purifier is disconnected from the gas supply at both the inlet and outlet, and the gas is passed through another fresh purifier. Through the purifier containing the spent or partly spent purifying materials, either cold or heated air is now passed, until all the sulphur combined with the metal has been expelled or roasted off, by which process the sulphides of the metal are converted into oxides.

To bring the oxides back to the metallic state, and to again render the reduced metals available for purifying further quantities of water gas, either cold or hot water gas is passed through them—that is to say, water gas of a temperature most suitable for the reduction. The gas direct from the producer being hotter than is necessary for this purpose, cold gas may be admitted along with it. The residual gas from this operation may be used as fuel, or for other purposes. When the purifying property of the material in the first purifier has thus been restored, this purifier may be again connected with the supply of hot impure water gas, whilst the material in the second purifier, which has meanwhile been in use for this purpose, is being revived. In this manner, the operation is repeated again and again.

Gas Motor Engines.—Campbell, H., of Halifax. No. 4355; March 11 1891. [6d.]

According to the present construction of gas-engines, says the patentee, the explosive mixture passes in a stream direct from the ignition chamber to the compression chamber, and intermingles with the spent gases therein, whereby the unspent gases are weakened and the power obtained therefrom is lessened.

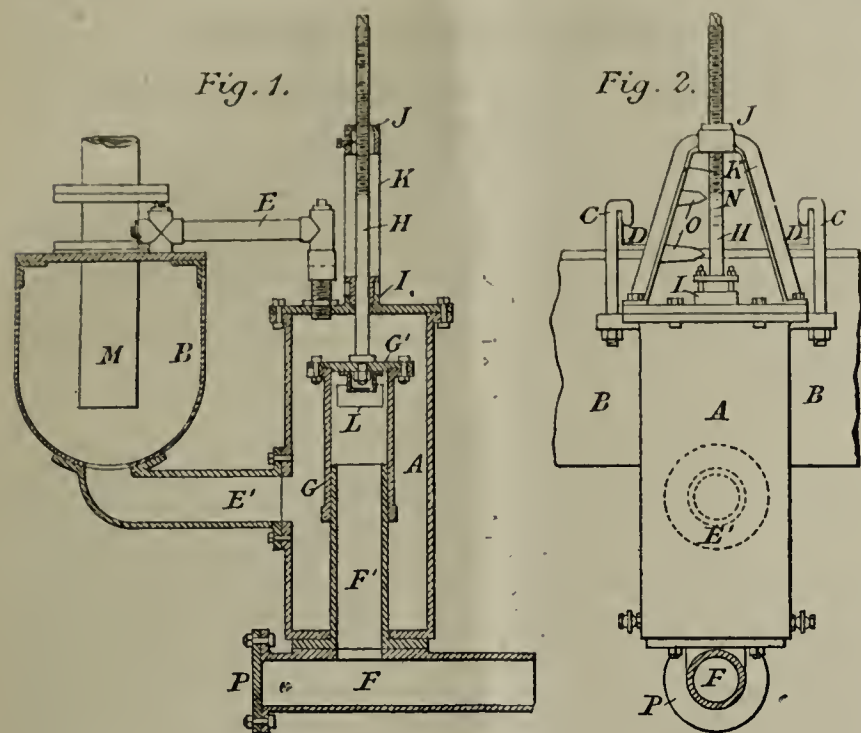
The object of the present invention is to obtain the greatest possible force of the gases; and this is accomplished by their more equal distribution by employing a disc or plate occupying a position between the ignition chamber and the compression chamber, so that as the gases enter they impinge against it, and are distributed, and enter the compression chamber in a more diffused state, by which means their strength is better maintained. The distributing disc may be perforated, or it may be made from fine wire gauze, so as to permit the gases to pass through in a diffused stream.

Light-Projectors for Street-Lamps.—Nieuwenhuys, A., of Brussels. No. 4607; March 14, 1891. [8d.]

In a former patent, the inventor described a construction of glass lenses or light-projectors for street and other lamps, constructed as inverted truncated cones surrounding the lower part of the lamp; the sides of the cones being formed as bi-convex lenses, whereby the light of the lamp was thrown in a more or less concentrated manner upon the road or floor in immediate proximity to the lamp. According to the present invention, instead of constructing the lenses or projectors of a bi-convex form, they are made as "plano-convex" lenses—that is to say, the face presented to the lamp burner is made a compound plane surface, while the outer surface is convex. By this construction, while still obtaining an effective distribution of the light, the weight of the projector is reduced to about one-half, and, in addition, the manufacture is greatly facilitated.

Regulating the Seal in, and Drawing off Tar and Liquor from, Hydraulic Mains.—Hislop, G. R., of Paisley. No. 22,810; Dec. 31, 1891. [8d.]

This invention has for its object to afford greater facility for regulating the hydraulic main seal in gas-works, and also to afford means for shutting off communication of the main with the discharge-pipe without the use of stopcocks. As shown in the engraving, the apparatus consists of a vessel A (preferably cylindrical in form), suspended at one side of the hydraulic main B by hooks or catches C taking over angle-iron bars D bolted to the top of the main. At its upper end it is connected by a pipe E to the top of the hydraulic main, for the purpose



of equalizing the pressure in both; and it is also connected by a branch E^1 to the bottom of the main. To the lower part of the vessel a flanged T pipe F is secured; the vertical branch F^1 of the pipe passing up through the centre of the vessel to such a height that its upper end is about level with the bottom of the main B , so as to be capable of drawing off the whole of the tar and liquor therefrom. Over the upper end of the branch F^1 (which is turned true externally), a hollow piston G is fitted; the piston being bored out to receive the branch and render it tar and water tight. The upper end of the piston is closed by a faced flange plate G^1 , bolted to a faced flange on the piston; and in the centre of the plate, a spindle or lifting-rod H is secured, screwed at its upper end, and passing through a stuffing-box I in the cover of the vessel, and thence through a tapped nut J carried by a saddle or bracket K bolted to the cover. The piston has openings or ports L made near its upper end, through which the tar and liquor flows from the interior of A into the pipe F , and thence away from the plant; the depth of seal in the main above the bottom of the dip-pipe M being regulated by the height of the undersides or lips of the openings L above the bottom of M . The spindle H regulating the position of the piston has a scale marked upon it, which (in conjunction with pointers on the bracket K) indicates the depth of seal or whether the main is empty, which it is when the piston G is screwed down until the ports L are opposite the upper end of the branch F^1 . When the ports are below the level of the upper end of the branch F^1 , and the underside of the cover G is screwed down against the upper edge of the branch, the piston is out of action.

The apparatus has claimed for it the following advantages: First, it provides for the accurate adjustment of the depth of seal above the bottom of the dip-pipe M . Second, it enables the hydraulic main to be flushed or emptied at pleasure. Third, by screwing down the hollow piston until its cover G^1 bears upon the upper end of the branch F^1 , communication between the main B and the pipe F is shut off, and by removing the flange P on the end of the pipe F , access can be had for the purpose of cleaning it out, and that without the employment of any stopcocks, or interfering with the regular working of the main; also, by removing the cover of A and weighting down the piston G , access can be had to the interior of the vessel. The vessel A is furnished with stopcocks at its lower end, for the admission of steam or hot water when required.

APPLICATIONS FOR LETTERS PATENT.

- 3417.—HUMPIDGE, H. T. and J. D., and SNOXELL, G. E., "Gas motor engines." Feb. 22.
 3482.—MOELLER, J., "Incandescent gas-lamps." Feb. 23.
 3522.—IMRAY, O., "Electrical igniting devices for gas-lamps." A communication from C. Wasmuth. Feb. 23.
 3554.—LEIGH, H. H., "Gas-heating burners." A communication from J. A. Elsner and L. Grambow.
 3556.—WRIGHT, F., "Dry gas-meters." Feb. 23.
 3574.—ROBERT, A., "Gas-engines." Feb. 23.
 3814.—GLOVER, S. and T., and CRITCHLEY, J., "Coin-freed attachment for gas and other meters." Feb. 27.
 3866.—SMETHURST, W., "Applying combustible mixtures of air and gas or inflammable vapour to driving motive-power engines, &c." Feb. 27.
 3047.—INSTONE, A. J., "Oil or gas engine." Feb. 16.
 3068.—BUTTERWORTH, E., "Gas motor engines." Feb. 17.
 3203.—PINKNEY, C. W., "Gas-engines." Feb. 18.
 3292.—CZERMAK, F., BERGL, A., and HUTTER, H., "Gas motor engines." Feb. 19.
 3305.—SAPORI, O., "Manufacture and utilization of gas, and apparatus therefor." Feb. 19.
 3326.—ADDIE, J., and CUNINGHAME, J., "Treatment of spent lime and gas liquors and of blast-furnace and other gases for the recovery of cyanides therefrom." Feb. 20.
 3354.—ROUZEE, G. L. V., "Flame regulators for lighting and heating apparatus." Feb. 20.
 3367.—BARR, J., "Gas-valves for regenerative furnaces." Feb. 21.

Coal in the North of Ireland.—For some time past mining operations have been carried on near Dungannon, with a view of developing the discovery of coal recently made in that district. The coal found is stated to be of excellent quality; and, as the shafts sunk are close to the Great Northern of Ireland Railway, the undertaking is likely to be a profitable one.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

The English Gas Coke Trade.

SIR,—The Chairmen and Directors of the English gas companies appear, from the reports of general meetings, to be exercised in their minds as to what is eventually to become of their coke; and they point with regret to the residuals balance-sheet. But they are not the only sufferers from a plethora of coke; for we poor people on this side of the Channel have had our markets absolutely ruined of late years by imported English coke, which has been poured into Hamburg and the Danish and Baltic ports in thousands of tons. I cannot quite make out what policy the English companies pursue when disposing of their residuals; but it appears to us that, as long as they obtain fair local prices, they do not mind what price, however low, they get for coke destined for export, provided their yards are kept clear. Consequently, it is poured into our markets at a price below its real value; thus ruining our local trade, and yielding the English directors themselves very little profit—the only people really profiting being the middlemen.

Now, this is all very well, or rather all very bad; and we are compelled to ask the question: If coke is in such demand in Denmark, Germany, and the Baltic provinces, that they can absorb thousands of tons annually beyond the considerable supply from local gas-works, salt-works, &c., why do not the English companies do something to encourage a similar demand, by exhibiting models of the many excellent slow-combustion coke-stoves in use generally on the Continent and in America? The Paris Gas Company have done much in this direction; and I have before me a book, with beautiful lithographed drawings, of the stoves recommended and sold by that Company, who attach as much importance to this question as the English companies do to gas-cooking stoves.

Of course, I know that people say: "Oh! deliver us from the awful German stove, with its sarcophagus-like appearance, and give us the cheery English fireplace." But, on the other hand, the Continental says: "Oh! deliver us from the wasteful English air-polluting fireplace, only fitted to warm certain portions of the anatomy of the British paterfamilias, posed in front of it in the graceful attitude so peculiarly English." I know full well the prejudice against the closed stove; but I maintain that the prejudice can be overcome if the English public were fully acquainted—first, with the fact that they can be obtained in every variety of form, and of artistic merit; and, secondly, that they are economical beyond comparison with the open English fireplace. With the closed stove, the heat can be regulated to a nicety, and the combustion is perfect—no smoke being given off; and they can be made to do duty as excellent ventilators, if properly fixed.

Compare Hamburg, Berlin, Frankfort, Copenhagen, Paris, and other Continental cities, with London, Birmingham, &c.; and although in the former there are as many—in fact, more—chimneys per square mile, for the people are packed together in huge complex buildings upon the "flat" system, the atmosphere is bright, and the yellow London fog is unknown. There can be no doubt that the English domestic chimney is the chief culprit in producing the terrible London fog; and it is nonsense to talk of expensive anthracite when you have an almost smokeless and cheap fuel in the form of coke.

The English gas companies depend upon the cement factories to relieve them of their surplus coke. Well, this is a broken reed to lean upon, for the foreign competition with the English cement trade is, I regret to say, becoming daily keener; and it appears that the chances of being able to dispose of large quantities of coke are becoming less as the new methods of cement fabrication are coming into vogue.

Much may be done by the English gas companies to popularize the use of coke in closed stoves. Grateful shareholders will thank the directors, grateful London will thank them, and grateful gas managers on the Continent (whose markets are being ruined), will thank them too. With such a glorious laurel-wreath of thanks to be earned in the future, how great should be their efforts to do something.

Danish Gas Company, Copenhagen, Feb. 26, 1892. F. D. MARSHALL.

The Inclination of Foul Mains.

SIR,—I am much gratified to learn, from the Inaugural Address recently delivered to the Manchester District Institution of Gas Engineers by Mr. Charles Armitage, of Lancaster, that his experiences fully support the views on the above subject laid down in my book on "The Chemistry of Gas Lighting," and also embodied in a paper read before the South-West of England District Association of Gas Managers on Sept. 9, 1890. The latter included illustrations of four foul mains as erected by me, at various gas-works in the neighbourhood of Salisbury, on the principle of an incline towards the hydraulic. It will be seen, by referring to the discussion on this paper, that the idea was objected to by several speakers; and I believe the prevalent practice still tends the other way.

Gas-Works, Salisbury, March 2, 1892.

N. H. HUMPHRYS.

Electric Lighting for Worcester.—At a recent meeting of the Worcester Watch Committee, it was reported that fifteen tenders had been received for the supply of electric lighting under the Provisional Order of the Corporation, and that Mr. W. H. Preece had been engaged to advise the Council as to the tenders.

A Gas-Stove Shattered by an Explosion of Gas.—Some consternation was caused in the eating-house establishment of a Mr. Worters, of Mercery Lane, Canterbury, yesterday week, by an explosion of gas. It seems that the tap supplying gas to the inside of a cooking-stove was accidentally turned on. The interior soon became filled with gas, which began to escape through the ventilator, which was in close proximity to a lighted jet on the top of the stove. An explosion naturally followed, the force of which may be imagined from the fact that the stove was blown to pieces, and several panes of glass removed from the window. Most fortunately, at the time no one was in the neighbourhood of the stove.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress was made with Bills last week:—

Further Standing Orders complied with: Bristol Gas Bill; Cleator Moor Local Board (Gas) Bill.

Bills read a second time: Bristol Gas Bill; Cleator Moor Local Board (Gas) Bill.

Bills committed: Ashton-under-Lyne, Stalybridge, and Dukinfield (District) Water Bill; Barrow-in-Furness Corporation Water Bill; Bradford Corporation Water Bill; Glasgow Corporation Water Bill; Ipswich Corporation Bill; Kilmarnock Corporation Water Bill; Liverpool United Gas Bill; Newport Corporation Bill; North Shields Water Bill; Oxford Gas Bill; Pontypridd Water Bill; Rhymney Valley Gas and Water Bill; Swansea Corporation Water Bill; Tredegar Local Board Water Bill; Southborough Local Board (Gas) Bill; Swinton and Pendlebury Local Board Bill; Uttoxeter Water Bill; Western Valleys (Mon.) Water (Gas Purchase) Bill.

Petitions against the following Bills have been presented:—

Ashton-under-Lyne, Stalybridge, and Dukinfield (District) Water Bill, from the Guardians of the Poor of the Saddleworth Township.

Barrow-in-Furness Corporation Water Bill, from the Dalton-in-Furness Local Board and Victor C. W. Cavendish.

Bradford Corporation Water Bill, from the Liversedge Local Board and Lord Hothfield.

Glasgow Corporation Water Bill, from the Magistrates and Commissioners of Police of the Burghs of Govan and Partick.

Liverpool United Gas Bill, from the Corporation of Liverpool.

North Shields Water Bill, from the Corporation of Tynemouth, the Newcastle and Gateshead Water Company, the Whitley and Monkseaton Local Board, the Tynemouth Union Rural Sanitary Authority, and the Duke of Northumberland.

Oxford Gas Bill, from the Corporation of Oxford.

Pontypridd Water Bill, from the Local Boards of Pontypridd and Ystradgynodwg, and the Proprietors of the Glamorganshire Canal Navigation.

Rhymney Valley Gas and Water Bill, from the Promoters of the Llanbradach District and Aber Valley Water Bill.

Swansea Corporation Water Bill, from the Monmouthshire County Council and the Swansea Rural Sanitary Authority.

Swinton and Pendlebury Local Board Bill, from the Corporations of Manchester and Salford and the Local Boards of Little Hulton, Barton, Eccles, Winton, and Monton.

Tredegar Local Board Water Bill, from the Ebbw Vale Local Board.

Uttoxeter Water Bill, from the Derbyshire and Staffordshire County Councils.

Western Valleys (Mon.) Water (Gas Purchase) Bill, from the Local Board of Bedwellty and the Blackwood Gas and Water Company.

HOUSE OF COMMONS.

The following progress was made with Bills last week:—

Bills read a second time, and committed: Airdrie and Coatbridge Water Bill; Blackpool Improvement Bill; East Grinstead Gas and Water Bill; Exmouth and District Water Bill; Ormskirk Gas Bill.

Bill withdrawn: Sunderland and South Shields Water Bill.

Petitions against the following Bills have been presented:—

Birmingham Corporation Water Bill, from Owners of Property in Birmingham and other places, and also along the proposed line of pipes.

Blackpool Improvement Bill, from the Fylde Water-Works Company.

East Grinstead Gas and Water Bill, from Owners, &c., of property.

Exmouth and District Water Bill, from the Budleigh Salterton Local Board.

London County Council (General Powers) Bill, from the New River and Kent Water Companies.

London County Council (Subways) Bill, from the Kent Water Company.

Mold Water Bill, from the Hawarden and District Water-Works Company.

Newcastle-upon-Tyne Improvement Bill, from the Corporation of Tynemouth.

Pontypool Gas and Water Bill, from the Abersychan Local Board, the Blaenavon Gas Company, and the Marquis of Abergavenny.

Proposed Extension of the Teignmouth Gas-Works.—The Teignmouth Local Board yesterday week considered a report presented by the Gas Manager (Mr. Portbury) with reference to the extension of the gas-works, which proposed an outlay of £12,544, which, with the addition of the lighting of Shaldon, would bring the sum up to £14,025. After a good deal of discussion, the matter was referred to Committee.

Increase in Price by the Crystal Palace Gas Company.—The Secretary of the Crystal Palace District Gas Company (Mr. Magnus Ohren) has announced that, in consequence of the continued high price of coal and labour, and the low price of coke, the Directors exceedingly regret that an increase in the price of gas has become absolutely necessary. They therefore give notice that the price of gas will be raised to 2s. 9d. per 1000 cubic feet from and after the dates of the present quarterly accounts.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Saturday, Feb. 27.

(Before Mr. Justice KEKEWICH.)

In re the Incandescent Gas-Light Company (Limited and Reduced).

This was a petition for the reduction of the Company's capital by a sum of £10,000, which it was alleged was not represented by available assets. The reduction was in respect of the ordinary shares, and did not affect the preference shares.

Mr. RENSCHAW, Q.C., and Mr. BRAMWELL DAVIS appeared for the Company.

His LORDSHIP made the order.

In re the Selby Gas Company.

This was a petition of an unusual character, for the restoration to the register of joint-stock companies of this Company; it having been struck off by the Registrar, pursuant to section 7 of the Companies' Act, 1880. The notices prescribed by that section had been duly sent by the Registrar to the Secretary of the Company, but had not been brought by him to the attention of the Directors; and, in consequence, the Registrar had struck the Company off the register. The Company had gone into voluntary liquidation, having made a beneficial sale of its undertaking to the Local Board; and, upon the resolution for the voluntary liquidation being communicated to the Registrar, it was discovered that the Company had ceased to exist, and the Local Board, before completion, required the name to be restored to the register.

Mr. BRAMWELL DAVIS appeared for the petitioners.

Mr. INGLE JOYCE, for the Registrar, said he did not object to the restoration, provided the liquidator of the Company would undertake to comply with the requirements of the Companies' Act as to notices to shareholders.

His LORDSHIP, upon such undertaking being given, made the order asked for.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Monday, Feb. 22.

(Before Justices WRIGHT and COLLINS.)

The Mayor and Corporation of Tynemouth v. North Shields Water-Works Company.

This action, which came before the Divisional Court, was brought to restrain the defendants, by injunction, from obtaining water from certain alleged impure and dangerous sources of supply.

Mr. FINLAY, Q.C., and Mr. CHITTY appeared for the plaintiffs; Mr. LAWSON WALTON, Q.C., and Mr. ROBSON, Q.C., for the defendants.

Mr. WALTON stated that, before going into an expensive issue as to the character and quality of the water, and the source from which it was obtained, they desired to raise a preliminary question whether any cause of action was disclosed in the plaintiffs' statement of claim. The necessity of a lengthened trial would be obviated if the defendants were right in their view. The plaintiffs, who were suing on public grounds, as though in the name of the Attorney-General, were the Urban Sanitary Authority of the Borough of Tynemouth, and had imposed upon them the duty of seeing that the district had a wholesome supply of water. The defendants were incorporated, under an Act passed in 1876, for the purpose of supplying North Shields and the shipping resorting thereto with water—Tynemouth being included in their district. By that Act one of the sources from which they were empowered to obtain their supply was a watercourse into which the owners of the Charnworth pit or colliery were pumping. The defendants were conducting this water by mains to their reservoirs; and it was then sent out to the inhabitants for domestic use. It was alleged that the water thus delivered was unwholesome and impure, was unfit for either drinking or domestic purposes, and was dangerous to the health of the inhabitants of the borough. The defendants, it was alleged, were not authorized to take water pumped from the colliery. Damages generally were claimed to the amount of £1000. A summons was taken out by the defendants for particulars of the pollution indicated, and its nature; and some were given. They related to the degree to which the water was said to be polluted by the presence of certain salts; but it was not alleged that anything in the nature of special damage or illness had been occasioned in the borough. The preliminary objection raised was that absolutely no ground existed for saying that the Tynemouth Sanitary Authority had imposed upon them the statutory duty of enforcing the supply of water by a Water Company in accordance with its Act of Parliament.

Mr. FINLAY explained that the meaning of the statement of claim was that, under the Public Health Act, if the supply of water was not sufficient, they might be compelled to execute other works.

Mr. WALTON said that no doubt it was the duty of the Sanitary Authority to see that a proper supply of water was furnished to the borough; but by the Public Health Act the mode in which that was to be carried out was prescribed. They were empowered themselves to arrange for the supply of water; and if they had cause to complain of the quality of that which was given by an existing water company, the dispute might be referred to arbitration. If the result of the arbitration was to show that the present water supply was insufficient, they had power to obtain their own. Section 51 of the Public Health Act enacted that any Urban Sanitary Authority might provide their district, or any part thereof, and any rural authority might provide their district, or any contributory place, with a supply of water proper and sufficient for both public and private purposes, and for this purpose might dig wells, construct water-works, and do any acts that might be necessary. No power was there given of ensuring an adequate supply of "wholesome water" by bringing an action against an existing water company. The present action was an entirely new departure on the part of the Local Authority. What they were complaining of had gone on for some years; and the Company had a Bill now before Parliament for the purpose of obtaining extended powers in reference to their water supply, and that would probably dispose of the whole difficulty. It was alleged that

the Company were exceeding their authority by taking water from places outside their area; and this was an action, in the nature of an information on public grounds, by the Attorney-General. But the Law Officers of the Crown would, of course, not interfere unless what was complained of would be likely to have results dangerous to the public health.

Their LORDSHIPS suggested that the matter should be allowed to stand over, to await the result of the application for the new Bill.

Mr. FINLAY said it was very important that the action should be proceeded with at once. If it were tried at the forthcoming Spring Assizes, he would consent that every point of law which the plaintiffs might wish to raise should remain open to them.

Justice WRIGHT thought the parties would have to consider the advisability of adding the Attorney-General as a party to the action.

Mr. FINLAY admitted that it would be prudent to do so, if it could be done without throwing the case over the Spring Assizes.

Mr. WALTON urged that it should be allowed to stand over until after the parliamentary inquiry was completed, as the whole matter would then be dealt with, and the action probably be discontinued.

Mr. FINLAY was willing to consent, if the defendants would give an undertaking not to draw water from the watercourse in question, which was the channel for the drainage from the colliery mentioned.

Mr. WALTON said at present this feed-water was passed into a reservoir which was not being used at all; but the existing water supply was so precarious that it might have to be drawn upon at any time.

Mr. FINLAY: We should be better without any water at all than having it supplied to us from this source.

Mr. WALTON said the present condition of things had subsisted since 1885; and it was very curious that, now that parliamentary action was being taken, the plaintiffs should so suddenly profess to have discovered the noxious character of this water. It was difficult to see any reason for this action but a collateral one connected with the application to Parliament. It appeared that there was some question about the purchase of the Water Company's rights by the Corporation; and, in fact, many vexed questions between the parties would have to be disposed of. Under the circumstances, the Court would probably not assume that any very serious grievance existed in this case, and that the professed anxiety of the plaintiffs had evidently only become acute in view of the legislation about to be invoked.

Mr. FINLAY: The matter is really urgent, for whenever the Company run short of water they fill up with this "stuff."

Mr. WALTON protested against this portion of the Company's supply being called "stuff." No kind of danger was alleged from its use; and as, if the general supply ran short, water might have to be drawn from the reservoir, the Company could not give the undertaking asked for. This question had been made the subject of a poll of the inhabitants; and their opinion had certainly not been expressed in favour of the steps taken by the Local Authority.

Tuesday, Feb. 23.

On the hearing of the case being resumed to-day,

Justice WRIGHT asked whether there was anything in the Private Act which obliged the defendants to supply water at all.

Mr. WALTON said there was not.

Mr. FINLAY said he should refer to the Tynemouth Improvement Act as imposing an obligation in this respect.

Justice COLLINS: You do supply water for the purpose of drinking, and accept payment for it?

Mr. WALTON: We do.

Justice COLLINS: Then is there not an obligation to supply pure water?

Mr. WALTON said he thought not. The mode in which the water was supplied was as follows: The Company laid their mains down a street, and private owners might, if they agreed with the Company, connect a private pipe of their own with the main; the amount payable being assessed by the size of the bore of the private pipe at the point at which it entered the main. The Tynemouth Improvement Act applied where the Company objected to afford a supply. They were not compelled to supply water for cattle, trade, or agricultural purposes. The obligation between the Company and the customer, the moment the supply was carried out, was not in any way affected by the Tynemouth Improvement Act.

Justice COLLINS: If there is an obligation to supply water, does not that import an obligation to deliver water fit to drink?

Mr. WALTON submitted that there was no implied warranty. Water could not be said to be a manufactured article. All the Company supplied was fresh water, taken from springs and streams. This water was put into the mains; and persons could take it or leave it. If they took it, the fact that the Company arranged the price imported no undertaking that the water should be perfectly pure. If it could be shown that the Company were under an obligation to continue to supply pure and wholesome water, then it might be worth while discussing as to the character of the water; but if the Company were under no obligation, and customers could put an end to the state of things by refusing to take the water, and get a sufficient supply by aid of the Public Health Act, then they would have no remedy in the present action. No sort of ground was alleged in the statement of claim for any of the relief which the plaintiffs claimed. Putting it at the outside, the only contract which could be suggested was a contract such as might be established with any tradesman selling goods. If an injunction could not be insisted upon, there was no substance in the action, which had merely been brought to attempt to evade the obligation imposed upon the Corporation by section 52.

Justice COLLINS: It might take them some time before they could get another supply.

Mr. WALTON: I suppose it would; but it would also take the Company some time to erect the necessary works if they were put under an injunction.

Justice WRIGHT: The way in which it strikes me is this: I think there is no cause of action upon the pleadings; but I should certainly not dismiss the action because the pleadings are not properly drawn. My learned brother thinks that a cause of action can probably be

picked out of the pleadings, therefore he also would not dismiss the action. Is it of any use, in the state of things, expressing an opinion on the mere pleadings?

Mr. WALTON: I quite follow what has fallen from your Lordship; but does your Lordship think it desirable that the issue as to the quality of the water should be tried, and then that the question of law should arise afterwards? or would your Lordships adjourn the matter for the pleas to be amended?

Justice WRIGHT: Until the difficulties are cleared away which are caused by the case being argued on demurrer, it is difficult to say what should be done.

Mr. WALTON: I ask that the case may be adjourned, in order that the pleadings may be so drawn that we should know what case we have to meet. My friend says there is a case of negligence.

Mr. FINLAY: I say it is a wrongful act.

Justice WRIGHT: It is said the water from the colliery is not being delivered and used at all.

Mr. WALTON: That is so; it has not been used for months.

Justice WRIGHT: Do you supply other districts?

Mr. WALTON: Tynemouth and North Shields.

Justice WRIGHT: Cannot you distribute the water so as to give this "stuff" to some other districts—say, for cleansing the sewers?

Mr. WALTON: We say there is no foundation for the statement about the water. It is an extremely important question to us; and we should like to have the issues which are to be tried clearly defined.

Justice COLLINS: It is not our function to re-draw the statement of claim.

Justice WRIGHT: Could it be admitted that the Company are within their rights (apart from the question of pollution) in taking water from the watercourse whence they take it, and by the other side—for the purpose of argument only—that the water is polluted by the fault of somebody else?

Mr. FINLAY: No; the facts are really as alleged. My learned friend is right in saying the channel is one formed by a stream of running water; but the only water in the channel is that which is pumped from the bottom of the mine. We say it is not a "stream" within the meaning of the Act. It is really a drain from the mine.

Justice WRIGHT: As at present advised, I do not think we could grant any injunction.

Mr. FINLAY: Your Lordships have not heard me yet.

Justice COLLINS: Here the Water Company, who have certain powers, have chosen to tap a sewer outside their district, and this sewer is in connection with the plaintiffs' cistern. Unless restrained, the Company will continue to send sewage water into the cistern. Why, under these circumstances, should an injunction not be granted?

Mr. WALTON: Because the Court will never grant an injunction where the nuisance can be abated by the plaintiff. He can abate it by ceasing to take the water.

Justice COLLINS: If customers choose to go without water, they can abate the nuisance; but not if they continue to take a supply. You have practically a monopoly.

Justice WRIGHT: We both think we ought not to decide the question upon the present state of the pleadings. Would there be any great expense in trying the facts at Newcastle?

Mr. WALTON: It would be an expensive investigation, as we should have to call scientific evidence as to the quality of the water. We say the water is not impure. If it should turn out that the plaintiffs are not entitled to an injunction, but only to mere nominal damages, there is no substance in the action.

Justice WRIGHT: You ought not to object to the expense if it will enable you to show that the water is pure. It is a serious thing to supply unwholesome water.

Mr. WALTON: It is a serious thing to put us to the expense of showing that the water is pure.

Justice WRIGHT: If you are supplying water pumped from a mine, it is for you to show that you are in the right.

Mr. WALTON: It is not a mine that is being worked, but a disused mine. I ask that the pleadings should be amended.

Justice WRIGHT: I never find it advantageous to force the other side to amend. We think that we cannot decide the question upon the present state of the law, and the case must go to trial, with liberty to either side to amend if they like. Costs to be reserved.

Mr. WALTON asked that the case might stand over till the July Assizes, in order that the parliamentary proceedings might not be interfered with.

Mr. FINLAY objected. He said it was quite true the Company had a Bill before Parliament asking for power to obtain water from the Newcastle Company. But notice had been given to the Town Clerk of Newcastle that this part of the Bill had been withdrawn; so that as the measure now stood it was merely to enable the Company to increase their charges.

Their LORDSHIPS decided that the case must proceed to trial in the ordinary way; all questions of law being left open to be dealt with then.

NEWCASTLE COUNTY COURT.—Feb. 29.

(Before His Honour Judge SEYMOUR, Q.C., and a Jury.)

Damages against the Newcastle Gas Company on Account of an Explosion.

In this case William Pinkerton, a miner, of Blaydon, claimed £50 from the Newcastle Gas Company on account of damage caused by an explosion of gas.

Mr. STRACHAN appeared for the plaintiff; Mr. GREENWELL for the defendants.

Mr. STRACHAN stated that the explosion took place at plaintiff's house on Nov. 24 last; and he alleged that it was caused by the negligence of defendants' workmen while connecting their main with the pipe on plaintiff's premises, and thus allowing an escape of gas which caused the explosion and damage within half an hour of the men leaving. The real damage done amounted to £95 17s.; but it was reduced to £50 to bring the action in the County Court.

Mr. GREENWELL urged that this was a serious question for the Gas Company. They were, like anybody else would be, sorry for the

consequences of the accident; but the jury were to consider whether they were liable for what had happened. They contended that they were not the responsible persons in the matter; it was the person who put the pipes into the house. He did not mean the actual plumber, but the landlord who employed him. It was the latter who was the person to see that the pipes were in a proper condition. The only ground upon which the jury could find the Company liable in this case for what had happened, was that the Company had been guilty of some breach of duty towards the owner of the house. It was no use their saying that there was negligence, unless they could find, as a matter of fact, what it was that the Company had neglected to do. In this case, there was nothing to show that the Company had done something, or had omitted to do something, in respect of which they could be blamed. The pipes in the house were the property of the landlord, and not of the Gas Company, who were not responsible for anything that was done to either the pipes or the gas inside the house. The Gas Company's workmen did nothing to cause the accident that occurred.

After evidence had been given, The jury found that defendants were responsible for the pipes up to the meter, and gave a verdict for plaintiff for the £50.

His Honour, on the application of Mr. Greenwell, consented to a stay of execution for a month.

Mr. GREENWELL stated that there would probably be an application for a new trial, on the ground that there was not sufficient evidence to go before the jury, and that his Honour ought to have non-suited the plaintiff.

The Thirlmere Water-Works and their Cost.—At last Wednesday's meeting of the Manchester City Council, Mr. Bax called attention to a statement by the Chairman of the Stretford Local Board to the effect that Sir John Harwood had said that the cost of the Thirlmere Water-Works would be £100,000 annually. This was given as a reason against amalgamation with Manchester; and if the statement was true, it would mean a rate of about 9d. in the pound. Alderman Sir J. Harwood said he might explain that it would require, to pay the expenditure upon the Thirlmere water scheme, £106,000 per annum; but this would be met in various ways. In five years they would have £20,000 more income than they now had. They had spent large sums on the Longdendale works, which would not require any repairs for 30 years to come; and with all the economies that they had been effecting, there need not be a single farthing of additional taxation.

The Charges of the Southwark and Vauxhall Water Company.—Last Thursday week a deputation from the Corporation of Richmond waited upon the Directors of the Southwark and Vauxhall Water Company, with a view to obtaining a reduction in the present charge of 1s. per 1000 gallons, for water supplied to the borough by that Company. The deputation was received by Sir Henry Knight, Chairman of the Directors, and the other members of the Board. Alderman Piggott, the Chairman of the Water Supply Committee of the Richmond Corporation, explained the object of the deputation, and pointed out that the Wimbledon Local Board was supplied by the Company at 8½d. per 1000 gallons, and the quantity taken was not so great. Richmond consumed during the last financial year 52,991,000 gallons. When the arrangement was made with the Company that they should charge 1s. per 1000 gallons, it was never contemplated that so much would be required. Mr. Dimpleby next addressed the Directors, and said that all Battersea water was supplied to the Vestry at 8 d. per 1000 gallons. Sir Henry Knight replied that Wimbledon and Battersea were within the parliamentary area of the Company as regards the domestic supply, and the water sold to the Wimbledon Local Board and the Battersea Vestry direct was for road watering; and it was only for road and trade purposes that water was supplied at less than 1s. per 1000 gallons. The Directors, however, would give the matter their careful and friendly consideration.

The Management of the Rotherham Corporation Gas-Works.—The recent decisions of the Rotherham Town Council relative to the management of the gas and water works (see *ante*, p. 263) have led Mr. J. Cox to tender his resignation as Chairman of the Gas Committee. In his opinion, the changes will cause a serious loss to the ratepayers; and he declined to take part in carrying them out. The matter came before the Council last Wednesday, when, in the course of the discussion, Mr. Cox said he could not see how the members could expect him to continue to act as Chairman of the Gas Committee, as it was a very important Committee, and one which embraced more of a commercial aspect than any other. Unless, therefore, the Chairman had the support of the majority of the Committee over which he presided, in his opinion he had no business to presume to take the office; and it was evident he had not the support of the majority. The views which he took with regard to the management of the gas-works were antagonistic to the wishes of the Council. He therefore failed to see how he could do otherwise than he had done. He had every wish to work for the good of the town, and be in peace and harmony with every member of the Corporation; but he would not be Chairman in name only. In the end, the Council referred the subject to the Gas Committee for consideration. Later in the proceedings, another matter connected with the management of the works was discussed by the members. The Council in Committee had recommended that Mr. C. B. Newton, of the Sheffield Gas-Works, should be appointed Gas and Water Engineer. Alderman Neill moved that the question be referred back to the Committee, arguing that from the resignation of the Chairman of the Gas Committee, and other circumstances, considerable feeling on the subject existed among the members of the Corporation. In his opinion it would be wise, in the interests of the gas-works and the amicable working of the Council, to reconsider the question. Mr. Cox seconded the amendment, contending that the Council had been placed in a false position in regard to the appointment. The discussion was a prolonged one, several members taking part in it. On being put to the vote, the amendment was negatived by four votes to sixteen; and the recommendation of the Committee was then passed. A motion, of which notice had been given by Mr. Sorsby—"That gas-meter rents be abolished, and that all consumers of gas and coke be charged one uniform price," was deferred for a month.

MISCELLANEOUS NEWS.

THE BOSTON (U.S.A.) GAS COMPANIES.

We have received from Mr. H. M. Cross, of Rialto Buildings, Boston (U.S.A.), the following communication furnishing what he describes as "Facts about the Boston Gas Companies":—

The Companies operated by the Bay State Gas Company of Delaware are—

	Capital.	Assessed Values.
The Boston Gas Company	\$2,500,000	.. \$4,457,200
The Dorchester Company	400,000	.. 298,400
The Roxbury Company.	600,000	.. 633,500
The South Boston Company	440,000	.. 386,300
Bay State Company of Massachusetts	500,000	.. 631,500
Total	\$4,440,000	.. \$ 6,406,900

The Bay State Company of Delaware have issued upon the above properties \$7,000,000 of first mortgage 5 per cent. bonds, \$3,000,000 of second mortgage 5 per cent. bonds, \$2,000,000 of income bonds of 7 per cent., and \$5,000,000 of stock at \$50 par value; making a total of \$17,000,000. Of this amount, the first and second mortgages represent the actual money paid for the properties, at prices far above their real market values, and including commissions and discounts on bonds. The income bonds and stock represent no money paid in, and are, in the language of the stock board, "wind and water" only.

All the territory now occupied by the combined Companies can be served by a new company, with works having a capacity of 10 million cubic feet of gas per day, and at a construction cost of \$7,000,000 or less. Gas capitalists desire a charter to construct such works, and will contract to furnish gas of one-third greater candle power and heat value than the gas now supplied by the Addicks Companies, and at a cost not exceeding \$1.25 per 1000 cubic feet in all the sections of the city now occupied by the Delaware Companies, or at \$1 for gas as is now supplied.

The Delaware Company are actually paying the interest on \$12,000,000, and are now earning fully 4 per cent. on the \$5,000,000 of stock; and the officers of the Company are quoted as saying that they will soon be earning 7 per cent. on the whole amount of the income bonds and stock. The only way in which income can be earned by a chartered company on \$7,000,000 of "watered" stock, is by excessive charges upon the customers of the company. The Boston Gas Company are charging their customers \$400,000 per annum, or more than \$1000 per day, in excess of what would be needed to pay 10 per cent. on the capital stock. They are doing this by hiring, from the Bay State Company of Massachusetts, their pipes at an annual rental of \$100,000; and they are buying from that Company, at \$1 per 1000 cubic feet, gas which the Bay State Company make for 35c.

In the published reports for the current year, it appears that the Bay State Company of Massachusetts, with a plant which cost \$700,000, earned \$450,000 in the year ending June, 1891—that is, the Boston Gas Company are paying out \$450,000 a year for the use of facilities which they could own for \$700,000. The Boston Gas Company can hire money at 4½ per cent.; and they also have a large amount of real estate which they could sell to provide money to build all the added facilities needed.

The evidence submitted proves beyond question that the Boston Gas Company are taking \$1000 per day wrongfully from their patrons, and in a manner which the Legislature will not tolerate.

With regard to the price of gas elsewhere, Mr. Addicks is fighting to get into Wilmington (Del.) with a new company; and he offers to sell gas at 75c. per 1000 cubic feet, in competition with the Wilmington Company, which is selling gas at \$1.12 per 1000 feet, and paying 12 per cent. dividends. Gas is sold in Lowell (Mass.) at \$1.10; and the Lowell Gas Company pay 12 per cent. dividends. The price of gas depends largely on the quantity consumed per mile of pipe; and the Boston Gas Company are selling more gas per mile of pipe than any other company in the world, and three times as much per mile as in Wilmington or Lowell. Nothing prevents the Boston Gas Company from selling gas at \$1 per 1000 cubic feet, except its connection with the Bay State Company. Proceedings to terminate this connection are now pending before the Legislature, on behalf of the gas consumers of Boston.

TOTTENHAM AND EDMONTON GAS COMPANY.

The Half-Yearly Meeting of this Company was held last Saturday week, at the Offices, Willoughby Lane, Tottenham—Mr. CORBET WOODALL in the chair.

The SECRETARY (Mr. James Randall) read the notice convening the meeting; and it was agreed to take as read the Directors' report and the accounts, which were summarized in the JOURNAL for Feb. 23.

The CHAIRMAN said it became his duty to propose the adoption of the report and accounts. But before saying anything to commend the resolution to the shareholders, he had to express, on behalf of the Directors, their sincere regret that the chair was not occupied by their respected Chairman (Mr. George Gripper). Most of those present had been in the habit of attending the half-yearly meetings, and knew the interest Mr. Gripper took in the affairs of the Company; and he was sure they would all join in hoping that he would be able shortly again to occupy the place he so fitly and happily filled. The account of him they received that morning showed he had been very ill, but was now on the way to becoming convalescent. Turning to the report, the Chairman said he was disposed to take the last paragraph in it as the text for the few observations he had to make. He felt that the figures in the accounts were eminently satisfactory, and such as they might very well congratulate themselves upon. As the proprietors were aware, the last two or three years had been a period of considerable trial to gas companies. There had been a large increase in the cost of coal, and also in the item of wages; and against the advance in coal, there had not been a corresponding increase in the amount realized by the

sale of residuals. The elasticity of the residuals market seemed to have failed in the last year or two. The effect of this had been apparent in the case of a great many companies, in the form of depleted reserve funds and an increased price for gas, and in some instances, reduced dividends. Therefore he thought it was a matter of great satisfaction to them all that they had been able to tide over this trying period without either raising the price of gas, reducing the dividend, or taking a penny from the invested reserve fund. This suggested to him the very great desirability of maintaining the reserve fund at a full and satisfactory amount. The advantage of such a fund in steadying the operations of a company—enabling the Directors to pass through periods of trial such as recently experienced with a minimum of inconvenience to the consumers as well as to the shareholders—could hardly be exaggerated. For his own part, he thought a good reserve fund was a better security for the value of their property than was a high dividend; and he trusted therefore that, when good times came, as he believed they would, this Company would not only maintain the fund but would increase it. But, of course, the proprietors were aware that they could only add to the reserve fund by one of two means—either by lowering the price of gas or decreasing the dividend. The Directors, however, were not contemplating a reduction of the dividend, but they were looking forward to a reduction in the price of gas. If they brought down the price, they might pay an increased dividend, or put the money, which such increase represented, into the reserve; and it would be a matter for the serious consideration of the shareholders whether they should not forego the additional dividend and increase the reserve. The Directors had had under their notice a threat of still further trouble in the matter of the coal supply. It was reported that it was the intention of the colliers to take a prolonged rest—to cease from labour, and to terminate for a time the output of coal. But he did not think this would cause the Company any inconvenience or loss, because their stock was fairly good. The object of this action of the miners was doubtless to maintain the excessive price of coal. It did seem to him much to be regretted that any body of men (whether workmen or masters) should be able to derange the whole trade of the country in so selfish and useless a manner. Except the increased cost of coal and the results obtained from residuals, there was not, continued the Chairman, much to call for attention in the accounts. He might say that, since Christmas, 1888, they had only once managed to earn the dividends. Each half year they had had to withdraw sometimes more and sometimes less from the undivided balance. The amount on the three years was £2394; but they had not had to touch the invested reserve fund. The price of coal throughout the past year was 18s. 2d. per ton; and this was an increase of about 2s. 6d. compared with the preceding year. The receipts for the residual products during the year only amounted to 9s. per ton; while in 1890 they received 8s. 11d. Consequently, they had paid 2s. 6d. more for coal; but had only realized 1d. in improved returns from residuals towards that increase—in other words, they had had an additional 2s. 5d. per ton which had had to be made up by savings in other directions. Of course, the great security of the Company was that they had a growing district, and a business that never stopped; and, so long as they had this increasing business, they could safely look in the face these occasional periods of trial. The only way to secure that the business should go on prospering was to follow the course which had characterized the Company in the past, and try to give as thorough and good a supply of gas as possible, and at as low a price as they could afford. There was one other item to which he might be pardoned for referring—the rates and taxes. It was a matter of peculiar and rare satisfaction to be able to congratulate the proprietors upon a reduction in the amount appearing in the revenue account as having been paid for rates and taxes. There was a second side to the question, and it was this—that this item included income-tax, which had been less because the profits were less. It was also a fact, however, that throughout the district generally the rates had gone down; and this seemed to point to an improved state of things in the neighbourhood.

Sir H. CARTWRIGHT, in seconding the motion, said he exceedingly regretted, with Mr. Woodall, the absence from the meeting of their respected Chairman; and he hoped that a short time would reinstate him in health. As to the report, he considered that it was most satisfactory; seeing that they had only to take a little more than £100 from the undivided profits for the purpose of paying the dividend. Referring to the price of gas, he said that many shareholders thought they ought to have increased it; but taking into consideration the joint interests of the consumers and the proprietors, the Board had determined not to raise the price if it could by any means be avoided. He hoped the increased consumption that was going on would enable the Directors to pay the same dividends without trenching further on the undivided balance.

Mr. MOORE called attention to the growing use of oil-lamps in the district for lighting shops; and he asked whether the Company could not compete with oil by supplying gas for business purposes, through a separate meter, at a lower price than for the domestic supply.

Mr. WATSON referred to the satisfactory increase in the number of gas-stoves let out on hire, and to the amount of gas that had been extracted from the coal. During the half year, they had produced 10,500 cubic feet, which he regarded as an extraordinary amount.

The CHAIRMAN, in reply, said the Directors had for a long time past been fully alive to the competition to which they were exposed from oil. They were not afraid of that competition on the ground of efficiency for money spent. But the advantage of the oil was that the consumers were able to purchase it in small quantities, and they hardly noticed the few pence expended from time to time; whereas a quarterly bill for gas appeared to be rather a serious thing. The Directors had made some efforts in the direction of making the collections at shorter intervals, and by the introduction of prepayment meters. Mr. Watson had referred to the number of stoves in use. This was a matter in which the Directors did take a great deal of interest; and they were delighted to find an increase from month to month.

The motion was then carried.

On the proposition of Mr. J. WARREN, seconded by Mr. WALTER LOW, dividends were declared, less income-tax, on the "A" stock at the rate of 11½ per cent. per annum, and on the "B" and "C" stocks at the rate of 8½ per cent.

Mr. ALFRED RICHARDS moved, and Mr. PERKINS seconded, a vote of thanks to the Chairman and Directors; and this having been carried,

A resolution was passed, expressing sympathy with Mr. Gripper in his illness, and hoping that he would be speedily restored to health.

The Rev. W. ALMACK (Mr. Gripper's son-in-law), on behalf of the family, briefly thanked the shareholders for their kind expression of sympathy.

The services of the officials having been fitly acknowledged,

Mr. J. RANDALL and Mr. W. H. H. BROADBERRY thanked the shareholders for their continued confidence in them; and the last-named gentleman gave a few figures regarding the quantity of gas produced and sold. He said that the actual quantity of gas made per ton in the past half year was 10,900 cubic feet, and sold 10,512 feet; but for the entire year, the amount sold stood at 10,002 feet. In 1866 they manufactured 53,324,000 feet; and last year 320,564,000 feet.

The proceedings then terminated.

BRISTOL GAS COMPANY.

The Half-Yearly General Meeting of this Company was held on the 26th ult.—Mr. J. W. S. DIX in the chair.

The SECRETARY (Mr. J. V. Green) having read the notice convening the meeting, the report of the Directors, with the accounts for the six months ending Dec. 31 last, to which reference was made in the JOURNAL a fortnight ago, was taken as read.

The CHAIRMAN, in briefly moving the adoption of the report and accounts, expressed the pleasure of the Directors at being able to present so favourable a statement to the proprietors. During the past half year, a great deal of money had, he said, been spent in repairs; and the works were in an efficient state to earn the dividend, while other companies had not earned theirs, but had drawn upon the reserve fund in order to pay a reduced dividend. This was a subject of congratulation; and he did not propose to add any superfluous remarks.

The DEPUTY-CHAIRMAN (Mr. G. K. Stothert) seconded the motion.

Mr. H. A. MEDWAY referred to certain complaints which had appeared in a local paper concerning the quality and pressure of the Company's gas, and said he would leave the Chairman to explain whether or not there was any justness in them. As to the complaints of inefficient light, he was convinced that a great deal of this was due to the use of bad burners. Then, again, there was the possibility of meters getting out of order and pipes becoming corroded. As far as he was concerned, he was tired of hearing these complaints; and if the shareholders looked to their responsibility in this matter, he thought householders should do their part.

The CHAIRMAN, in reply, said he was glad of the opportunity afforded of referring to the matter. The Company had statutory obligations now to provide gas of 14.50-candle power; but before their recent Act it was 13.50 candles. The Company now supplied gas of a quality far in excess of that which they were obliged to send out. He would, in support of this, take the November returns issued from the official testing office, which, owing to its being in the lowest-situated street in the city, was certainly, from the Company's point of view, the most disadvantageous site for the tests to be made. The daily registers, as issued from that office, for November, showed that the gas ranged in quality from 16.1 to 15.65 candles; and here he would remind both the shareholders and the public that the obligation of the Company was only to provide a light equal to 14.50 candles. Taking February, he found that the Company had sent out gas as high as 16.29 candles, according to the returns from the official testing office, although it was a higher quality than that when it left the works of the Company. The photometer used by Mr. Kitt (the Chief Examiner of gas) was out of order, and he was about to be supplied with a new one. This was a fact which the Company would rejoice at, because his reading of the quality of the gas and theirs differed materially. According to their register, gas had not left the Company's works once in February of less illuminating power than 16.50 candles. It would thus be seen that the Company endeavoured to do all they were obliged to do, and much more; and, instead of so much complaint, he thought they should receive some expression of gratitude from the consumers.

A SHAREHOLDER expressed satisfaction that the leakage was not so great as it had once been. He said he had had experience in the laying of pipes; and seeing how easy it was for the mains to leak, and how difficult for the exact place of the leakage to be ascertained, he would suggest that the main should be protected with a packing of brown lime concrete. This would cost more, it was true; but it was of great importance that the Company should protect their pipes in the best possible manner.

The CHAIRMAN thanked the proprietor for his practical suggestion. At the same time, he said he was glad to announce that the loss of gas showed a decrease of 2 per cent.

The MAYOR (Dr. Highett), who is a Director of the Company, added a few remarks to enforce the advisability of consumers looking to their pipes and burners, the reward of which would, he said, be a better light.

The motion was then put, and carried unanimously.

The retiring Directors having been re-elected, Mr. F. N. Tribe was appointed an Auditor in place of his father, Mr. W. Tribe, who relinquished the duties.

The half-yearly dividend, at the rate of 5 per cent., was next declared; and the business of the ordinary meeting concluded.

A special meeting was then held, at which the Directors were authorized to proceed with the Bill now being promoted by the Company to enable them to extend their works.

The proceedings closed with a vote of thanks to the Chairman and Directors.

The Campbell Gas-Engine Company, of Halifax, have just opened a branch show-room at No. 103 Snow Hill, Birmingham; the new premises being lit by electric light driven by means of a 4-horse power Campbell gas-engine. The branch will be under the management of Messrs. A. and G. Bentley.

PROVINCIAL GAS AND WATER COMPANIES.

From the financial statements and reports of meetings of the various Provincial Gas and Water Companies mentioned, we have taken the particulars contained in the following paragraphs.

Gas Companies.

The net profit at the disposal of the Abingdon Gas Company for the six months ending Dec. 31 last was £1350; and at the meeting of shareholders last Thursday, the Directors recommended that £500 of this sum should be employed in reducing the temporary loans, and that dividends at the rates of 5s. per share on the original shares, and 3s. 6d. per share on the "B" shares, should be declared. This would absorb £345, and leave a balance of £505 to be carried forward. The total receipts were £2405; and the expenses, £1493—leaving a profit of £912. This, added to £613 unappropriated from the previous half year, made up £1525, of which £174 was used in payment of interest on the temporary loans and on bonds.

The tenth half-yearly meeting of the Barry Gas and Water Company has been held. It was reported by the Directors that, owing to the continued increase in the business, it had been found necessary to apply to Parliament for powers to realize further capital to extend the works. The balance-sheet showed an allowance of £2201 from the revenue account for interest on the debenture stock; the balance available for dividend on the ordinary shares being £1880. The expenditure had been £2785 and the receipts £4885. The Directors recommended a dividend at the rate of 5 per cent. per annum on the various stocks. The Chairman (Mr. T. Webb), in moving the adoption of the report, said that the revenue from gas and water was constantly advancing. It had increased from £2748 a year ago to £4693. They had now about 25 miles of pipes, and from £8000 to £10,000 worth of mains which were not yet productive, but every week they were getting more so on account of the increase in houses. The report was adopted.

In moving the adoption of the report and balance-sheet at the meeting of the Castleford and Whitwood Gas Company last Wednesday week, the Chairman (Mr. J. Watson) stated that extensions had been made in the retort-house, including three stacks of seven retorts each, which would largely increase the producing power. The sale of gas had advanced from 15,250,000 feet in the corresponding half of 1890 to 17,038,700 feet in the past six months. The total receipts amounted to £3415; and the balance available for distribution was £1260. Out of this the Directors recommended a dividend at the rate of 9 per cent. per annum, and that £100 be placed to the reserve fund, which would then stand at £500. The motion was adopted; and the dividend recommended declared.

The report adopted at the half-yearly meeting of the Douglas Gas Company on Monday of last week showed net profits amounting to £3496—an improvement as compared with the corresponding period of 1890. Including the balance brought forward, there was available for dividend £5044, out of which the Directors recommended a dividend of 35s. per share.

According to the remarks made by the Chairman (Mr. H. Rollinson) at the recent meeting of the East Ardsley Gas Company, during the past six months the quantity of gas produced was 5,344,000 cubic feet, as against 4,735,000 feet in the corresponding period of 1890; and the Directors were able to pay a dividend of 5 per cent., and carry forward a small balance. Anticipating an increased demand for gas next winter, he stated that the Board had decided to erect a new gasholder for storing from 45,000 to 50,000 cubic feet. The holder would be a two-lift one, and capable of containing from 90,000 to 100,000 cubic feet of gas. The contract for the tank had been let to Mr. Walter Binns, of Bradford, for £750, and the holder would be made by Messrs. W. C. Holmes and Co., of Huddersfield, for £990. The holder would be 62 feet in diameter and 16 feet deep. The report was adopted.

At the recent half-yearly meeting of the Eastbourne Gas Company, the report submitted by the Directors stated that the revenue account showed a profit for the half year of £5550, which, added to £6983 the balance brought forward after payment of a dividend in August last, would give a total sum of £12,534 available for dividends. The Directors, therefore, recommended that dividends for the past half year be declared at the rate of 13 per cent. per annum upon the £20,000 original capital of the Company, and also upon the £12,490 (the amount raised on the "C" shares), and at the rate of 10 per cent. per annum upon the £55,000 paid-up capital raised on the "B" shares, which would absorb the sum of £4861, and leave a balance of £7672 to be carried forward to the next account. The report was adopted.

The report presented at the 91st half-yearly meeting of the Harrogate Gas Company (the principal features in which were noticed in the JOURNAL last week) was adopted by the shareholders at their assembly on the 26th ult. In the course of the remarks made by the Chairman (Mr. C. Allanson) on the occasion, he reviewed very lucidly the report and accounts and said he ventured to think the present position of the undertaking might be regarded as highly satisfactory; much credit being due to the officers recently appointed, and to everyone in the employ of the Company. He thought the flourishing condition of the gas-stove department would be best exemplified by his remarking that 25 per cent. of the total quantity of gas registered by meters was used by cooks, heating-stoves, and engines. The proprietors would be interested to know that the weekly cash payment system had been adopted, under which the working man or the small householder could pay weekly for the gas he consumed. The patent for this had been worked out by Mr. W. Deighton, the Company's Foreman, and Mr. T. Wright, of Leeds. The Chairman afterwards referred to the necessity for raising additional capital, and explained that it was the desire of the Directors to offer the new shares in such amounts as to form an attractive investment for their gas consumers. This co-operative scheme, it was stated, had been introduced with marked success by the South Metropolitan Gas Company; and the Directors believed it would prove equally successful and beneficial at Harrogate. At the close of the Chairman's remarks, the statutory dividends were declared; and the proceedings closed with a vote of thanks to the Directors for their services during the past year.

The half-yearly meeting of the Hastings and St. Leonards Gas Company was held last Thursday. The Directors reported that the increase in the business mentioned in the two previous reports had

been well maintained. The quantity of gas manufactured during the year was nearly 24 million cubic feet in excess of the previous year, or 8 per cent. The accounts showed a profit of £12,071, which, with the balance brought forward from the preceding half year, made a sum of £37,433 to be dealt with by the shareholders; and it was proposed to pay a dividend at the rate of 12 per cent. per annum on the £25 shares, and a dividend at the rate of 9 per cent. on the £20 shares. With regard to the manufacturing operations (which are under the charge of Mr. C. E. Botley, Assoc. M. Inst. C.E.), the quantity of common coal carbonized was 16,066 tons, and of cannel 187 tons, from which was produced 165,933,000 cubic feet of gas. The residuals made were: Coke, 10,033 tons; breeze, 672 tons; tar, 156,219 gallons; and ammoniacal liquor, 342,351 gallons. In moving the adoption of the report and the statement of accounts, the Chairman (Mr. J. Brown, J.P.) said he considered the past half year was one of the most successful he had known. Considering the great depression the town had passed through, and that there were very few gas companies who nowadays could hold their own, he thought the report was highly satisfactory. It might be asked what was the cause of their prosperity. There were several things which favoured them. The first was the very large increase of their trade, which had gone up by leaps and bounds. Electricity did not seem to affect it at all—indeed, the more electricity was introduced, the more trade they did. The second reason was the considerable care bestowed upon details by the Directors and officials—a matter on which a great deal of their profit depended. He would mention one case to show what was done—viz., in purifying the gas. In 1886, this cost £429, and the coal carbonized amounted to 12,680 tons, at a cost of 9'86d. per ton; while in 1891 purifying cost £326, the quantity of coal carbonized was 16,254 tons, at a cost of 4'68d. per ton. The third cause of prosperity was their position with regard to finance. They had a reserve fund, or undivided profits, of £30,000; and, in addition, there was an item of £20,000 premiums on the sale of shares, on which sums they paid no interest at all. Adverting to residuals, he said that coke was now a drug in the market all over the country; but they had received more from them than in any corresponding half year, though they had not obtained such a good price for it as they ought to have done. The sensational part of their trade was in ammoniacal liquor. In 1886 they received from its sale £21, and one half year nothing at all; but in 1891 they realized £1425. Mr. G. W. Veness seconded the motion, which was agreed to.

The annual meeting of the Ilfracombe Gas Company was held on Wednesday last. The report (which was adopted) showed that there had been a good average increase of business. The balance standing to the credit of profit and loss account and available for dividend was £1224, out of which the Directors recommended the payment of the usual dividends of 10 per cent. on the "A" shares, 7 per cent. on the "B" shares, 4 per cent. on the "C" shares, and 2½ per cent. towards the arrears of dividend on the "A" shares—leaving only 3½ per cent. due. The make of gas, it was also stated, had increased by 2,053,000 cubic feet.

At the recent annual general meeting of the Longwood Gas Company, the Chairman (Mr. E. Armitage, J.P.), in moving the adoption of the report and accounts, stated that, owing to the difficulties the Directors had encountered during the past year, and having to contend with a falling off in sales, an advance in wages, and the high price of coals, he was unable to congratulate the shareholders upon a very high result. At the same time, he was pleased to be in a position to state that, by the improvements adopted in the works, and by strict economy in their management, they were able to reduce the unaccounted-for gas; and they hoped to show something better another year. The Vice-Chairman (Mr. R. Thornton) seconded the motion, and it was carried. Subsequently, in acknowledging a vote of thanks, the Chairman expressed the satisfaction of the Directors at the way in which the Manager and Secretary (Mr. J. L. Mitton) discharged his duties—adding that the Board had full confidence in him.

Last Tuesday, the annual meeting of the Rugby Gas Company was held. From the report it appeared that the receipts on revenue account for the year ended Dec. 31 last amounted to £12,236, and the expenditure to £8901; leaving £3335 to be carried to the profit and loss account. The net balance was £4864; and the Directors recommended the payment of a dividend for the past six months at the rate of 11 per cent. per annum on the paid-up share capital. The report was adopted.

The annual meeting of the Sevenoaks Gas Company was held last Thursday week. From the report and accounts which were submitted, we learn that the gross receipts for the half year were £5393, and the gross expenditure £3719. The profit amounted to £1674; and the sum available for dividend was £2578. The Directors recommended the usual appropriation—viz., 10 per cent. (less income-tax) on the original capital, and 7 per cent. on the additional capital. As to the operations at the works, during the six months 3229 tons of coal were received, of which 2498 tons were carbonized and used; and the following residual products were made: 2498 chaldrons of coke, 240 chaldrons of breeze, 25,303 gallons of tar, 37,470 gallons of ammoniacal liquor, and 24 tons of sulphate of ammonia. The report was unanimously adopted.

The annual meeting of the South Bank and Normanby Gas Company was held last Thursday week. The report of the Directors showed that the receipts on revenue account, with the balance from the previous year's accounts, amounted to £6594, and the expenditure to £3562, which left a balance of £3032. An interim dividend of 4 per cent. was paid in August last, and a further dividend of 5 per cent. was recommended. The report was approved.

Water Companies.

The ninth half-yearly meeting of the East Warwickshire Water Company was held at Nuneaton last Saturday week. The report of the Directors stated that the number of houses now connected with the Company's mains was 1240, as compared with 1140 in August last. The financial statement showed that the half-year's working had resulted in a profit of £227; and of this sum £192 had been paid away as interest on the debenture bonds. In moving the adoption of the report and accounts, the Chairman (Mr. H. Townshend) referred to the difficulties which had been met in boring for an increased supply, and stated that, in view of the great progress of the town—progress which the Company

never anticipated to such a degree—a further supply was absolutely necessary. The report was agreed to.

The report and accounts of the Maidstone Water Company, which were submitted at the half-yearly meeting on the 25th ult., showed that the water-rents had amounted to the sum of £4228, and the profit to £1997; making the sum of £5378 to the credit of the profit and loss account. The Directors recommended the payment of a dividend (free of income-tax) for the half year of $4\frac{1}{2}$ per cent. on the 10 per cent. shares, and of $3\frac{1}{2}$ per cent. on the 7 per cent. shares. These payments would absorb the sum of £1957, and make the dividend for the year on the 10 per cent. shares $8\frac{1}{2}$ per cent., and on the 7 per cent. shares $6\frac{1}{2}$ per cent. The Directors stated that they found it necessary that the powers of the Company to build a pumping-station at the Forstal, Aylesford, to pump the Cossington water (which at present was only used by gravitation) into the two higher services, should at once be utilized; and they had entered into contracts amounting to £3367 for the erection of the necessary engine-house, boiler-house, engine, and pump. The Directors also mentioned that they had received a further communication from the Maidstone Urban Sanitary Authority, which would be laid before the shareholders; but they did not see their way to advise them to part with their property at the present time. The Chairman (Mr. C. Ellis), in moving the adoption of the report, said he thought it was satisfactory—he was going to say exceedingly satisfactory—because it showed that the Company was gradually progressing, and that during the past year they had been able to increase the dividend by 10s. on the 10 per cent. shares, and 7s. 6d. on the 7 per cent. shares; and, speaking for the Directors, he believed he might say that they saw no reason why they should not be able to continue increasing the dividend. Proceeding, he said the Directors had received a further communication from the Urban Sanitary Authority; but they did not advise the shareholders to part with their property at the present time. He thought it likely that the shareholders would not feel inclined to dispose of the concern unless they obtained a very considerable price for it. The sum offered for the undertaking was £130,000. The matter was now in the hands of the shareholders; and it was for them to decide whether or not they would recommend the Directors to make an arrangement to part with the property. Major Haynes seconded the motion. After a short discussion, the letter which had been received from the Urban Sanitary Authority was produced; and the following resolution which it contained was read: "That the Directors of the Water Company be requested to bring the question of the purchase of the undertaking by this Authority before the shareholders, as it is thought desirable that the supply of water to the town should be under the control of the Local Authority, and to ascertain if the Directors and shareholders are willing to sell at a fair and proper price, and in such case to suggest that such price should be arrived at by arbitration or agreement." Mr. Day then moved that the letter from the Local Board having been read, and the resolution of the Directors considered, the shareholders decline to accept the invitation of the Local Board. He remarked that if the Board wished to buy the concern, the Company were perfectly competent to put a price upon it without going to arbitration. This motion having been seconded, Mr. Cox—feeling that this and similar undertakings should belong to the people, and be managed by their representatives—proposed an amendment, to the effect that the shareholders were willing to sell the property at a fair price. The amendment was not seconded, and Mr. Day's resolution was carried, as well as the report of the Directors. An extraordinary meeting was then held, at which the Directors were empowered to raise the sum of £5000, part of the capital authorized to be raised by the Company's Act of 1885, by the issue of mortgages and ordinary shares of the value of £10 each.

The annual meeting of the Newcastle and Gateshead Water Company was held yesterday week. The Chairman (Colonel Potter, C.B.), in moving the adoption of the report—which was noticed in the JOURNAL for the 23rd ult.—said he thought every shareholder would be satisfied with the balance-sheet, which showed that the Company were in a prosperous condition. During the past year, they had spent upwards of £74,000 on capital account. They had completed the high service at Gateshead, and had constructed at Beacon Lough an extra reservoir, holding about 250,000 gallons of water, at a height of 550 feet above the level of the sea. The Company were laying a new 20-inch main from a second point at Gateshead; so that they might be enabled to supply the people of the sister borough with a better supply of water at a greater pressure. In Newcastle they had completed a 30-inch line of pipes from Newburn to the foot of Rye Hill; and it was temporarily connected at Newburn with the pipe from the filter-bed at Throckley. From the foot of Rye Hill, they were carrying a 24-inch pipe through several important streets; so that in a very short time they would be able to give a very much larger supply to Newcastle. They were also busy laying a pipe from Newburn to Whittle Dene. When this and the filter-beds were completed, they would have an extra supply through a 30-inch main laid to Newcastle; and they hoped in the course of time to be in a position to supply the city with as much filtered water as the inhabitants might require. The quantity of water used averaged 100 million gallons a week; and the Company had in store sufficient to last for thirty weeks. The Redewater works would be completed possibly the year after next. Mr. W. B. Wilkinson seconded the motion, and it was agreed to. Dividends for the half year ended Feb. 1 were then declared on the original consolidated stock at the rate of 10 per cent. per annum, making, with the interim dividend paid in August last, 9 per cent. for the year; on the stock under the Act of 1876, at the rate of 7 per cent. per annum, making, with that paid in August last, £6 6s. per cent. per annum; and on the preference stock, at the rate of 5 per cent. per annum. A special meeting was afterwards held, when resolutions were passed empowering the Directors to raise, as required, the sums of £125,000 and £30,000 authorized to be raised on mortgage under section 29 of the Company's Act of 1889, and section 25 of their Act of 1890, and consenting to the money being issued in the form of debenture stock, on which a dividend of 4 per cent. will be paid.

According to the report presented at the half-yearly meeting of the Sevenoaks Water Company on the 21st ult., the balance at the credit of the profit and loss account was £1200, out of which sum the Directors proposed the payment of a dividend at the rate of 8 per cent. per

annum on the consolidated stock and £5 12s. per cent. on the share capital, free of income-tax. In moving the adoption of the report, the Chairman (Mr. W. H. Cronk), stated that, though there was a slight falling off in the revenue from water-rents, they had earned a substantial sum by the sale of stone taken out of the Company's lands, and they had effected certain savings in various items of expenditure. He also referred to the application which the Company are making to the Board of Trade for power to increase the capital by £12,000, which, he said, would bring the nominal capital up to £40,000, and would save the expense of another application to the Board of Trade a few years hence. The power they sought had met with opposition from the Board of Guardians and the Local Board; but he thought both bodies had been badly advised in taking this step, and that unnecessary legal expenses would be incurred on both sides. For his own part, he had no doubt that what they asked for would be granted in its entirety, as it was just and reasonable. The report was adopted; and among other subsequent business, the Directors' fees were increased to £157 10s.

The ordinary general meeting of the South Essex Water Company was held on the 27th ult.—Mr. W. C. Fooks in the chair. In moving the adoption of the report, the Chairman congratulated the shareholders on the satisfactory position of the Company. They were, he said, paying an increased dividend, in addition to writing off a large sum for depreciation. The concern was now in a sound financial position; the works were in capital order; and everything was progressing favourably. He believed they were within measurable distance of paying a 4 per cent. dividend. The Directors would not require any more capital to complete the works in hand until the beginning of next year, when he hoped the shareholders would respond liberally. The motion was carried.

DARLINGTON CORPORATION GAS SUPPLY.

The Quality of the Gas—The Dinsmore Process.

On the minutes of the Gas Committee coming before the Darlington Town Council last Thursday, Mr. Drury referred to the quality of the gas supplied in the borough. This, he said, was not so good as it used to be; and he thought it was a great mistake to reduce the pressure to the extent it was now done during the day. The consumers who had gas-stoves were almost unanimous in complaining that there was not pressure enough to enable them to use them; and he considered it was very unfair not to give them a sufficient supply. Then, again, a short time since the Dinsmore process was introduced at the works, at a cost it was reported of something like £1000, which was practically a dead loss. He saw from the minutes that they were going to introduce some fresh Dinsmore plant, which would seem to point to the fact that the first was not satisfactory. The Mayor (Alderman Walker) said that, as to the alleged poverty of the gas, he thought the Gas Manager would support him in saying that the average illuminating power was $16\frac{1}{2}$ candles. The day pressure question was a very serious one. If they gave through the day a pressure equal to that at night when all the lamps were lighted, they would increase the leakage possibly 5, 7, or even 15 per cent.; and clearly any profit hitherto derived from those who wished to cook by gas would be lost in that case. As to the Dinsmore process, some little time ago they had the matter before them, with the result that they came to the conclusion that there was something in it; and, under certain conditions, they agreed to allow the Dinsmore Company to make an experiment at the works, but not at the ratepayers' expense. Certain plant was put up at a cost not of £1000, but about £500; and since then sanction had been given to the Committee to erect plant necessary for an experiment at their own cost. The Committee believed that, when this new plant was tried, the result would be that they would get a largely increased illuminating power without the use of cannel coal at all, and with very common coal, which would cost some shillings per ton less than they were now paying. If it succeeded, it would mean a saving of a large amount each year to the Corporation; and if it failed, they would lose very little indeed. The minutes were then adopted.

Extension of Electric Lighting at Blackpool.—The Electric Lighting Committee of the Blackpool Town Council have decided to recommend the Council to considerably extend the lighting of the Promenade by electricity. It is also intended to light a few of the principal thoroughfares, and supply places of business desiring the light.

Strike at Messrs. Richmond and Co.'s Gas-Stove Works.—Owing to a dispute which arose about a fortnight ago, at the gas-stove works of Messrs. Richmond and Co., Limited, of Warrington, as to the employment of Union and non-Union men, the whole of the unionist fitters threw up their work. Although this proceeding caused temporary inconvenience, the vacant places were soon filled; and work is now going on practically as usual—the firm having gained a complete victory. The strikers appealed to the local Trades Council for support; and an interview took place between representatives of this body and the Directors of the Company, at which it was proposed, as a termination of all differences, that the disaffected hands should be allowed to resume their duties. As, however, the works were full of men who had taken the place of the strikers, and as the proposal meant the dismissal of the new hands, some of whom had left other situations or come from long distances, the Directors declined it. They felt themselves to be under an obligation to the new men who wished to remain at their work, and who had had promises made to them of certain and constant employment to keep them in their places. A further proposal to the Directors that the differences should be referred to the Mayor or some other gentleman of position was also declined on the same ground. Proof of the good feeling of the Directors towards unionists as a whole was still, they maintained, testified by their retention of men of the Tinplate Workers' Union then on the works, and who wished to remain there. During the height of the strike, one of the discontented hands assaulted a cripple boy in the Company's employ, for which he subsequently had to pay a fine of £5 and costs.

THE SMETHWICK GAS UNDERTAKING.

The report and statement of accounts of the above undertaking for the twelve months ended Dec. 31, 1891, have lately been issued by the Secretary (Mr. W. J. Sturges). They show that the result of the year's work was a net profit of £192. However disappointing this result might be, it was not surprising when it was remembered that the enormous increase in the cost of coal and labour during the past two years had been met without making any addition to the prices charged to the consumers. The sale of gas continued steadily to increase; the improvement in this respect being 4,366,100 cubic feet, or 3·1 per cent. The total revenue from this source, after allowing for discounts, &c., amounted to £19,098—an increase of £639 as compared with the previous year. The receipts from coke and breeze amounted to £6053—a reduction of £288 compared with 1890, and due to diminished value. Prices were well maintained during the earlier months of the year; but a considerable decline took place later on—large quantities of outside coke being introduced into the Midland markets by dealers from gas-works at a distance, where the local demand was poor. Tar showed an improvement of £770; while on ammoniacal liquor a diminution of £122 had taken place, owing to the continued depression of the sulphate of ammonia market. The total receipts from all sources amounted to £26,852, against £26,498 in 1890—an increase of £354. On the expenditure side of the revenue account was found the cause of the serious reduction in the net profit. The expenses showed an advance of £2170 as compared with the year 1890. The cost of the manufacture of gas had risen to £16,025, from £14,319; being an increase of £1705. Of this increase, coal was responsible for £1518; the coal carbonized during the year having cost 13s. per ton, against 11s. in 1890, and 9s. in 1889. The repairs and maintenance of works cost £1472, against £1332 in the previous year. The rates and taxes showed a considerable increase; being £995, as compared with £801 for 1890—the rateable value of the works and mains having been increased by the Assessment Committee. The total increase in expenditure was £2170, against which there was only £353 of additional income; thereby reducing the gross profit for the year by £1817—the amount of gross profit being £7764. The amount provided for interest and redemption was £7572, which being deducted from the gross profits, left the net profit for the year £192. The total loans outstanding on Dec. 31, 1891, were £156,202, and £5887 had been repaid, which made up the amount sanctioned to be borrowed—viz., £162,089; the total amount authorized by their Act of Parliament and Provisional Order being £182,709. Appended to the report was a comparative analysis of the accounts and working results for the years 1890 and 1891. It shows that the gross cost of gas per ton of coal carbonized was 24s. 8·5d. last year, and 22s. 6·8d. in 1890; and per 1000 cubic feet of gas sold, 2s. 7·4d. and 2s. 4·7d. The net cost of gas in the two years was: Per ton of coal carbonized, 14s. 8·0d. and 11s. 10·1d.; per 1000 cubic feet of gas sold, 1s. 6·7d. and 1s. 3·1d. The net profit was: Per ton of coal carbonized, 2·99d. and 2s. 6·71d.; per 1000 cubic feet of gas sold, 0·31 and 3·26d. Last year 15,448 tons of coal were carbonized, which yielded at the rate of 10,001 cubic feet of gas per ton, as compared with 14,989 tons and 9928 cubic feet per ton in 1890. The residuals produced per ton of coal last year were: Coke and breeze, 12·59 cwt.; tar, 11·47 gallons; ammoniacal liquor, 34·74 gallons—the last two figures being a slight advance on 1890.

THE OPPOSITION TO THE SWINTON LOCAL BOARD GAS BILL.

A well-attended meeting of ratepayers convened by the Chairman of the Barton and Eccles, Winton, and Monton Local Board, was held last Friday week, to consider a resolution declaring that it was expedient, in the interests of the ratepayers in the district, that the Bill promoted by the Swinton and Pendlebury Local Board in the present session of Parliament, for authorizing them to purchase a portion of the gas undertaking of the Corporation of Salford, to construct gas-works, and to supply their district and other districts with gas, should be opposed. Mr. W. D. Kendall, the Chairman of the Board, moved the resolution; and then Mr. J. Ashton inquired whether, in the event of the Swinton Local Board inserting in their Bill the clauses suggested by the Eccles Board, the latter proposed to withdraw their opposition. The ratepayers intended to give an unconditional opposition to Swinton supplying Eccles with gas, whatever the Board might do. The Chairman said the resolution before the meeting, which was a broad one, was for opposition; and if it was passed, it was sufficient to cover everything. Mr. Davy, as Chairman of the Gas Opposition Committee, stated that he represented more than 3000 ratepayers who would not have this gas scheme suggested by the Board. The truth was they were in a muddle; and the muddle had arisen in consequence of the clauses to which Mr. Ashton had referred. They would find, he thought, that, if they took a proper course about a differential rate, Salford would supply them with gas at a less price than they could get it at by supplying themselves. Mr. Burgess, another ratepayer, said the Eccles people had during recent years had a reduction of 11d. in the price of the gas supplied by Salford; and it seemed to him that, if they approached Salford in a proper manner, they would obtain a further reduction of 4d. After about two hours' discussion, the resolution was carried, on the understanding that the Local Board should offer an uncompromising opposition to Swinton supplying Eccles with gas. The Board afterwards met to consider their position.

Last Tuesday, the Local Board withdrew their original petition for clauses to be inserted in the Swinton Bill safeguarding their interests. In addition to the opposition which will now be offered by them, the Barton Rural Sanitary Authority, the Little Hulton Local Board, and the Salford Corporation will oppose the Bill. Messrs. A. Knowles and Sons, colliery proprietors, and Captain Dautesey, of Agecroft Hall, Pendlebury, have also petitioned to safeguard their interests. Mr. Bidder, Q.C., has been retained by the Swinton Board in support of the Bill; and the witnesses who will be called include Sir Frederick Bramwell, Mr. George Livesey, and Mr. Corbet Woodall.

THE BIDEFORD GAS COMPANY'S PROVISIONAL ORDER.

Board of Trade Inquiry.

On behalf of the Board of Trade, Major MARINDIN, R.E., held an inquiry recently into the application of the Bideford Gas Company, Limited, for a Provisional Order.

Mr. J. A. THORNE appeared in support of the application; Mr. TEMPLE COOKE opposed on behalf of the Bideford and Northam Local Authorities.

Mr. THORNE first traced the career of the Company from the formation to the year 1870, when they resolved themselves into a limited liability Company, and applied for a Provisional Order so that they might extend the works. They were opposed then, as now, on the ground that the Town Council contemplated applying for an Order on their own account, and intended to build new works. The Company, therefore, withdrew their application. Their present share capital, which had been increasing gradually, was £6150; but the shareholders had from time to time devoted large portions of their profits to improving the works. They had now reached a point when they could go on no longer without extensive additions and improvements. He (Mr. Thorne) questioned the right of the Local Board to consent or dissent to the application, as the Company did not seek to construct new works within the district of the Authority. As to the objection of the Northam Local Board, he pointed out as significant that neither the Westward Ho nor the Appledore Gas Company had entered any opposition to the application. He had some doubts as to the sincerity of the town to purchase the gas-works, and supposing they did wish to do so, their financial resources were not sufficiently large. He attributed the breakage of sewers complained of not to defect v. mains, for they had all been renewed within the last 21 years, but to the passing of a heavy steam-roller through the streets.

Mr. W. D. JOCE, the Secretary of the Company, was the first witness called. He said that since 1882 the production of gas had increased from 11,148,000 to 20,178,000 cubic feet, or about 80 per cent. An extension of the plant was absolutely necessary. There had been no complaints of any importance during a period of about twenty years; and for the past ten years the Company had paid a 10 per cent. dividend.

In cross-examination, witness admitted that the Company lost on the sale of gas to large consumers, who received 42½ per cent. discount. He denied that he had received any complaints of importance as to the public lighting for some time. The contract price for lighting the town lamps was £2 13s. 10d. for 4-foot burners, and £3 2s. 6d. for 5-foot burners.

Mr. F. Fulford, the Company's Manager, said he had been in their employ for 20 years. The daily consumption of gas was about 80,000 cubic feet, which closely equalled their output. The gas mains and pipes were in good condition, almost all having been relaid during the time he had been Manager.

Mr. Arthur F. Phillips, M. Inst. C.E., considered the works were very well situated, and in fairly good condition, but not of modern stamp. The daily output could not be increased except at the greatest risk. For even present requirements, it was absolutely necessary that alterations and extensions should be immediately carried out; and looking at the probable increase of consumption, he had advised the Company to expend £5000 in this way. Then the capacity would be increased to a daily output of from 175,000 cubic feet to 180,000 feet. The capital of the Company had been administered with great wisdom. The price charged for gas was exceedingly low; in fact, he did not know that there was any town with a corresponding consumption where gas was so cheap.

Mr. G. W. Vincent said his firm consumed nearly 2½ million cubic feet of gas for motive power and heating, mostly in the day time; and unless he received the 42½ per cent. discount, he should utilize Dowson's gas plant.

Mr. COOKE, in opening the case for the opponents, said if the largest gas consumer were prepared to manufacture their own gas if the 42½ per cent. discount was withdrawn, the proposed alterations in the works advocated by the promoters seemed almost, if not entirely, unnecessary. The objection of the Northam Local Board ought to have considerable weight; and in addition, the general body of ratepayers were against the Order. As to the public lighting, the light had been bad; and the price had been increased from £2 5s. to £2 13s. 10d. per lamp. The principal objection, however, related to the injury of the roads by the laying of gas-mains. The Bideford Town Council felt the time had come when they should have the management of the gas-works. It was perfectly true that a proposal of the same kind was made twenty years ago, and that it came to nothing; but the body was composed of a different set of men then. The Council were willing and most anxious, if terms could be arranged, to buy the Gas Company's works. In view of the possibility of this being done, he suggested that the Inspector, if satisfied with the *bona fides* of the Council, should recommend the suspension of the present application for twelve months. If at the expiration of that time terms had not been agreed upon, it would then be a question whether the Order should be granted.

The Mayor (Mr. R. Dymond) said the Council desired to purchase the gas-works because the profits would ease the local rates as the profits from the water-works had done. They intended to pay for the concern with money which could be borrowed at a rate of interest not higher than 3½ per cent.

After a short discussion between Counsel, the Inspector said it seemed to him the Company were prepared to sell, and the town wanted to buy.

Mr. COOKE declared his readiness to settle the matter; but Mr. THORNE said he had no instructions to do so.

Mr. THORNE then summed up on behalf of the Company, commenting on the fact that, although the opponents had a Gas Engineer from Exeter (Mr. Willey) present, they had not called him.

The inquiry ended with an understanding that Major Marindin would withhold his report for a month. Meanwhile the town authorities would endeavour to arrange some definite basis of valuation with the Company.

AN ELECTRIC LIGHTING INSTALLATION FOR SALFORD.

At the Monthly Meeting of the Salford Town Council last Wednesday, the members were asked by Mr. Phillips to concur in a resolution of the Gas Committee, that it was expedient the Corporation should exercise the powers conferred upon them by their Electric Lighting Provisional Order. Mr. Phillips pointed out that, unless they took advantage, by Aug. 4, of the Order, any company that had the power could enter the borough and break up the streets, and retain possession for 42 years, at the end of which time the Corporation might find it necessary to buy them out at considerable expense. The Committee did not at present submit any scheme. They were sending out circulars to see where the electric light was wanted; and when they had obtained this information, and had fully considered the matter, they would submit a scheme, but it would only be a very small installation to begin with—sufficient to secure the right to retain the electric lighting in their own hands. The supply would be extended as occasion seemed to render necessary. In the meantime all that was wanted was that the Council should express an opinion as to the expediency of the Corporation exercising their powers. Mr. Roper seconded the motion, and Alderman M'Kerrow supported it. Mr. Mansfield then moved, as an amendment, that it was expedient that the Corporation should for the present postpone the exercise of their powers. He reminded the members that the electric light was at present exceedingly expensive; and that, charging 8d. per unit, as they proposed to do in Salford, it would be about three times the price of gas, which would make it quite prohibitive to any except the wealthy classes. He did not think the latter should be supplied at the expense of the general body of the ratepayers; and he believed the Sub-Committee was unanimously of opinion that a serious loss would result. What right, he asked, had the ratepayers of the borough to be called upon to provide the electric light for 180 gentlemen or advertising shopkeepers, as was done at Bradford? [A Member: Bradford is not making a loss.] He questioned that. In any case, it must be remembered that Salford was not a self-contained place like Bradford or Manchester, and had not many of those hotels, places of amusement, and other establishments such as were likely to take the electric light. Mr. Malkin seconded the amendment. In replying on the discussion, Mr. Phillips, whilst admitting that a profit would not be made out of electric lighting at present, predicted that the light would eventually pay. The cost of a small installation would probably be from £10,000 to £15,000; and he thought they had better run the risk of losing a little at the commencement, than have to pay a large sum to buy out a private company at the end of 42 years. On a division the amendment was rejected, only seven voting for it; and the motion was carried by a large majority.

The Law Relating to Water Companies.—A petition has been presented to the House of Commons from Fulham, praying for an alteration in the law relating to water companies.

Reductions in Price.—The Directors of the Stourbridge Gas Company announce a further reduction in the price of gas from 2s. 10d. to 2s. 8d. per 1000 cubic feet to consumers of under 100,000 cubic feet, and from 2s. 8d. to 2s. 6d. to consumers over the above quantity.—The Haslingden Union Gas Company have reduced the price of gas from 3s. 9d. to 3s. 7d. per 1000 cubic feet for small consumers, and to 3s. 4d. for large consumers.

The Gas Supply of Mexborough and Swinton.—A movement is on foot for the purchase of the Mexborough and Swinton Gas Company's works. The Company was established 36 years ago, with a capital of £28,000; and the present price of gas is 3s. 6d. per 1000 feet. The proposal as to purchase is made by the Chairman of the Swinton Local Board, who advocates the co-operation of the Local Board in the adjoining parish of Mexborough for the joint purchase of the undertaking. The popular view is in favour of the scheme.

Gas Exhibition and Cookery Lectures at Llandudno.—A short time ago the Llandudno Improvement Commissioners reduced the price of gas used for domestic purposes to 3s. per 1000 cubic feet; and, with the view of stimulating consumption, an exhibition of gas appliances was held in the Masonic Hall in that town from Monday to Friday last. It was organized by a local tradesman; and the stoves shown were supplied by Messrs. John Wright and Co., of Birmingham. Practical lessons in cookery were given twice daily by Mrs. J. B. Thwaites, and were well attended. The exhibition was in every way successful.

The Borrowing Powers of the Wigan Corporation Gas and Water Committees.—Regarding the statement which was made recently in the Wigan County Borough Council as to the various Committees and their capital expenditure (see *ante*, p. 303), some further remarks touching upon the subject were made at the last Wednesday's meeting. On the minutes of the Gas Committee being submitted, Mr. R. Johnson said he took it that, with respect to the application for increased borrowing powers to the extent of £40,000, this was practically a solution of the difficulty he pointed out at the previous meeting of the Council. The Gas Committee had spent money for which they had no borrowing powers, and were simply putting themselves right. Mr. M'Quaid asked how much of the £40,000 had already been expended. Mr. Holmes replied that nothing had been spent out of it at present. Mr. Stuart stated that the estimated expenditure for the next three years was £32,000; and they thought it wise to apply for borrowing powers to the extent of £40,000. He considered that, when such an extraordinary result had accrued from the gas undertaking, the ratepayers ought to be proud of it, especially when there was such a constant increase in the consumption of gas that the thousands of pounds already handed over as profits were bound to be followed by even more. This reflected great credit on the management; and he thought the Council ought to show their confidence in those who had charge of the undertaking by supporting the application. The minutes were adopted. Alderman Richards, the Chairman of the Water Committee, announced that the Local Government Board had consented, so far as they were concerned, to the additional borrowing powers asked for on behalf of the water undertaking.

METROPOLIS WATER SUPPLY.

The London Water Question and the Birmingham Water Scheme.

Our readers will remember that the Committee of Members of Parliament and other gentlemen interested in the question of the water supply of the Metropolis, as it will be affected by the Birmingham water scheme, whose proceedings were recorded in the JOURNAL last week, arranged to have another meeting on the 29th ult., to hear the result of an interview held by a Sub-Committee with representatives of the Birmingham Corporation and the members for that city.

In accordance with this arrangement, a meeting was held in one of the committee-rooms of the House of Commons on Monday last week, under the presidency of Sir J. Lubbock, Bart., M.P. It was reported that the Committee appointed to confer with the Birmingham members were satisfied that the improvement of the water supply of the city was a matter of urgency, and that, after hearing the promoters' explanations, they were not prepared to recommend that the scheme should be opposed. In order, however, that London should be in no way hampered in the future, the Committee suggested that two clauses should be added to the Bill—the first giving the Metropolitan authorities the right to cross any of the aqueducts proposed to be constructed; and the second providing that any arrangements with regard to compensation should be fair to London as well as to Birmingham. Regret was expressed that it should be necessary to proceed with the Bill pending the forthcoming inquiry by a Royal Commission; but it was agreed that the measure should not be opposed if the promoters were willing to amend it as suggested. It is understood that the Engineers of the Birmingham scheme do not see any objection to the insertion of the proposed clauses.

At the meeting of the London County Council on the following day, Sir J. Lubbock informed the members of what had taken place at the conferences held since the previous meeting of the Council (which now met for the last time prior to its dissolution). He stated that they were assured that an additional supply of water for Birmingham was a necessity. Mr. Chamberlain said that to obtain it would require at least eight years; and, as prudent men, they must look well ahead. They would, however, meet the Metropolitan and other Members of Parliament on points of detail. They urged strongly that, in the opinion of their Engineer, there would be a sufficient supply of water left for London. They courteously, however, consented to postpone the second reading of the Bill till Tuesday, the 8th inst. He was informed that there was considerable opposition to the Bill in Birmingham itself. The result of the interview was communicated on the previous day to a second conference of the Metropolitan and Home Counties Members, when much regret was expressed that any further appropriation of water-bearing areas should be agreed to until the Royal Commission had reported. At the same time, though no resolution was arrived at, there was a general feeling that, if the needs of Birmingham were so very urgent (which, of course, would have to be proved to the satisfaction of the Committee on the Bill), and subject to some agreement on details, it would not be reasonable to oppose the second reading. It was hoped, however, that the Bill would not be passed by the Committee unless the urgency of the project was clearly proved. At a later stage, the Water Committee submitted a special report, with the following recommendation: "That this Council trust that Parliament will not pass the Birmingham Corporation Water Bill before the water consumers of the Metropolitan area have had an opportunity of putting their case before the Royal Commission, except on the clearest possible evidence that the urgency of the matter in the case of Birmingham is so great that it must be pushed forward immediately, without regard to the requirements of the population of the Thames basin; and the Council hope that, should the Birmingham Bill be referred to a Select Committee, an instruction will be given to the Committee in this sense." Mr. Lloyd moved, as an amendment—"That this Council will take every step to prevent the Birmingham Water Bill being passed until the Royal Commission has reported." After a brief discussion, the amendment was rejected, and the recommendation agreed to.

CITY OF ST. PETERSBURG NEW WATER-WORKS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Thursday, at the Cannon Street Hotel, E.C.—Mr. W. T. WESTERN in the chair.

The accounts for the year showed that the gross receipts for water had been 255,420 roubles; and the miscellaneous profits amounted to 6875 roubles. The working expenses came to 98,247 roubles; leaving a balance of 164,048 roubles (equal nominally to £22,168), against 152,022 roubles—being an increase at the rate of about 7½ per cent. From this balance had to be deducted for difference in exchange £4413; and for general charges of management (including income-tax in Russia and in England), £1332. Allowing for interest received, there remained a net profit of £16,449. The year's interest on the debentures and the "B" debenture stock absorbed £7774 and left a balance of £8675 to the credit of profit and loss. The Directors proposed to make a further payment of 10 per cent. on the "B" debenture stock on account of arrears of interest; and these would thereby be reduced to £7591. The report stated that no progress had been made with the appeal of the Municipality in the action as to payment for meters.

The CHAIRMAN said the course of events during the past year had been very favourable. The increase in the gross receipts for water was a little under 9000 roubles, and in the miscellaneous receipts 3600 roubles. On the other side, the expenses were only 500 roubles more than they were last year—a circumstance which reflected credit on their Manager in Russia. The rate of increase had not been so great as in some previous years; but this was natural, for they were now supplying all the better class of houses in their district, and were more and more dependent upon the smaller property for an increase. The rate of exchange, which was a matter of great concern to the Company, had

unfortunately been unfavourable, and but for the circumstance that, in the first half of the year, they brought over all the funds they could, the result would have been more against them than it had been. The net outcome was that the Company had earned about £200 more than in 1890. The shareholders would be pleased to know that, with the exception of the debenture debt (which was now in the position of being amply secured), the Company had practically no liabilities. The subject which probably was most in their minds was whether or not the Municipality were going to buy the Company's undertaking. During the year the Directors received an intimation from the Municipality that they were about to take up the matter; and they appointed a Commission to investigate it. Several meetings had been held by them, to which the Company's representative was invited; and he had, under the instructions of the Board, given all the information that was required as to the accounts and working of the concern, so as to put them in a position of being able to judge as to the advisability or otherwise of acquiring the property. The Municipality had also appointed another Commission of experts, who had inspected the whole of the machinery and plant; but up to the present, no definite communication had been made to the Directors. The date at which the Municipality had the right to take over the undertaking was May 31. He concluded by moving the adoption of the report and accounts.

Mr. R. S. GUINNESS seconded the motion.

The CHAIRMAN, in reply to questions, said the town had the option of purchasing the undertaking in one of two ways. First, they might pay the Company by an annuity—that was, they might take the present balance-sheet and say, "Your last year's profits amounted to 160,000 roubles; and we will pay you that amount for 25 years." The second option they had was that they could pay a lump sum down, which would be equal to fourteen times the annual income. In the event of the town not agreeing to purchase, the Company would remain in its present position.

The motion was carried.

The retiring Directors (Lord E. S. Churchill and Mr. R. S. Guinness) and the Auditors were re-elected; and the proceedings then terminated.

Sales of Shares.—Among some miscellaneous shares sold by auction, by Messrs. Suddards and Stansfield, at Bradford, a few days ago were fifteen original shares in the *Clayton, Allerton, and Thornton Gas Company*, which were disposed of at £18 10s.; and ten fully-paid £10 shares in the *Kildwick Parish Gas Company* which realized £12 5s.

Gas Plant for Australia.—The Whessoe Foundry Company, Limited, of Darlington and London, have just received a further large order for gas plant—comprising purifiers, valves, and connections, a telescopic gasholder, and wrought-iron tank—from Australia. This fact shows that the gas industry continues to develop in the colony.

Extension of the St. Helens Gas-Works.—The question of the extension of the St. Helens Corporation Gas-Works has for some time been considered by the Gas Committee, and negotiations have been in progress for the purchase of the property adjoining the works. The Manager (Mr. Samuel Glover) reported at the last meeting of the Committee that an extension of the retort-house would be shortly required; and the matter was referred to a Sub-Committee, who are already taking into consideration the illuminating power of the gas.

New Offices for the Wrexham Water Company.—The old offices of the Wrexham Water Company having been found altogether inadequate to meet the requirements of the business, new premises have been erected from the designs of Mr. A. C. Baugh. The building was commenced in February of last year, and finished in December; the Company taking possession on the 24th of that month. The completed premises may be justly described as model offices; being admirable in design, substantially built, and replete with every improvement devised by modern science for the economy of time and space, the practical application of the most approved sanitary principles, and the expedition of business in every department connected with the Company's undertakings. The contract was entrusted to Mr. W. E. Samuel; the amount being £2100.

The Progress of the Keswick Electric Light Company.—From the annual report of the Directors of the Keswick Electric Light Company, it appears that during the past year they have experienced great difficulties in having to run the station with plant only partially supplied with water power, in consequence of which considerable expenditure has been incurred in providing steam power to supply the deficiency. It is stated that the business of the Company continues to increase; and in order to meet the requirements, it has been found necessary to make considerable extensions in the main-wiring, the advantages of which to the Company are not yet fully felt. The accounts show a balance upon the year's working of £87, which, being added to the balance from the previous year, makes a sum of £122. The Directors propose the payment of a dividend of 3 per cent., which will leave £44 in hand. The receipts from consumers amounted to £542.

The Recent Proceedings against the Chelsea Water Company.—The Secretary of the Chelsea Water Company (Mr. G. H. Gill) has sent to the papers, by the desire of his Directors, an explanation in connection with the proceedings lately taken against the Company by Mr. Elgar, for cutting off the supply of water to his premises, as reported in the JOURNAL last week. He admits that the Company's collector, in demanding from Mr. Elgar a water-rate for a longer period than that for which his occupancy of the house rendered him liable, not only exceeded his duty, but acted in direct contravention of his instructions. These facts would, Mr. Gill says, have been explained to the Magistrate at the adjourned hearing on the 27th ult.; but he, unfortunately, declined to hear any statement from the Counsel representing the Company. He adds that the Directors are, as may well be supposed, very sincerely annoyed at the treatment Mr. Elgar has received at the hands of their collector, and they will endeavour to at once make such further rules and regulations as will render the repetition of such an occurrence impossible. Mr. Archibald Dobbs has offered a few comments on Mr. Gill's letter; stating that the chief office repeated, in a letter signed by the Assistant-Secretary, the exact claim made by the collector, who, he says, seems to have done his duty faithfully to the Company, and he accuses the authorities of want of chivalry, to say the least, in trying to throw the blame upon their servant.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

Monday was a busy day with the Edinburgh and Leith Gas Commission—the business being such that the daily press, which frequently turn off the doings of the Commissioners at their monthly meetings in a paragraph, devoted as much as a column to it. The business was of just such a sort as good readable matter could be made for the general public; though to the practical man much of it will probably appear as "small beer." There was little of a technical nature about it; and it could not escape observation that, when that element was removed, the Commissioners were much more at home, and talked more sensibly than they often do. From this, I reason that a Gas Commissioner ought to hold office for a considerable time. Three years is not long enough to acquire a knowledge of the business which would enable them to speak with authority. One has but to look back upon some of the early remarks of new-comers to see how true this is. Those Gas Commissioners who are content to sit at the feet of the officials for a year or two, make the best in the end; those who begin airing their crude notions as soon as they take their seat on the Commission usually talk much nonsense, and probably do harm by their indiscretion before they settle down in the team. A Gas Commission is therefore a place where "new blood" should be introduced sparingly. This opinion, I know, flies directly in the face of that which is generally entertained by the community. There is an almost universal distrust, most unaccountable but still most true, of all connected with gas supply; and the common notion, assiduously fostered by persons who aspire to office, is to turn out the wicked old incapables, and to replace them by reformers. I think I have before advocated a school of instruction for Gas Commissioners. Such a proposal, of course, could only be made in satire; but it is within reason to suggest two things by which the business of at least the Edinburgh and Leith Gas Commission might be facilitated. The first would be that new-comers should, in all technical matters, accept implicitly, and support, within the Commission and outside of it, the opinions of the responsible officials who are in charge of their business. The next is that those who are more experienced—the Conveners of Committees—should each introduce their own work [to the Commission, giving a short explanatory statement of it. This would often suffice, and would save irrelevant and sometimes bombastic discussion. The reflex influence on the public mind would be considerable, as the belief would gain ground that the Commissioners were a work-a-day body of men in whom confidence might be placed. It is to be noted with satisfaction, in connection with Monday's meeting, that Mr. Kinloch Anderson, the Convener of the Works Committee, spoke moderately and sensibly upon the subject of the coal supply for next year, and that the other Commissioners had the good judgment to keep silence and not to indulge in heroic remarks upon a delicate and intricate subject. The stair-lighting question, though some of your readers may look upon it as scarcely worthy of so much attention, was the principal matter before them. Probably two-thirds of the community in Edinburgh live in tenements which are reached by common stairs; and it will thus be seen that it must, of necessity, be a subject of great importance. That it is of importance to the Gas Commissioners, was shown by the remark of Provost Aitken that if all the stair-lights were kept burning till morning, having only been paid for till midnight, the annual loss to the Commissioners would be £5000. The remedies proposed were that the lights should be charged for for the whole night; and that the lighting should be left, as at present, to the residents, but that the extinguishing should be undertaken by the Corporation. The latter proposal is open to several objections; and the only satisfactory solution of the difficulty, unless the present method is to be enforced, is to burn them all night. The question of the irregularities in the working of the Surveyors' Department was brought up by Mr. Kinloch Anderson. The decision of the Commissioners was such as no one can take exception to; but the reading given to it by the Lord Provost, is not so free from objection. Though the Lord Provost be the head of the Gas Commission, his position is more one of courtesy than of power. The work of the Commission is really done by its officials. The Commissioners are little more than a consultative committee. They could be done without; the officials could not. The real head of the Commission is the Treasurer; and Mr. Gibb, who holds the office, was justified in raising the question as to how his powers were to be affected by the Lord Provost's dictum that in future the heads of departments were to be independent. The Lord Provost surely spoke without reflection when he reduced the Treasurer's power to that of giving advice to the heads of departments, and reporting to the Commissioners. This means that henceforth the staffs are not to look to the permanent and stable element in the constitution of the Commission, but to Commissioners, who are the unstable and inconstant element. The departments, set up in independence, are certain to clash; and in the absence of someone at the head of the house, the Commissioners will be pestered by applications to settle differences, and the work of "a house divided against itself" will not be satisfactorily performed. The Lord Provost seems to be afraid of heads of departments shirking their duties. How is the granting of autonomy to them to prevent that? It is now no person's duty to keep an oversight of the staff; and to report whatever may be going wrong in another department equally independent with your own, will savour of tale-bearing. The head of a department is not likely to report himself when he feels disposed to shirk his duties; and there is no one else who has any call to do it, except the staff he has under him. This is such a complete reversal of all authority, that I cannot think that the Lord Provost meant what he said; and therefore a return to ways of reason ought to be one of the Commissioners' first steps. Among other items before the Commissioners, it was satisfactory to observe an increased output of gas in January of nearly 11 million cubic feet over that of January of last year. It was also a pleasure to see the courteous manner in which the portrait of the late Mr. J. K. Watson was received, and ordered to be hung up in the room in which, in the old days, his weighty words of counsel were so often heard. The portrait is an excellent likeness of the late Mr. Watson.

An action has lately been decided by Sheriff Balfour in the Glasgow Small Debt Court which has a considerable amount of interest for

landlords and house factors, as also for gas corporations and gas companies whose operations include a stove-hiring department. It was raised at the instance of the Glasgow Corporation Gas Trust against Mr. H. D. Sharp, house factor, of Paisley Road, Glasgow, and the amount sued for was the value of a gas-stove and fittings, which had been hired by the pursuers to the tenant of a house for which the defender was the factor. The tenant of the house being in arrears with her rent, the factor sequestrated and sold certain of the effects which were in the house, including the gas-stove and fittings hired from the Corporation. The defender contended that the gas-stove and fittings, although hired articles, were in law presumably the property of the tenant, and therefore fell under the landlord's hypothec. Mr. John Bowers, from the Town Clerk's department, who appeared for the Corporation, submitted that whatever the common law was with reference to hired articles falling under the landlord's right of hypothec, the principle contended for by the defender did not apply to the case in question. By their own Gas Acts, and the General Gas Acts incorporated therewith, the Corporation Gas Commissioners have power to let for hire any meter for ascertaining the quantity of gas consumed, and "any fittings for the gas" supplied by them; and in the case of *The Gaslight and Coke Company v. Hardy*, decided by the Court in England in 1886, it was held that the words "any fittings for the gas," included gas-stoves. By section 14 of the General Gas-Works Clauses Act, 1847, which had been incorporated with the Gas Acts of the Glasgow Corporation, it was also provided "that such meters and fittings shall not be subject to distress or landlord's hypothec for rent of the premises where the same may be used, nor to be taken in execution under any process of a court of law or equity, or any fiat or sequestration in bankruptcy against the person in whose possession the same may be." Under the circumstances submitted by Mr. Bowers, Sheriff Balfour held that he must find for the Corporation; and he gave decree in their favour for £1 16s. 6d., with expenses.

The Gas Committee of the Hamilton Town Council reported to the monthly meeting of that body, which was held on Thursday, that they had had under consideration the question of the proposed extension of the gas-works, including suggestions made in reports by the Manager (Mr. Johnston) and by Mr. A. Gillespie, gas engineer, of Glasgow. It may be remembered that I alluded to Mr. Gillespie's suggestions a couple of weeks since. The Committee do not seem to be prepared to adopt the proposals contained in Mr. Gillespie's report, as they resolved to recommend that "in the meantime," with the view of meeting the temporary wants, ten new retorts if possible be erected on the space occupied by the smithy hearth; that the space behind the present retort-houses be roofed in and utilized as a coal-store; and that the old gasholder-tank be cleaned out and used as a stock tank. They further decided to make another inspection of the works, and to consult with the engineer as to other proposed extensions. Mr. Brown, in the absence of Provost Archibald, moved the adoption of the Gas Committee's report, and said that the Council might rest assured that they would obtain the very fullest information as to the extension scheme before they adopted it. Mr. Tainsh, a former Convener of the Gas Committee, said that the extension of the works was needed, and should be gone on with. Mr. Sanders urged that the proposed expenditure would cover the introduction of the electric light; and Bailie Wylie remarked that the Committee were only advising at present the erection of ten retorts, which were absolutely necessary. Eventually the report of the Committee was adopted.

The subject of stair-lighting is being dealt with in a Bill which the Police Commissioners of Dundee are promoting in Parliament this session. As deposited, the Bill contained what is known as the Glasgow clause, which provides that the lighting and extinguishing of the lights shall be performed by the Corporation, the cost being laid upon the owners of property, who are entitled to recover from the occupiers 15s. in respect of each light. The Committee in charge of the Bill, on Thursday night reconsidered this provision, and resolved to substitute the Edinburgh clause for the Glasgow one, with modifications. The Edinburgh clause was given in these "Notes" last week. The modifications upon it are that the £10 rent limit is removed, and the proprietor may recover the cost of lighting from occupiers of whatever rent; and a limit charge of 20s. each for stair-lights and of 25s. each for lights in courts and passages is imposed. It is curious to see the Dundee Police Commissioners adopting a provision which has been the occasion of so much friction and inconvenience in Edinburgh.

The failure of Messrs. John Dobbie, Sons, and Co., of Leith, which I mentioned last week, was the subject of consideration by the Finance Committee of the Arbroath Gas Corporation on Monday night. The Convener read a circular from the trustee appointed by Mr. Dobbie under a trust-deed, intimating stoppage of payment. The contract with the Gas Corporation for their residuals, is guaranteed; and the Committee resolved to hold the cautioner liable, and to retain the residuals until an arrangement is made with him. It was also resolved to ask the cautioner to pay immediately a sum of £341 due.

In connection with the petitions to the Court of Session relating to the affairs of the Glasgow Alum and Ammonia Company, it was to-day reported to the First Division that a settlement of the differences between the petitioning parties had been arrived at. The Barrhead Gaslight Company withdraw their petition, and consent to that of the Alum and Ammonia Company being granted.

The death has just been announced of Mr. William Motherwell, of Airdrie, who was one of the oldest inhabitants of the district, as he was also one of the most respected citizens of the burgh. He was long an active Director of the Airdrie Gas Company; and for upwards of twenty years he was likewise a Director of the Airdrie and Coatbridge Water Company. His extensive knowledge of business matters rendered him specially qualified to take a share in the management of those and various other commercial and industrial undertakings of the town of Airdrie and neighbourhood. His death severs one of the few remaining links that connected the first decade of the century with the last. He was born in 1809.

I omitted to mention in last week's "Notes" that the actual revenue derived by Glasgow Gas Trust from the sale of residual products during the financial year (beginning on June 1) up till Feb. 10 was £72,161 3s. 1d., as compared with £65,843 3s. 7d. during the corresponding period of 1891; thus showing an increase of £6317 19s. 6d.

At the last meeting of the Glasgow Police Commissioners, it was reported by ex-Bailie Gray, Convener of the Watching and Lighting Committee, that the stair-lighters in the town's employment had applied for an increase of wages amounting to 2s. per week. He said that the Committee had gone carefully into the question, and had come to the conclusion that the stair-lighters had no grievance.

The electric lighting enterprise hitherto carried on in Glasgow from two central stations—one low pressure and the other high pressure—by Messrs. Muir, Mavor, and Coulson has this week passed into the hands of the Corporation, to be conducted henceforth by the Gas and Electric Lighting Committee. The first new contract for electric light actually taken in hand by the Committee is for a billiard saloon, involving somewhere about 200 16-candle lamps, for which, in the meantime, high-tension current alone is available. It is stipulated in this case that the customer must pay all the expenses for running the requisite (overhead) wires and the fitting arrangements, as also a charge of 8d. per Board of Trade unit. In the course of some months, a new low-pressure station will be built and equipped from plans by Professor Kennedy, for supplying current for the west-central and more westerly portions of the city.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—During the past week, business all through the coal trade of the Lancashire district has been altogether disorganized by the unreasoning pressure on the part of consumers to get in extra supplies, in anticipation of the approaching stoppage of the pits; the demand in most cases far exceeding anything likely to be the actual requirements during the probable cessation of work. The result is that the rush of orders sent in to collieries has filled up their books for fully a month ahead; and although a number of the leading firms have not made any formal advance upon their list rates, there has been a decided—and in many cases considerable—upward movement in prices generally. As regards round coal, the advances in the open market have averaged 1s. 6d. to 2s. per ton; but in some instances quotations have gone considerably beyond these. At the pit mouth, best Wigan Arley ranges from 13s. up to 15s. per ton; Pemberton four-feet, and second qualities of Arley, 11s. to 12s.; common round coals, for house-fire and also for steam, forge, and general manufacturing purposes, averaging about 10s. per ton. Some of the iron-works and other establishments are closing, rather than pay any material advance in the price of fuel; but as regards gas-works, where a stoppage of operations is out of the question, extra supplies have been sought, subject to prices current for the time being. Engine classes of fuel seem to have been most seriously affected by the present crisis in the coal trade; and absurdly fancy prices are in many instances being quoted where customers are pressing for extra supplies. But buyers generally are readily paying an advance of 2s. per ton upon recent quotations; while in some instances sellers are asking fully 4s. per ton upon the prices they would willingly have taken only a week or two back. Burgu may be quoted as averaging about 8s. to 9s. per ton; best slack, 6s. 6d. to 7s. 6d. and 8s.; with common sorts not obtainable under about 4s. to 5s., and this only in very exceptional cases. On the other hand, as much as 10s. per ton has been quoted for slack at the pit's mouth.

Northern Coal Trade.—The coal trade has for the past week been extremely excited; and prices for several kinds have moved up in an erratic fashion. Although it was well known that the Northumbrian miners would continue to work even in the event of a "stop week," the action of the men of Durham was doubtful, and, in consequence, prices rose for many kinds though not for all. Best Northumbrian steam coals have advanced very slightly—to 10s. per ton, free on board; and at this price the demand has increased, though an abundant supply has been maintained. Second-class coals have been at about 1s. per ton less. Small steam coals have risen, because many manufacturers have bought them in place of Durham coals; and the price is about 5s. per ton, free on board. In household coals there has been no alteration; the supply being largely from collieries that are not yet affected by the strike. Gas coals have been most influenced by the sharp demand; and vast quantities have been shipped to London. In addition to the ordinary steamers, others have been chartered; and the demand has been so great that the rate of freight has in a fortnight risen from 3s. 4d. per ton, Tyne to London, to 4s. 6d. per ton. It is difficult to say the price of gas coals; but it is certain that from about 8s. 3d. they rose to 9s. 6d. per ton, which latter figure was paid, while higher prices have been asked. Contracts, however, are being arranged on a lower basis; and one for Rotterdam is believed to have been concluded at what is considerably below the figure that ruled last year. With the collapse of the movement, it is tolerably certain that the consumers of coals—gas, household, and manufacturing alike—have stocked so largely that there will be a great fall in the prices of fuel. Bunker coal is steady, and manufacturing coal has shot up very considerably. Coke is rather quiet; some furnaces having been put out that took coke from this district. The price of best blast-furnace coke is about 15s. 6d. per ton free on board. Gas coke has been offered and sold more freely, and there has of late been more disposition to look at the merits of this fuel for household purposes; but the price is still very low.

West of Scotland.—There is a firmer tone in the coal trade in this district, caused by the threatened mining difficulties in England. As yet there is no indication that the Lanarkshire colliers intend to co-operate in the holiday policy. Within the past few days a rather better demand has been experienced for Lanarkshire coal; and a number of shipping contracts have been placed. Prices are firm at the old quotations; and in some instances, it is understood, sellers have been able to command a slight advance. Prices may be quoted: Main, 7s. 9d. to 8s.; ell, 8s. 3d. to 8s. 6d.; splint, 8s. 6d. to 8s. 9d.; steam, 10s. 3d. to 10s. 6d. The shipments of coal from Scotch ports last week show a gain over the previous week of about 17,000 tons, and an increase as compared with the corresponding six days of last year of fully 6000 tons.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, March 5.

Sulphate of Ammonia.—The market remains *in statu quo*; and there is no movement either up or down. There is a fair inquiry, principally from dealers, which seems to prevent a further decline, and which the peculiar inertness of the Continental demand might otherwise have brought about. The return of severe weather checks the home demand; but when the position is thoroughly sifted, there is really no large quantity available, and the production is, of course, now on the decrease. There are at present no buyers above £10 5s., f.o.b. Hull, Goole, or Leith; but Liverpool sulphate can be secured at a little below this figure. Nitrate is dull, at 9s. 4½d.

LONDON, March 5.

Tar Products.—The depression in these has been somewhat accentuated during the week; benzols having again gone easier, and buyers being scarce. Pitch for forward delivery is also lower; as the users of it hold off, anticipating much lower prices. There has not been much doing in anthracene; nor is there any great variation in its value. Creosote and common oils are also flat, with but few buyers. A considerable quantity is now being used as fuel—especially in districts where only high-price coal is available. The value of tar is receding, in sympathy with products; and a large contract was settled last week at 15s. The average prices for the week are as follows: Tar, 15s. Pitch, 31s. Benzol, 90's, 2s. 4½d.; 50's, 1s. 9d. Toluol, 1s. 4d. Solvent naphtha, 1s. 3d. Crude benzol naphtha, 30 per cent., 11d. Creosote, 1d. Naphthalene salts, 25s.; pressed, 45s. Carbolic acid, crude 60's, 1s. 0½d.; 70's, 1s. 4d.; crystals, 5d. Cresol, 8½d. Anthracene (30 per cent.), "A" quality (nominal), 1s.; "B" quality, 8d.

Sulphate of Ammonia.—For forward delivery, prices are somewhat advanced; but for prompt, £10 to £10 2s. 6d., less the usual discount, is still the ruling value. Gas liquor (10 oz.) is quoted at 6s. to 7s. 6d.

Extension of the Horley Gas-Works.—Owing to the very large increase in the Horley Gas Company's sales of gas, the Directors have decided to make considerable extensions to their gasholder plant, coal-stores, mains, &c.; and Messrs. J. and H. Robus, of Bucklersbury, E.C., have secured the contract. It may be remembered that this firm erected the works originally from the plans of Mr. Jabez Church, M. Inst. C. E., the Company's Consulting Engineer, who has also designed the extensions now in progress.

The Gas-Works Purchase Question at Sutton Coldfield.—The result of the poll on the proposed purchase by the Sutton Coldfield Corporation of the local gas-works and the portion of the mains belonging to the Birmingham Corporation within the borough boundaries is as follows: In favour, 875; against, 1118—majority against 243. On the figures being announced by the Mayor at the public meeting of ratepayers last Saturday week, it is reported that they were received "with loud expressions of indignation."

Gas Exhibition at Parkgate.—An exhibition of gas cooking and heating appliances has lately been held, under the auspices of the Parkgate Local Board, at the Miners' Institute in that town. It was opened by Mr. J. Smith, Chairman of the Gas Committee, who remarked that the Board were desirous of increasing the sale of gas, and also of keeping the neighbourhood informed as to the latest novelties and appliances in gas cooking; and they had promoted the exhibition with a view of improving their finances. Mrs. J. B. Thwaites gave a series of interesting cookery lectures, which attracted crowded audiences. The exhibition was well attended.

Electrical Fittings, but no Light.—On Monday last week Mr. Commissioner Kerr disposed of the case of *The Brush Electrical Engineering Company, Limited, v. Satchwell*, in the City of London Court. The plaintiff Company, of 49, Queen Victoria Street, E.C., sought to recover £23 for supplying electrical fittings in April, 1891, to the defendants, Messrs. Satchwell and Co., auctioneers, of Bucklersbury, E.C. Mr. Poley, for the defendants, said they entered into a contract with the plaintiff Company to supply them with the electric light. To do this, of course, fittings, &c., had to be put up. This had been done; but it now appeared the plaintiffs could not put on the current, and consequently the defendants could get no light. Mr. Poole, for the plaintiffs, said his Company had no power to put on the light where the particular premises happened to be. Mr. Commissioner Kerr said he never heard of anything so monstrous. The contract was obtained by misrepresentation, which in law amounted to fraud; and now the plaintiffs wanted to make the defendants pay for fittings although they could not use them. Mr. Poole said he hoped the Court would not brand the plaintiffs with misrepresentation. Mr. Commissioner Kerr replied that he did, most unhesitatingly. Judgment was given for the defendants, with costs.

Welsh Interests and the Birmingham Water Scheme.—The Press Association states that Welsh interests are now rising against the Birmingham Water Bill just when the threatened opposition of the Metropolitan and Home Counties Members is being practically withdrawn, as intimated in another part of the JOURNAL. Before the second reading of the Bill, a course of action will be resolved upon by the Welsh Members, as well as by the Commons Preservation Society. It is stated that the Birmingham Corporation, in going into the head waters of the River Wye for their supply, propose to acquire 32,000 acres of common land, comprising about 390 small farms, having rights of common over the land in question. In view of this fact, the Right Hon. J. G. Shaw-Lefevre intends to move, at the second reading stage, that the Bill be referred to a Hybrid Committee, with instructions to report as to whether it is necessary to expropriate the common rights, and also whether it would not be possible to arrange for the public having continued access to the land. These points have been under the consideration of the Welsh Members, who also intend to protest against English towns taking possession of Welsh sources of water supply, which may sooner or later be required for the Principality, in view of the exceptionally rapid growth of the population in Glamorgan-shire, and the fact that the Rhondda Valley has more than once been within reasonable distance of a water famine.

The Quality of the Abergavenny Water Supply.—With the view of setting at rest any uneasiness that may exist as to the quality of the water supplied to Abergavenny, two samples have been submitted to Dr. Dupré, whose analyses thereof have been published. In both cases the water is pronounced to be in every respect high-class, and admirably adapted for drinking and domestic use generally.

The Birmingham Compressed Air Power Company.—This Company was incorporated by Act of Parliament (47 & 48 Vict., cap. 199) for the purpose of supplying compressed air in Birmingham; for distributing motive power; and the supply of air for ventilating, refrigerating, or blowing furnaces. Under a winding-up order made on Dec. 19 last, a statement of affairs has now been submitted by the Secretary and the Chairman, showing liabilities £4524, of which £1711 are unsecured, with an estimated surplus in assets of £4264; and, as regards contributories, a total deficiency of £119,155. From the observations of the Official Receiver (Mr. C. J. Stewart), it appears that the nominal capital of the Company is £300,000, divided into 30,000 shares of £10 each. On April 15, 1886, the Company entered into a contract for £129,714, with the City of London Contract Corporation, for the following purposes: (a) The construction of necessary works for an installation of 6000-horse power; (b) the purchase of land; (c) the issue of prospectuses, &c. In consequence of the insufficiency of the share subscription, the Company were unable to carry out their contract; and arrangements were accordingly made with the City Corporation whereby the proposed outlay on the works was reduced. On July 29, 1890, the contract was discharged by a deed of arrangement; sums of money, amounting in all to £106,538, having been paid to the Corporation. The Company commenced the delivery of air power in July, 1889. The failure of the undertaking is attributed to the fact that the mains for the supply of air power were laid to large consumers, who were not willing to pay a sufficiently remunerative price, instead of to smaller consumers, from whom, in proportion, more profits would have been obtained; also to the want of proper meterage and measurement, and to leakage and difficulties of supply which had not been foreseen.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 434.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon invest-ment.
£			p. c.					£ s. d.
GAS COMPANIES.								
590,000	10	15 Oct.	10½	Alliance & Dublin 10 p. c.	10	16-17	..	6 3 6
100,000	10	"	7½	Do. 7 p. c.	10	11½-12½	..	6 0 0
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105-107	..	4 13 5
100,000	20	27 Nov.	8	Bahia, Limited	20	12-14	..	11 8 6
200,000	5	12 Nov.	7½	Bombay, Limited	5	6½-6¾	..	5 11 1
40,000	5	"	7½	Do. New	4	4½-5½	..	5 14 1
380,000	Stock	26 Feb.	12½	Brentford Consolidated	100	105-115*	..	5 14 1
150,000	"	"	9½	Do. New	100	153-158*	..	5 17 1
220,000	20	16 Sept.	11½	Brighton & Hove Original	20	40-42	..	5 9 6
888,500	Stock	16 Sept.	5	Bristol	100	98-103	..	4 17 1
320,000	20	15 Oct.	11½	British	20	43-45	..	5 0 0
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	10	19-20*	..	5 15 0
51,510	10	"	8½	Do. 7 p. c.	10	14-15*	..	5 13 4
328,750	10	"	—	Buenos Ayres (New) Limited	10	5-6	..	—
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	93-96	..	6 5 0
150,000	20	26 Feb.	8	Cagliari, Limited	20	24-26*	..	6 3 1
550,000	Stock	15 Oct.	13a	Commercial, Old Stock	100	244-249	+1½	5 4 5
165,000	"	"	10a	Do. New do.	100	190-195	..	5 2 7
130,000	"	30 Dec.	4½	Do. 4½ p. c. Deb. do.	100	118-123	..	3 13 2
800,000	Stock	30 Dec.	13	Continental Union, Limited	100	222-227	-3	5 14 6
200,000	"	"	10	Do. 7 p. c. Pref.	100	185-195	..	5 2 7
75,000	Stock	16 Sept.	10	Crystal Palace District	100	190-200	..	5 0 0
486,090	10	29 Jan.	10	European, Limited	10	19-20	..	5 0 0
354,060	10	"	10	Do. Partly paid	7½	14-15	..	5 0 0
5,470,820	Stock	12 Feb.	12	Gaslight & Coke, A, Ordinary	100	210-215	-3½	5 11 8
100,000	"	"	4	Do. B, 4 p. c. max.	100	94-97	..	4 2 5
665,000	"	"	10	Do. C, D, & E, 10 p. c. Pf.	100	245-250	..	4 0 0
30,000	"	"	5	Do. F, 5 p. c. Pf.	100	116-121	..	4 2 9
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	169-174	..	4 6 2
1,300,000	"	"	7	Do. H, 7 p. c. max.	100	150-154	+1½	4 10 11
463,000	"	"	10	Do. J, 10 p. c. Pf.	100	241-246	..	4 1 3
476,000	"	"	—	Do. K, 6 p. c. Pf.	100	145-150	..	4 0 0
1,061,150	"	11 Dec.	4	Do. 4 p. c. Deb. Stk.	100	113-116	..	3 9 0
294,850	"	"	4½	Do. 4½ p. c. do.	100	118-123	..	3 13 2
908,000	"	"	6	Do. 6 p. c. do	100	163-168	..	3 11 5
3,800,000	Stock	12 Nov.	12	Imperial Continental	100	221-225	-1	5 6 8
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4-4½	..	6 13 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p. c. Deb.	100	108-110	..	4 10 11
541,920	20	27 Nov.	6½	Monte Video, Limited	20	15-16	..	8 2 6
150,000	5	27 Nov.	10	Oriental, Limited	5	8½-9	..	5 11 1
60,000	5	30 Sept.	7	Ottoman, Limited	5	4-5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited	10	2½-3½	..	—
420,000	100	3 Nov.	6	People's Gas of Chicago—	100	100-105	..	5 14 3
500,000	100	1 Dec.	6	1st Mtg. Bds.	100	100-105	..	5 14 3
150,000	10	15 Oct.	10	2nd Do.	100	9-10	..	10 0 0
500,000	Stock	26 Feb.	15½	San Paulo, Limited	100	266-271*	..	5 14 5
1,350,000	"	"	12	South Metropolitan, A Stock	100	220-225*	-1	5 6 8
200,000	"	"	13	Do. B do.	100	232-237*	..	5 9 8
725,000	"	30 Dec.	5	Do. C do.	100	138-143	..	3 10 0
600,000	Stock	16 Sept.	11½	Do. 5 p. c. Deb. Stk.	100	—	..	—
Tottenham & Edm'nton, Orig.								
WATER COMPANIES.								
729,331	Stock	30 Dec.	10	Chelsea, Ordinary	100	250-255	-6	3 18 5
1,720,560	Stock	15 Oct.	8	East London, Ordinary	100	203-208	-1	3 16 11
544,440	"	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	136-140	..	3 4 3
700,000	50	11 Dec.	8	Grand Junction	50	98-102	..	3 18 5
708,000	Stock	12 Feb.	10½	Kent	100	260-265	-3	3 19 3
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max.	100	222-227	-3	4 3 8
406,200	100	"	7½	Do. 7½ p. c. max.	100	189-194	..	3 17 4
260,000	Stock	30 Sept.	4	Do. 4 p. c. Deb. Stk.	100	120-123	..	3 5 0
500,000	100	12 Feb.	12½	New River, New Shares	100	330-335	..	3 12 4
1,000,000	Stock	29 Jan.	4	Do. 4 p. c. Deb. Stk.	100	124-127	+1	3 3 0
902,300	Stock	30 Dec.	6½	S'thwk & V'xhall, 10 p. c. max.	100	144-149	-1½	4 7 3
126,500	100	"	6½	Do. D 7½ p. c. do.	100	140-145	..	4 9 8
1,155,666	Stock	11 Dec.	10	West Middlesex	100	244-249	..	4 0 4

a Next dividends will be at this rate.

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TO CORRESPONDENTS.

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MARCH 15, 1892.

The Miners' Fault.

At the moment of writing these lines, there is every prospect of the extraordinary experimental strike of the coal miners of the Durham fields, and of the men of other districts who own immediate allegiance to the Federation, being entered upon to the fullest extent talked about for weeks past. The acquiescence of the Durham men, who have a local organization of their own, in the policy initiated by the southern men, was only declared last week. This addition to the ranks of the systematic idlers has greatly increased the gravity of the situation; but it leaves the fundamental questions of right and wrong, wisdom and folly, which must occur to all observers of this remarkable labour movement, precisely where they

were. The position created by the adoption of the "stop fortnight" is indeed worthy of the most attentive and dispassionate consideration by all classes of the public. The issue would have been clearer if every pit in the land had been stopped at the same moment; but matters are complicated by the fact of the Scotch miners and the men in some other districts having declined to "play" for the stipulated week or fortnight. In consequence of this lack of agreement, it is to be feared that when the futility of the counsels of the Federation leaders becomes manifest, as it will surely be in due time, these "blind leaders of the blind" will be able to shield themselves by the plea that their policy failed, not because it was essentially bad, but because it was not applied with sufficient thoroughness all over the country.

So far as the supply of gas coal is concerned, there is no cause for great anxiety. The miners might "play" for a very much longer period than their means permit, without putting the gas undertakings to any generally serious inconvenience, although we are not prepared to deny that, here and there, a good deal of trouble has been brought upon individual managers by the readiness of coal contractors to plead the "strike argument" as a means of squeezing more money out of purchasers. But this trouble, of course, is all in anticipation of the actual strike; and no critical history of this portentous incident of contemporary industrial developments will be complete that does not duly discriminate, and put in their proper sequence of date and importance, its antecedent, accompanying, and consequential results. Who was to foresee that the mere "wind" of the Federation proposals was to force up the price of best house coal in London to 35s. per ton? Not the men's leaders, certainly; for they have repudiated all responsibility for wilfully bringing about such a state of things. Neither did they mean to stop mills, factories, iron-works, steamships, trains, or do any other of the infinitely ramified pieces of mischief which it is now certain will attend their rash action. According to the declaration of the Federation leaders, they had no notion that a single poor child would have to go supperless and shivering to bed in consequence of their conduct. They appear to have reasoned in this way: "The value of coal is falling, and the masters say that wages must go down. This is partly due to the accumulation of stocks; and therefore if we left the coal in the ground the stocks would be cleared off, and we could arrange for the future to bring up just enough to sell at prices that will suit the owners and ourselves, and no more." This is a perfectly intelligible line of argument; and it is one, it may be remarked, which is not a new invention of Trade Union officials. On the contrary, it is as old as the first beginnings of commerce, and arose from the desire of primitive producers or owners of useful commodities to keep a good market for their articles of trade. We may be sure that the savage hunter of the pre-historic times when the mammoth roamed where the Beckton Gas-Works now stand, had wit enough to stay at home, and let the pelts remain on the animals' backs, when he discovered that the market was temporarily glutted. So he "played" in his cave, or rush-shelter, just as the pitman is "playing" now in his more comfortable tap-room. The only novelty in the proceedings of the modern man is that he has less of the game in his own hands.

For it must be understood that there is nothing essentially immoral in the endeavour to cure a glut by restraining production. It is, indeed, a commonplace of all producers' policy. When an agriculturist discovers that a particular crop is unremunerative, he can grow less of it, at his peril. Similarly, we are far from holding that if the circumstances of the coal industry a month ago had been as simple, and as capable of such ready remedy, as we have put them in the preceding paragraph, it would not have been perfectly legitimate for the remedy to have been applied. And this might have been attempted at the instance of either masters or men, or of both together. It is plainly a matter of indifference to the purchaser whether one or the other party among the producers determines to stop adding to the stocks in the market until accumulations shall have been cleared off. In trade, where every man fights for himself, it would be quite as open to a buyer to take advantage of the existence of heavy stocks to lower his offers, as to a producer to keep stocks short, or out of sight, in order to prevent this effect.

All this is mere commonplace. There are many commodities in the world which are maintained in value by the simple expedient of not swamping the market with them; and we can all think of others—such as matches, for example—which have apparently been forced down to hopeless cheapness simply through the pressure of over-competition in production. The point is, however, with regard to all such cases, how the regulation of production is to be managed in order to produce exactly the effect desired—no more and no other.

It has been stated that this regulation might conceivably be set in operation by the owner or the workmen, who form the two modern divisions of the order of producers. Since their interest in keeping up the value of their produce is the same, while the general direction and control of its disposal is in the hands of the former division—that of the owners—how is it, we are led to ask, that they do not effect this regulation whenever they please, quite as a natural part of their business operations? Why do not the colliery-owners, for instance, of Durham, or Yorkshire, or any other district, or of all the coal-fields together, simply arrange coal values by ordering their pits to be closed for a week, a fortnight, or any length of time they think fit? The only valid reason why they do not act in this way must be because they cannot. Besides, they know, by observation and by partial but instructive experience, that such proceedings would be futile. And as it would be with the masters, so it must be with the men. What is impossible to the brains of an industry cannot be practicable by its feet and hands. The lesson that one division of the producing interest learnt long ago has to be taught to the other; but the teaching will be all at the cost of the learners, while the adepts will pocket the fees.

In truth, there is nothing that the newly-organized workers of this and other countries more urgently need to learn thoroughly than the omnipotence of law and the limitations and proneness to error of human counsel. There seems to be a notion abroad that Trade Unions can do no wrong, that the enfranchised and organized working man is infallible, and that he can ask and have, not merely in the matters of wages and hours of work, but in the greater issues of industrial and commercial politics, and that he can even mould the moral law to his desires. This is a delusion which requires to be exposed whenever met with. Whatever may be the case in some instances, we are persuaded that the chief reason why Trade Unions are regarded in many quarters with suspicion, and held at bay, is the presumption of their paid officials to be their own law-givers. Every man has a right to make the best terms he can for his labour; and if he prefers to relinquish his individual freedom for the sake of the protection and the feeling of solidarity with his fellows which membership of a Trade Union confers, that is his affair. All the same, he must not deny to another the liberty of choice which he has himself exercised. Faithfulness to engagements willingly entered into, truthfulness of word and deed, the ability to recognize and respect what is worthy in opponents—these qualities must not be treated as old-fashioned and exploded superstitions by any party of the community that really desires the support of the remainder for working out its own ends. We should like to see these considerations more regarded than they are by the self-appointed labour leaders. They knew how to get rid of a Michael Henry when they caught him in an act of treachery to themselves; but other means are required for dealing with the misrepresentations of a Ward and the tyranny of a Wilson. It is the idlest of stump-orators' tales to describe the labouring classes of the present day as "down-trodden slaves." Quite the contrary. As a modern writer declares: "Preponderating political power has well-nigh everywhere passed, or is passing, to them. A century ago the masses were nothing. Now they are everything, or are fast becoming everything." But the same writer concludes his admission with the pregnant caution: "Assuredly, the masses will be monstrous fools if they do not use the power placed in their hands to better their material condition. As assuredly, they will be more monstrous fools still if they use it unjustly. Labour, like capital, is under the moral law. Here, too, it holds good that '*quidquid fit contra conscientiam ædificat ad Gehennam*'—a very real hell upon earth." Unfortunately, men do not learn by the experience of others, or we should not now be witnessing an insane attempt on the part of Labour to

effect what Capital has over and over again failed to do—regulate the market in accordance with its own desires, regardless of the loss and suffering of the rest of the community.

The Result of the Chartered Assessment Appeals.

THE assessment appeals of The Gaslight and Coke Company came before the Court again last Saturday, when a tabular statement of the effect of the judgment, as worked out for the different parishes, was put in. The remainder of the day was occupied by the inevitable controversy on the subject of costs; and though the matter was adjourned to yesterday, it was not even then finally disposed of. We cannot, therefore, yet report the end of this prolonged affair. According to the table showing the apportionment of the rateable value of the property among the various parishes where the assessment has been appealed against, whereas the total of the figures appearing in the valuation lists is £418,692, and the total as stated in the Company's cases was £168,256, the figures as settled by the judgment are £378,097. The judgment cannot therefore be described as merely "splitting the difference." The mean of the two totals in the dispute is £293,474, upon which the judgment is a rise of £84,623, or more than one-half of the total of the Company's valuation. The comparatively small sum of £40,595 has been knocked off from the parish lists, while £209,841 has been added to the offered figure of the Company. This can hardly be scored as a triumph for the Company's advisers. It is difficult to write with patience of this kind of half-legal, half-technical business, which subjects the proprietors of gas undertakings and the representatives of the ratepayers—and eventually the public—to a quinquennial "bleeding" for the sole profit of a horde of hungry non-producers in the shape of valuers and lawyers. Doubtless all these gentlemen are very worthy and clever persons; but we altogether fail to admire the system which renders them necessary in connection with the rating of gas-works for the relief of the poor. It is the public who have to support them in the long run; and the reflection occurred to us more than once, while these terribly costly appeals were in progress, that the scene in the Clerkenwell Court-House ought to have been photographed, if it had been possible, from the mental and physical point of view of the Chairman. He saw day after day dozens—literally dozens—of wigs concentrated before him, supported by an equally strong second line of black-coated gentlemen who were the surveyors, engineers, valuers, solicitors, accountants, and so forth. And every wig was, as it were, the focus upon which converged months' work of a small army of experts, all rejoicing in the certainty of big fees however the result might turn, and fortifying themselves with the happy prospect of having it all over again five years hence. The whole system is simply a disgrace to the administrative order of the country that endures it. Meanwhile, whether this or any other variety of litigation is or is not a bright point of the British Constitution, the first business of the parties to it is obviously to win, which is what The Gaslight and Coke Company failed in doing this time. Their failure, we fear, is not a good augury for the future rating of gas undertakings in the Metropolis or outside. We shall be absolved from any charge of wantonly questioning the conduct of the Company's case by the professional gentlemen engaged, inasmuch as their leading Counsel—Mr. Littler, Q.C.—actually went out of his way, at the hearing on the 26th ult., to point out how badly off his clients were left as the result of their efforts to obtain a lightening of their burden of rates. This was a wholly uncalled-for observation, since it could not affect the issue, and merely introduced another bitter drop into the cup of disappointment which everybody concerned in getting up and presenting the Company's case has had to drink. If it comes to a question of ascribing blame to the representatives of the losers, Mr. Littler himself will not escape; for he needlessly "antagonized" the Court throughout the inquiry, and his management of his case compares very unfavourably in most respects with that of the Solicitor-General (Sir Edward Clarke, Q.C.) for the respondents. It is, of course, impossible to sound the depths of the judgment, and ascertain how its terms were arrived at; but we are shrewdly of opinion that the appellants overdid their parts. Carried a very little farther, their case would have demonstrated that the stupendous hereditament involved

in the appeals has no value at all. It is unnecessary, however, to pursue these reflections. Such as it was, the Company's case was presented most ably by their witnesses; but wherever the superior talent lay, the fact remains that the parishes are on the winning side this time.

The Southern and Midland Association Meetings.

Two District Gas Managers' Associations met last week—the Southern in London, and the Midland in Birmingham; but, owing to an unfortunate conspiracy of circumstances, the latter was practically a spoilt day. By a misfortune quite unprecedented in the history of such gatherings, both the first and the second entries in the programme failed to come off in regular order. The President, Mr. W. Littlewood, of West Bromwich, excused himself at the last moment from attending, on the ground of illness; and he did not even send his Inaugural Address to represent him in spirit. Mr. Hunt was due to open a seasonable discussion upon photometry and standards of light; and a cruel Nemesis, in the form of a Committee of the Gas Department, kept him otherwise engaged until past the hour fixed for his appearance before the Association. The day was thus deprived of its most interesting events, which was the more to be regretted as the attendance of members was good. The Executive of the Association are deserving of sympathy in the exceedingly awkward position which Fate forced them to occupy last Thursday. The good dinner with which the proceedings terminated was sorely needed to put the disappointed members once more at their ease. The Midland misfortune stands in strong contrast to the Southern meeting, which was conspicuously pleasant and successful. Mr. John Methven, of Beckton and Nine Elms, as a gas engineer of world-wide reputation in the difficult science of photometry, was a hard President to follow; but Mr. A. Dougall, of Tunbridge Wells, proved an admirable successor. His address, which will be found in another column, is one more example, and a particularly bright one, of the truth for which we have so often contended in these pages—that if a President of a technical association is worthy of his elevation to this office, he cannot fail to produce a valuable and interesting Inaugural Address if he will only confine himself to his own individual experiences for his principal matter. We have no hesitation in declaring that, in the estimation of hearers and readers of his practical, plain-spoken, and really philosophical address, Mr. Dougall has by this one effort placed himself well to the front among the younger and rising order of gas managers. It has been notorious that, in his position at Tunbridge Wells, Mr. Dougall has, until recently, been overshadowed by a more prominent and influential figure. He has bided his time, however, with conspicuous patience and loyalty; and now he is coming into his reward. The other proceedings of the Southern meeting comprised an informal exposition, by Mr. Sugg, of the novel 16-candle photometrical standard, which was criticized with some point by Mr. Methven, who spoke under all the reserve due to the impromptu character of the discussion. At the annual dinner which followed the meeting, Mr. J. W. Helps, of Croydon, the deservedly popular Honorary Secretary and Treasurer of the Association, in responding to the toast of his health, moved in appreciative terms by Mr. D. Ford Goddard, Mayor of Ipswich, and a Past-President of the Association, tentatively unfolded a hopeful scheme for extending the usefulness of the organization. It would be premature to say anything respecting Mr. Helps's suggestion; but we venture to express the wish that he will feel encouraged, by the sympathetic manner in which his remarks were received, to put his views forward in a more definite form upon the first convenient opportunity.

Sir Douglas Fox has been elected an honorary member of the Society of Engineers, in place of Sir G. B. Airy, K.C.B., F.R.S., deceased.

Death of Dr. Redwood.—The death is announced, at his residence, at Boverton, Glamorganshire, of Theophilus Redwood, Ph.D., Emeritus Professor of Chemistry and Pharmacy to the Pharmaceutical Society of Great Britain. He had reached the advanced age of 86.

The Royal Commission on Water Supply.—In the House of Commons yesterday afternoon, Mr. Ritchie announced the names of the Royal Commissioners on the London Water Supply. They are: Lord Balfour of Burleigh (Chairman), Sir George Barclay Bruce, C. E., Professor James Dewar, F.R.S., Sir Archibald Geikie, Mr. G. H. Hill, M. Inst. C. E., Mr. James Mansergh, M. Inst. C. E., and Dr. W. Ogle.

WATER AND SANITARY AFFAIRS.

It is somewhat remarkable that the House of Commons should have devoted fully three hours of its time to the discussion of the Birmingham Corporation Water Bill on the motion for the second reading. That the motion was at length carried by a majority of more than two to one, by no means assures the passing of the Bill in the present session. It now stands referred to a Hybrid Committee, armed with all the powers that such a tribunal can possess. Not only will the London County Council have *locus standi* before this Committee, but a similar position will be occupied by all the County Councils in any way interested in the measure. Thirty petitions have been presented against the Bill; and it is possible for another swarm to follow. Under the instruction moved by Mr. Shaw-Lefevre and agreed to by the House, the Committee have power to inquire into the rights of the commoners affected by the proposed works. The result, as stated by Mr. Courtney, is that, if a farmer or a commoner presents a petition three days before the meeting of the Committee, he will be entitled to be heard against the Bill; and the Commons Preservation Society will be in the same position. On the other hand, it appears that Birmingham is prepared with a whole legion of witnesses, including Sir Frederick Bramwell, Mr. Hawksley, Mr. Mansergh, and Mr. J. W. Gray. The Mayor of Birmingham will be forthcoming, together with Sir Thomas Martineau, and a cloud of eminent chemists and geologists; as well as engineers able to speak upon the merits of the Manchester, Liverpool, and Sheffield schemes. The London County Council will, of course, take care to fortify themselves, especially as the *entente cordiale* between that body and the Birmingham Corporation has been impaired by the discovery of a speech by Sir T. Martineau, showing that it was not urgency but strategy which induced Birmingham to bring forward its scheme at the present juncture. We are not quite sure that Birmingham might not retort on London, and assert that the County Council have "strategic" reasons for their professed concern lest the Metropolis should run short of water. There is also a natural feeling of vexation among the Birmingham authorities, at the unexpected falling away of the Metropolitan members after the revelation given to the House by Sir John Lubbock during the debate on the second reading. The consent to the Bill by these members was founded on the persuasion that its existence was due to a dire necessity; whereas the quotation from Sir T. Martineau's speech showed that Birmingham was actuated by a desire to anticipate London in getting hold of the sources of the Upper Wye. It was further shown that, in another speech of somewhat earlier date, Sir T. Martineau had accepted a statement by the Water Engineer (Mr. Gray) that the existing source of supply for Birmingham might suffice for another twenty years. The "great hurry," therefore, resolved itself into a scheme of rivalry. This statement of the case by Sir J. Lubbock seriously affected the chance of the second reading; and Mr. J. Chamberlain, who had charge of the Bill, had to exercise all his ingenuity to overcome the effect of the *exposé*. When the division took place, Sir J. Lubbock and some other Metropolitan members showed their sense of the situation by walking out of the House without voting.

From the remarks we have already made, it will be seen that the inquiry before the Hybrid Committee relative to the Birmingham Bill threatens to assume such proportions as to render it scarcely inferior to the coming investigation by the Royal Commission. Had Birmingham waited for the Commission instead of trying to run before it, such patience might have had its reward. Mr. Ritchie has rightly remarked that the scope of the inquiry to be conducted by the Royal Commission is less wide than it was assumed to be by some of the speakers in the recent debate. The inquiry does not traverse the whole water supply question; but, at the same time, should it be thought necessary to go outside the watersheds of the Thames and the Lea, the source to be found in Mid-Wales will most likely come under review. In that case Birmingham will necessarily have a hearing, as claiming the higher portion of the watershed feeding the Elan and the Claerwen. In contrast, there is the contingency that, after the Birmingham Corporation have expended a very large amount of the ratepayers' money on counsel and witnesses, the Hybrid Committee may declare the preamble of the

Bill not proved. It is quite possible that the Committee may consider there is no special urgency in the Birmingham case, and that it would be more proper to wait until the Royal Commission present their report. The preamble of the Bill declares that a new water supply is needed by Birmingham, and that it is necessary to go out of the Midland district to obtain it. But how far the need is pressing remains to be seen. Birmingham may be thankful if the enterprise can be postponed. It is tremendously costly, and will add largely to a debt already felt to be burdensome. The Birmingham estimate of between £6,000,000 and £7,000,000, may also serve as a warning to London, which, with its immensely larger demand and greater distance, would require an outlay augmented in proportion. If Birmingham likes to spend its millions, it may do so; and our own opinion is that London need be in no trouble with regard to the matter.

Mr. A. G. Vernon Harcourt, F.R.S., Lee's Reader in Chemistry at Christ Church, Oxford, and one of the Metropolitan Gas Referees, was last Friday elected a member of the Athenæum Club, under the terms of one of the rules which provides for "the annual introduction of a certain number of persons of distinguished eminence in science, literature, or the arts, or for public services."

The Gaslight and Coke Company's Assessment Appeals.—The parties concerned in these appeals attended the Court again last Saturday for the purpose of dealing with the allocation of the amount decided upon as the rateable value of the Company's property among the various parishes concerned, and discussing the question of costs. A statement was presented as the result of the Accountant's allocation, which was accepted on all sides, with the exception that Mr. Littler desired, on behalf of the Company, to separate the City of London into the various component parishes. The Court, however, declined to accede to this; treating the City as an aggregate appeal. A long discussion followed as to the manner in which costs should be awarded; and it had not terminated when the Court adjourned till yesterday. The report of the proceedings will be given next week.

Post Office Diligence.—A good deal of complaint is sometimes made that the officials of the Post Office do not take any trouble to secure the delivery of a misdirected or inadequately addressed letter; and therefore an instance to the contrary is worth recording. A paragraph referring to the process in use at the Govan Iron Works, Glasgow, and elsewhere, for the recovery of the oil and sulphate of ammonia from blast-furnace gases, which appeared in the papers some time ago, found its way to America, and came into the hands of a firm in New York. These people 'gummed' the newspaper extract on the front of an envelope bearing their name and place of business, and addressed it "To the Proprietors, Glasgow, Scotland." On arriving at the Post Office there, the letter-carrier was advised to try the Furnace Gases Company; and, after travelling about, the envelope eventually reached the makers of the plant employed at the Govan Works—Messrs. R. and J. Dempster, of Newton Heath, Manchester.

Petroleum-Engines.—At the meeting of the Institution of Civil Engineers last Tuesday, Professor W. C. Unwin, F.R.S., M. Inst. C. E., read a paper on the above subject. He gave a short account of the earlier motors worked by petroleum, and then described the Priestman engine. In this a jet of oil, controlled by the governor, and a current of air are mixed in a spraying-nozzle, which reduces the oil to very fine particles. The mixed air and spray are received in a vaporizing chamber, heated by a jacket through which the exhaust of the engine passes. During the suction stroke an additional air supply, also regulated by the governor, enters the vaporizer, and drives forward the charge into the cylinder. The charge is compressed, ignited by an electric spark, expanded while doing work, and finally exhausted; the cycle being the same as in the "Otto" gas-engine. The author gave particulars of trials of a 5-horse power Priestman engine. Comparing the fuel consumption with that of the steam-engine, he said 1 lb. of oil might be taken as equivalent to 1½ lbs. of coal; and, on this basis, the consumption in the oil-engine, running at full power, was equal in three trials to 1.18 lbs., 1.23 lbs., and 1.02 lbs. of coal per brake horse power per hour—a thermo-dynamic result which he regarded as remarkable. The lowest known consumption of steam in steam-engines is 12.45 lbs. per indicated horse power per hour, which corresponds to 1.61 lbs. of coal per brake horse power. The oils used in the trials were analyzed by Mr. C. J. Wilson. From these analyses, and the observations made, the following percentage values of the expenditure of heat were obtained: Heat shown on the indicator diagram, 16.12; heat rejected in jacket water, 47.54; do. in exhaust gases, 26.72; radiation and unaccounted for, 9.61—total, 99.99. The useful work at the brake was 13.31 per cent. The author compared the cost of working an oil-engine with that of steam and gas engines; and described the various applications of the oil-engine. He stated that on all occasions when he had had one under observation, it had been started without difficulty, and worked without any hitch. It appeared to require little more attention than a gas-engine.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 501.)

THE Stock Markets have made some further advance in the past week in the direction of improvement. The tendency was not much marked at the opening; but, as the week went on, things generally made a brighter show. The chief feature was the improvement in Argentines and others of the same class, owing to more cheerful views being taken in regard to the threatened difficulties. Money is abundant, and the market is as easy as it well could be. The demand for high-class securities for investment continues brisk; and prices are rising accordingly. Business in the Gas Market has been very quiet, on the whole—on some days, next to nothing. Changes in quotation are few and very slight; but, such as they are, they tend downward. The Metropolitan Gas Companies remain very steady; and the strike of the Durham miners does not appear to have affected their quotations at all. Although the men have come out, many people believe that they will not remain out long, and that terms will be arranged promptly. Gaslight "A" was steadily dealt in throughout the week at 212-213½; never going outside these figures. A fair amount was done in the debenture, preference, and limited issues, and prices generally were well up to the mark; but nevertheless "C," "D," and "E" were lowered 1. A few bargains were marked in South Metropolitans early in the week, at about average figures; but afterwards they were quite neglected. Nothing at all was done in Commercial; there being apparently a great dearth of stock in the market. Suburban and Provincial Companies were quite without feature. The Crystal Palace District Company had their meeting on Friday, and voted their usual dividends. The Company have at last resolved to restore the price of gas to 2s. 9d. per 1000 cubic feet, from which they ought never to have reduced it. By coming down to half-a-crown, their earning power was enfeebled; and the profit-balance for the last half year was less than 2¼ per cent. on their capital. The result is that, although the authorized dividends only amount to an average of 7½ per cent., the payment of these swallows up the entire net revenue balance and a further £2500 out of the reserve fund. The Continental Companies continue to droop; and both Imperial and Union have lost another point. Oriental has receded ¼, which is attributable to the rate of exchange. Among the South Americans, the better feeling in Argentines has put Buenos Ayres up ½; but Monte Video has fallen to a similar extent. The Water Companies' quotations have been put down with a liberal hand; but it is not likely that much stock has been parted with.

The daily operations were: Gas was quiet on Monday; and prices closed unchanged. In Water, East London fell 4; Kent, 2½; Southwark, 2; and Grand Junction, ½. On Tuesday, the tendency in Gas was weaker. Gaslight "A," ditto "C," "D," and "E," Continental Union, and Imperial Continental fell 1 each. A further fall in Water took place. Southwark receded 4½; New River, 2½; and Lambeth and West Middlesex, 2 each. Hardly any business was done on Wednesday; but Gaslight "A" was put up 1 again. Lambeth 7½ per cent. fell 2. There was a little more activity on Thursday, but not much change. Buenos Ayres rose ½; but Oriental fell ¼. Lambeth 10 per cents fell 2. Friday was a brisker day; and prices were steady generally. The only move was a drop of ½ in Monte Video. In Water, Chelsea fell 2½; Grand Junction, 2; and East London, 1. Saturday produced no new feature in Gas. Water still fell. Chelsea receded 5; and Lambeth, 2.

ELECTRIC LIGHTING MEMORANDA.

The Dangers of Electric Light Wires—The Life and Fire Risks of Electric Lighting—The Cost of Domestic Electric Lighting—Mr. Tesla's Aims.

THE new electric lighting companies have, as a rule, managed their business so much more carefully than their precursors, that they have not only avoided repetitions of those horrifying "accidents" which attended the crude performances of the early electric lighting speculators, but they have also lulled the public into forgetfulness of the danger that lies in the most innocent-looking electric light wires. We noticed not long ago, with reference to Mr. Tesla's remarkable experiments with currents of exaggerated voltage, how the irrepressible Mr. W. H. Preece had, with most unscientific special pleading, ventured to assure the newspaper-reading public that, because Mr. Tesla was not killed, therefore there is no danger whatever in high potential electricity. This particular variety of the "scientific hoax" will hardly survive the experience of the Chatham Electric Light Company, reported elsewhere. In this case, one man was killed outright, and another badly injured, by contact with a wire inside a consumer's premises. We have no desire to discuss the affair here, but simply to note the fact. The inquest was attended by Major Cardew, R.E., the electrical adviser to the Board of Trade; and the incident will therefore have its due effect at head-quarters, notwithstanding the attempts that

will in all probability be made in certain places to laugh it off, or to explain it away.

While mentioning the Chatham catastrophe, we must not overlook what transpired with reference to a similar circumstance at the recent meeting of the Bath Electric Lighting and Engineering Company. The Chairman of the Company (Lieut.-Col. Vaughton) said, in the course of his address to the shareholders, that "he regretted very much that there had been two accidents during the year. One man, after some time, was able to return to his work; but in the other case the shock to the system had been too great, and the unfortunate sufferer had succumbed to his injuries." Taking these examples of personal injury caused by electric light currents in conjunction with the other significant fact, of the fire offices having largely increased the premium charged for the insurance of the Crystal Palace during the continuance of the Electrical Exhibition, it is only reasonable to conclude that that superior "safety" which advertising electricians are in the habit of claiming for their illuminant is still a figure of speech. The action of the fire insurance companies is, as may be supposed, strongly resented by the electricians. *Industries* remarks upon the "incalculable harm" done to the electric light industry by what it calls "this ill-advised action of the insurance companies." Our contemporary, moreover, drives the lesson home itself by plaintively observing that "it is as if they (the fire offices) said that electric lighting is dangerous; whereas the whole object of the exhibition is to show that electric lighting is now practically perfect." It does not seem to occur to this writer that the insurance companies, who have to back their opinion very heavily, must be allowed to exercise their own discretion as to the degree of completeness with which this "object" of the exhibition has been attained. The less the electricians and their friends in the Press say about this matter, the better it will be for them.

A very good paper on "Domestic Electric Lighting" was recently read before the Architectural Association by Mr. Max Clarke. It was calculated to be useful not only to architects, but also to their clients, because it dealt with the elementary points of electric lighting practice in a plain, unpretentious style, and was conspicuously free from those attempts to appear clever by artful jugglery with terms of electrical measurement which too often disfigure papers of this character. Mr. Clarke's teaching is not very deep, of course; but it is perfectly trustworthy so far as it goes, which is a good deal to say. The first thing an intending user of electric light generally wants to know is what it is likely to cost him; and here comes his initial difficulty, for, unless he addresses his inquiry to the right person, he may be seriously misled. If the prospective user is a consumer of gas, and the main of a central station lighting company passes his door, he can easily procure tenders for wiring, and can ascertain the cost of the service, the charge for the meter, &c. Then if he takes the company's price for electricity per unit in pence, calls it shillings per 1000 cubic feet for gas, and increases his last year's gas bills in proportion, he will obtain a fair notion of what the electric light will cost. If the householder lives in the country, it is more difficult to institute any trustworthy comparison of the probable expense of electric lighting with the actual cost, even when known, of oil and candle lighting. Generally speaking, except in the case of a very good class of country house, where the best colza oil and wax are freely used, the oil and candles cost even less than gas, because the standard of lighting is lower. It is idle to talk about electric lighting for a country house remote from gas supply, unless the establishment is maintained upon a considerable scale. When gas-engine power is available, it may be practicable to adopt electric lighting generated by an isolated plant in substitution for oil or candles costing about £50 per annum. If steam power must be used, which means skilled attendance, it can hardly be worth while to make the experiment for a lighting bill of less than £150 per annum.

One of the best critical notices of Mr. Tesla's famous lecture upon alternate currents of high potential and frequency that has come under our observation, appeared in *Nature* over the signature "A. W. R." The writer admits that "in Mr. Tesla we have a scientific explorer, who, if health and life be granted him, will travel fast and far." It is also pointed out that Mr. Tesla's work has an object, and is not intended to end with displays of scientific fireworks. "He is one of those who hold that a phosphorescent glow is the light of the future. He hints at artificial auroræ spreading from the summits of towers of hitherto undreamt-of heights; and he has at all events got as far as producing in air, at atmospheric pressure, a glowing flame bounded by two rings about a foot and 30 inches in diameter respectively. Whether his visions will all be realized may be doubtful." Decidedly doubtful, we should say; but it is at least pleasing to have another definition of the "light of the future." There is a growing feeling that on many accounts incandescent electric lamps fall very far short of perfection. They have somehow failed to give complete satisfaction, even to those who use them constantly and like them best; while there is no gainsaying the fact that the unemotional public preserve a mortifying manner of taking them for what they are, not for what they are said to be by their makers. Shall we be quite happy when we are all able to go to bed by the light of Mr. Tesla's artificial auroræ? Perhaps so; but there is a good deal of difficult ground to be covered before that supreme result is attained.

WILLIAM THOMAS WALKER.

We regret to record the death, on the 6th inst., at Eastbourne, of Mr. William Thomas Walker, member of the well-known firm of Messrs. C. and W. Walker, of Donnington and London. He had been suffering from impaired health for upwards of a year; and his sojourn at the seaside, which commenced in November last, was with the view to its possible amelioration. The late Mr. Walker possessed exceptional ability as an engineer, had great business capacity, and was an excellent employer. In the development of the industry of gas engineering, he travelled for many years on the Continent; visiting the principal cities, and even penetrating into the heart of such countries as Spain, Egypt, Turkey, and Russia. In fact, he saw a great deal of the world; and it may be safely said that there is not a country in which gas is made where Messrs. C. and W. Walker's appliances are not to be found. This is due mainly to the extraordinary enterprise of the member of the firm who has just been removed. To his high qualities as a business man he united great amiability. An honourable, upright gentleman he endeared himself to all who knew him; and his loss will consequently be greatly felt. Mr. Walker had for a long time been associated with the Volunteer movement. He was Major of his regiment—the Highgate Volunteers; and but for his lamented decease would shortly have attained the colonelcy. His proficiency as a field officer was obtained at the School of Instruction at Aldershot. As an instance of the interest he took in military matters, it may be mentioned that, on the occasion of his visit to the Crimea in 1886, he found, near the spot where a number of officers and men of the 23rd Royal Welsh Fusiliers (the Duke of Cambridge's Own Regiment), who fell at the Battle of the Alma, were buried, a stone which had for thirty years marked their grave. When the regiment erected a handsome memorial to their former comrades, this old stone, with its rudely-carved inscription, was thrown aside. Mr. Walker brought the stone to England, and handed it over to the regiment, the officers of which had it erected in the centre of the barrack square of the regimental dépôt at Wrexham. In acknowledgment, he was made a perpetual member of the mess, and was presented by the officers with a framed illuminated address, "in grateful thanks for the trouble, thoughtfulness, and great generosity displayed by him in rescuing from destruction, and presenting to them, the original stone which marked the spot where so many of their gallant comrades were laid to rest, killed at the Battle of the Alma, Crimea, 20th September, 1854." The funeral took place last Friday in Highgate Cemetery (which is in the neighbourhood of the residence of the deceased in Bishopswood Road), and was attended by the widow and family, Mr. C. C. Walker, J.P. of Shropshire and Staffordshire, and other relatives, as well as by representatives of the various departments of the firm in London and Shropshire.

THE CRYSTAL PALACE ELECTRICAL EXHIBITION.

SIXTH NOTICE.

THE present exhibition is remarkable in at least one respect—for the collection of motive machinery, mostly in action, and all of it applicable to the driving of dynamos, which is perhaps the most exacting work that can possibly be laid upon any kind of prime mover. It is well worth while, to anybody who loves an engine, to pay a visit to the so-called machine-room of the Palace; for here may be seen a goodly array of examples of the very best practice in steam and gas engine construction that the world can show. It has been our duty, as faithful critics, to publish some very sharp and sweeping censures upon much that is offered to public view as part of the latest Electrical Exhibition; and we have not hesitated to point out where, in our judgment, the electricians have gone wrong in their lighting devices, and also where they have failed to do credit to their resources and opportunities. There is nothing but praise to be given, however, for the style in which electricians and mechanical engineers have worked together at the solution of the engineering problems presented by the modern development of dynamical electricity. If there is very little Art in the Crystal Palace Exhibition, there is plenty of Science. The latter is, no doubt, the strong point of the age; and it is conspicuously the redeeming feature of this Exhibition. It is not our province to describe in detail, or to criticize, the purely electrical machinery shown at the Crystal Palace. Experts may be able to discriminate between the rival dynamos and their fittings, turned out by such leading firms as Cromptons, Siemens, Laings, &c.; but it will be sufficient to admit here that these productions are manifestly of the highest class. There is no mystery about the practice of these manufacturers. They display every detail of their work; and certainly for quality of materials and finish of manufacture there is nothing to choose between them.

Radical differences of design are, of course, noticeable in the dynamos, and in the arrangements for driving them. A really grand show, in the estimation of an engineer, is that of Messrs. Davey, Paxman, and Co., who must be credited with having from the first set the British standard of excellence in steam plant intended for electric lighting purposes at the highest

pitch attainable by materials and labour. This firm have a contract for supplying steam to the Crystal Palace Company; and accordingly they have installed in their boiler-house a row of seven 120-horse power steel boilers of the locomotive type, which furnish steam for all the engines in the exhibition. Over the boilers there is fixed a steel receiver 16 inches in diameter, into which steam from any or all of them is delivered, and from which the main steam-pipe starts. These boilers are fitted with Gresham and Craven's injectors, and there is an auxiliary duplex steam feed-pump, by Messrs. A. G. Mumford and Co., of Colchester. Messrs. Davey, Paxman, and Co.'s own show comprises, in addition to these boilers, one of their new marine type triple-expansion steam-engines, indicating 350-horse power, coupled direct to a Kapp multipolar dynamo by Johnson and Phillips, which is rated to maintain 2250 full-size 16-candle power incandescent lamps, or 250 arc lamps of 2000-candle power "actual." The dynamo supplies the incandescent lamps in the Picture Gallery, and at the same time maintains a number of Brockie-Pell and Gülcher arc lamps, and charges some accumulators. The performance of the combination leaves nothing to be desired. Its special feature is the slow speed (115 to 130 revolutions per minute) at which it is driven. The idea of the designers was to produce a motor and dynamo that could be depended upon to run for months on end without needing repairs; and so they copied the style of marine engines, which commonly drive ships many thousands of miles without stopping, and only need adjustment of their brasses at the end. The engine is fitted with a highly-sensitive governor, and can be started in any position. It is supplied with steam at 160 lbs. pressure from a new type of water-tube boiler, introduced by the firm to meet the demand for steam generators of this class. Altogether, if this plant could always be driven at something approaching a full load, it could hardly be surpassed for economy. Unfortunately, statistics having reference to central station working show that this is a very large "if" indeed.

Widely differing from the Davey-Paxman practice is that of Siemens Bros. and Co., Limited, who show a very fine array of high-speed dynamos coupled direct with Willans and Tangye engines. Messrs. Laing, Wharton, and Down also favour the Willans high-speed engine; and so to some extent do Messrs. Crompton and Co. The Brush Electrical Engineering Company have high-speed direct-coupled engines of their own; and the same may be said for Messrs. Easton and Anderson. In short, the direct-coupled engine and dynamo is a noticeable feature of the machine-room. It is evidently thought that the elimination of the belt removes one source of danger of breakdown; but it by no means follows that there is no such risk in the case of direct-coupled plants. There have been several wholesale extinctions of the Palace lighting since the exhibition was opened; and we understand that the honours for these illustrations of the uncertainty of all arc lighting are divided between the belt and the direct-driving plants. It has been declared by respectable authorities on the subject, that the modern English form of electrical generating plant is the directly-coupled high-speed engine and dynamo; and that the slow-running horizontal condensing engine, such as the Galloway engine belonging to the Palace Company, and used for years in their lighting service, is obsolete for this purpose. Precisely how much justification there may be for this view we cannot pretend to say; but it is significant that a firm of such experience and standing as Messrs. Siemens Bros., to say nothing of the others, are content to be identified with this principle.

The most interesting class of machinery exhibits to gas engineers will naturally be the gas-engines; and of these there is a particularly large and representative collection. Notice must, in the first place, be taken of the Crossley exhibit, which is not so large as might have been expected; but this may be explained by reference to other specimens of this firm's engines to be found scattered over the exhibition. Several examples of the newest patterns of "Otto" engines, with the latest improvements for igniting the charge, preventing the engine starting backwards, &c., are shown on stand No. 44. The makers do not pretend to compare their productions with those of their rivals; but they have signalized the expiration of their monopoly by lowering their prices, and point to their 20 years' experience and experiments as constituting sufficient reasons why they should retain the patronage of power users. Some arc lamps are being supplied satisfactorily from the Crossley stand. It should be remarked here that many exhibitors of gas-engines work in conjunction with exhibitors of electric light and fittings, and advertise the combination, by which arrangement it is rendered possible to see what this kind of power is capable of doing. We have no hesitation in stating that the supply of arc light from gas-engine driven dynamos is generally a success. In one or two instances incandescent lamps are also well maintained by gas-engines; but this is a very much more trying performance. When a number of incandescent lamps supplied by a gas-driven dynamo are collected together, the slightest pulsation is faithfully indicated by the lamps, which are, in fact, extremely sensitive instruments for this purpose. There has been some talk of a competitive trial of gas-engines in connection with the exhibition; but we hardly expect makers to submit to anything of the kind. The two common devices for correcting the irregularities of gas-engines, and preventing their affecting incandescent lamps, are heavy fly-wheels—a pair of them to

every engine—and a belt not too tight. These "dodges" are very transparent, however, and condemn those who place too great reliance upon them.

The gas-engine exhibit of next importance to Messrs. Crossley's is that of the "Campbell" Company, of Halifax; but that of the "Stockport" engines is not far behind. A "Stockport" 6-horse power engine is employed by Messrs. Barclay and Son to generate current for their model country-house plant on the Scott-Sisling system, which involves the use of accumulators, and is a good specimen of what can be done in this way. The Stockport engines are not new, but, like others of their class, the makers are constantly improving them. The reason they have been patronized by Messrs. Barclay and Son is their ease of starting, which is effected by an ingenious new device. The Campbell engines are likewise well known, and are recommended on account of their simplicity of parts, efficiency, and regularity of movement. "Griffin" gas-engines are shown by Messrs. Dick, Kerr, and Co., Limited, of Kilmarnock. These engines run with great regularity, and are made in large sizes as well as in small patterns.

The ingenious Atkinson "Cycle" engines are shown; claiming respect as usual for their economical working, while attracting notice by their uncommon appearance. The "Trusty" engines of Messrs. Weyman and Co., Limited, of Guildford (Surrey), use the "Otto" cycle, and are well made machines. Day's patent vertical engine is a comparatively new-comer in the field. It is made by Messrs. Day and Co., of Bath, and is a neat, workman-like looking engine. The "Fielding" gas-engine, by Messrs. Fielding and Platt, of Gloucester, is another of the rival "Otto" type machines, appealing to power users upon the usual grounds. The "Trent" engine is shown by the manufacturing Company of the same name, whose works are at New Basford, Nottingham. Another Nottingham specialty of the same kind is the "Premier" engine, made by Messrs. Wells Bros., of Sandiacre; which is also upon the "Otto" or Beau de Rochas principle. A new production under a somewhat hackneyed name is the "Acme" engine (M'Gee and Burt's patent) shown by Messrs. A. Burt and Co.; while the "Capitaine" patent gas and oil engine shown at stand No. 53 is unique.

Enough has been stated to indicate the importance of the gas-engine exhibits at the Palace. If we do not describe these machines minutely, it is because some of the best of them are old friends of our readers, and it is impossible to explain the points of such motors in letterpress. We are deliberately of opinion that, in some makes of the cheaper gas-engines now coming into the market, finish is being sacrificed to cheapness; which is a mistake that will bring its own punishment in the long run. Also there is too much fly-wheel about many of these engines. It may be vain to look for a higher duty from the gas consumed for motive power until the hot-cylinder engine or some kind of gas turbine motor appears; but regularity of revolution and the reduction of internal friction will occupy gas-engine designers for some time to come, and prices are very unsettled. There is no appearance of any tendency on the part of electricians to neglect the gas-engine as a convenient source of power; indeed, the evidence points the other way. We confess, however, that we should have been better pleased with the gas-engine people if they had shown more enterprise in connection with this exhibition. Engines of from 2 to 16 horse power nominal are well enough, so far as they go; but why was not the opportunity taken of showing what can be done upon a larger scale? Where is the 100-horse power engine, using Dowson gas, that we have read about? For all that can be learnt at the exhibition, it would appear that the efficiency of the gas-engine ends just where that of the steam-engine begins—that is, at a motor of about 50-horse power. But this is just where we were ten years ago; and here we seem to stick.

Death of Mr. T. Mahony, of Cork.—We regret to record the death, on Monday last week, at his residence at Blackrock, of Mr. Timothy Mahony, J.P., the Chairman of the Cork Gas Consumers' Company. Our readers may remember that only about a fortnight ago Mr. Mahony presided at the meeting of the Company; and therefore his removal has been sudden. In fact, he was in his usual health last Sunday week; but early on the following morning, he was seized with slight hemorrhage, which was followed by syncope—death resulting from failure of the heart's action. The deceased gentleman succeeded Mr. J. F. Maguire, M.P., in the chairmanship of the Gas Company; and he was also a Director of the Passage Railway Company and of the Macroom Railway Company, as well as associated with other undertakings. He was at the head of the firm of Messrs. Martin Mahony and Sons, woollen manufacturers, who were the first to commence the production of tweeds in Ireland. From a small beginning, the concern has become one of the most important in Cork—employing many hundred hands. Mr. Mahony was, from its foundation, an active member of the Society of St. Vincent de Paul, and was finally its President; and it may justly be said that he took part in all movements calculated to benefit his fellow-creatures. At the meeting of the Corporation on the day of his decease, a resolution was passed expressing the profound regret of the members at the loss of a highly-esteemed citizen and a distinguished philanthropist, and their sympathy and condolence with his family in their bereavement.

NOTES.

Lord Rayleigh on Heat-Engines.

Lord Rayleigh's suggestion for improving the efficiency of steam-engines by raising the temperature of the water in the boiler by the addition of saline substances, which was the subject of a "Note" in the JOURNAL for the 1st inst., has been criticized by several writers in *Nature*, and in particular by the well-known marine engineer, Mr. J. Macfarlane Gray. Mr. Gray supports the view that superheating steam is of little service; proving that "less than 4 per cent. is gained by superheating 200°." But he vehemently contradicts Lord Rayleigh's astounding announcement that, by the addition of saline matters to water in boilers, the possible efficiency, according to Carnot, may be increased. Mr. Gray asserts that there would be no gain from superheating by a saline solution, over the usual method of superheating steam raised from pure water. It is not the saline mixture, but the steam, which is the working substance; so that the efficiency would be precisely the same, whether or not a salt is dissolved in the water from which the steam is derived. The plan foreshadowed by Lord Rayleigh was patented by Mr. S. Geoghegan some ten years ago. Mr. James H. Cotterill admits that there is a gain by superheating; but, putting aside cylinder condensation, the gain is small. He remarks that superheating was originally introduced with the object of drying the steam and diminishing cylinder condensation; and he thinks that, now that the difficulties attending its use have been in great measure removed by the lubrication of cylinders by mineral oil, it is hoped that the practice may be revived.

Magnetic Iron Rust.

At the recent meeting at Hobart, Tasmania, of the Australasian Association for the Advancement of Science, Professor Liversidge, F.R.S., of the University of Sydney, read a suggestive paper on the rusting of iron. The author remarked that in books upon chemistry it is usually stated that iron rust is composed of the hydrated sesquioxide of iron; but on examining a very large number of specimens of rust from many different places, and from iron articles of various kinds, and formed under very varied conditions, Professor Liversidge has found that in almost every instance the rust contained more or less magnetic oxide. Indeed, in some cases the rust, although presenting the usual rust-brown colour and appearance, was, when powdered, practically altogether attracted by the magnet. The specimens of rust which first drew the author's attention to this subject were large rust scales obtained from some old tramway metals, which he was led to collect and examine on account of their resemblance to the crust so often present upon metallic meteorites. On crushing these scales in a porcelain mortar, and testing the dust with a magnet, it was found to be wholly susceptible to magnetism, owing to the small quantity of magnetic oxide present being mechanically enclosed in the rust particles. The production of this magnetic oxide does not seem to have been due to the presence of mill scale, because, when bright iron wire, plates, rods, nails, &c., were artificially rusted in many ways with free access of oxygen, in almost every instance a large amount of magnetic oxide was formed. These observations have some practical bearing upon the problem of the preservation of wrought-iron structures from rust.

The Ventilation of the Sorbonne.

According to the report of the Sanitary Commission of the *Lancet*, one of the most perfect examples of ventilation of a public building in the world is the new Sorbonne amphitheatre, used for all the great ceremonies in connection with the Paris University. The building is of the nature of a theatre, only with a platform in place of a stage, and with all the seats of equal grade. The plan of the interior is, however, practically like that of a theatre, and the principles of warming and ventilation adopted are the same as have been applied to the new Vienna Opera House. The air is admitted into the hall by openings under every seat—indeed, all the seats are fixed upon air chambers. The air is propelled into the building by three fans placed side by side in the intake; and a portion of it can be diverted, by means of a valve, to a warming-furnace, while the rest passes on—both currents, however, mixing before entering the house, so that the temperature is fully under the control of the attendants. The rate of intake provides for a normal supply of 20 cubic metres of fresh air per head per hour, calculated on the seat capacity of the house; but by hard driving the supply can be considerably increased. The motive power for the fans is a 15-horse gas-engine. In summer the entering air can be washed and cooled by a water-spray. The inlets under the seats are covered with perforated baffle-plates, so as to render the current of air imperceptible. The outlets measure rather more than one-half of the collective area of the inlets. They are situated in the roof of the hall, and under the galleries. Gas-burners help to draw up the vitiated air until it reaches the final outlet-shaft, through which the air passes at a calculated rate of 1·20 metres per second. It has not been found necessary to place an exhaust-fan in this outlet-shaft. By a refinement of design found nowhere else, means are provided for turning the whole power of the heating-furnaces upon the walls, seats, &c., of the amphitheatre for an hour or so before the time fixed for a meeting. The temperature of the whole interior is raised to 160° Fahr., until the inner surfaces have absorbed a store of heat,

when cold fresh air is again turned on, so that the company have the luxury of a warm building with an atmosphere as cool as that outside. The gas that lights the amphitheatre is burnt above a glass false roof; and its heat only tends to drive out the foul air faster.

TECHNICAL RECORD.

SOUTHERN DISTRICT ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

The Annual Meeting of this Association was held last Wednesday, at the Holborn Restaurant, High Holborn, under the presidency of Mr. A. DOUGALL, of Tunbridge Wells. There was a fair muster of members; and several friends were also present.

The usual formal business first engaged attention.

MINUTES OF LAST MEETING.

The minutes of the meeting held in November of last year were taken as read.

REPORT OF THE COMMITTEE.

The HON. SECRETARY (Mr. J. W. Helps, of Croydon) then read the following report:—

The Committee, in submitting the seventeenth annual report, have pleasure in stating that the Association continues in a flourishing condition. It is to be regretted that three members have been lost by death during the past year—viz., Mr. John Chapman, of Harrow (a member since 1877); Mr. F. M. Edwards, of St. Mary Cray; and Mr. C. King, of High Wycombe. The latter gentlemen were elected in February, 1891. Three members have resigned—making a total loss of six. In the same period, six new members have been elected; leaving the total number 88—the same as last year.

The usual number of meetings have been held. At the February meeting, Mr. John Methven, of Beckton and Nine Elms, gave an eminently practical Inaugural Address; and it becomes a valuable contribution to the recorded proceedings of the Association. At the summer meeting in May, a pleasant excursion was made to Windsor. Mr. Methven kindly provided the luncheon, after which the gas-works were visited—Mr. J. Wadeson, the Manager, giving every assistance in looking over the various parts of the works. The members then proceeded to the Castle and grounds, under the guidance of Messrs. J. Wadeson, Strange, and Wadeson, jun. A drive through the Great Park to Virginia Water and back, completed the day's enjoyment. The party afterwards dined together at the Star and Garter Hotel, Windsor. The third meeting, in November, was held at the Holborn Restaurant; and two excellent papers were read. Mr. J. Tysoe, of East Greenwich, gave his experiences with stoking by the aid of machinery, and an interesting discussion resulted. Mr. R. Herring, of Dover, read a paper "On a Rapid Means of Increasing the Yield of Gas from Ordinary Retort-Settings," which was received with the attention the subject deserves.

The funds of the Association are still in a healthy state. The total receipts for 1891 amounted to £48 4s., and the expenditure to £47 12s. 9d.; leaving a balance to be carried forward of £42 10s. 4d., against £41 19s. 1d. in 1890. Under these circumstances, the Committee are glad to be able to send to the members, as in previous years, a copy of the "Reports of District Associations."

Our esteemed Hon. Secretary (Mr. James W. Helps) has again been active in forwarding the interests of the Association; and the Committee readily acknowledge the indebtedness of the members to Mr. Helps for his valuable services.

Mr. E. Price has resigned the position of Auditor, which he has held for many years with credit to the Association. Mr. W. H. H. Broadberry has been appointed, and has kindly consented to fill the vacancy.

Messrs. C. Gandon and H. G. Mitchell have been elected to the Committee, to fill the places of those retiring by rotation.

With the assistance and co-operation of the members, the Southern District Association has a progressive future of usefulness before it; and this, coupled with the feeling of friendship which exists between the members, adds to the enjoyment of all, while assisting in the imparting of valuable knowledge relating to the important industry the Association represents.

On the proposition of the PRESIDENT, seconded by Mr. J. THORMAN (West Ham), the report was unanimously adopted.

THE EX-PRESIDENT.

The PRESIDENT said he had now a very pleasing duty to perform, and one he was sure which would meet with the hearty approval of all the members. It was to propose a vote of thanks to the retiring President (Mr. John Methven), who had occupied the position with conspicuous ability and dignity, and had done much to further the objects of the Association. It was unnecessary for him to enumerate the great services he had rendered—not only in presiding so ably over their deliberations, but also in giving to the members the results of his experience in the matters under discussion during the year.

Mr. W. D. CHILD (Romford) seconded the motion, which was cordially agreed to.

Mr. METHVEN said he was much obliged to the members for the manifestation of approval that they had accorded to his humble endeavours to carry out the duties of the office of President. It had been a source of gratification to him; and, although he congratulated them in now having a very worthy occupant of the chair, he left it with feelings of regret.

NEW MEMBERS.

On the motion of the PRESIDENT, seconded by Mr. W. H. H. BROADBERRY (Tottenham), the following gentlemen who had been nominated for membership were elected: Mr. F. W. Thurlow, Secretary and Manager of the High Wycombe Gas Company; Mr. A. W. Archer, Manager of the Enfield Gas-Works, Ponders End; Mr. W. A. Walker, Engineer of the

Worthing Gas Company; and Mr. G. F. Marsh, Secretary and Manager of the Buckingham Gas Company.

The PRESIDENT then read the following

INAUGURAL ADDRESS.

Allow me, gentlemen, at the outset of this address, to thank you heartily for the honour you have conferred upon me in electing me to be your President. I must confess that I feel the responsibility attached to the position to be very great; and it was only after much hesitation that I accepted the presidency—feeling, as I did, how difficult it would be for one of the younger members of the Association to maintain its character, especially in view of the fact that I am called to follow in the steps of a gentleman of such wide experience and such high attainments as our late President.

In addressing you to-day, I am quite aware that I cannot say anything that will possess any special feature of novelty or of extraordinary interest; but I trust you will follow me with some degree of interest while I deal briefly with a few matters which have come within the range of my own experience.

It is gratifying to remember that at no period in its history has the gas-producing industry experienced a retrograde movement so far as increase in business is concerned, but that steady progression has ever been its characteristic feature. This satisfactory state of affairs has not been merely such as we might naturally expect from the increase in the population, but has been due to the growing desire for more light, and to the fact that gas has been gradually displacing other illuminants. Gas having found an entrance as an illuminant into most houses, except those of the working classes, it might have been expected that the large increases in its consumption would ere this have stopped, and that we should have had to be content with merely maintaining our position. But, far from this being the case, there has been a continued and steady rise in the figures registered by our meters. Take for example Tunbridge Wells, which has no abnormal record to show. During the last decade the population increased 14.75 per cent.; the gas consumers, 21.16 per cent.; the gas consumed, 66.84 per cent.; and the increase per consumer, 38 per cent.

The value of gas as a heating agent has long been acknowledged; but there was little chance of much progress in that direction as long as it remained at high prices. On the gas engineer therefore rested the responsibility of so cheapening it that it should be available for heating as well as lighting purposes; and to this end many of the ablest men in our profession have been, and are still, devoting their best energies. Improvements in the construction of new works, in the manufacture and distribution of gas, and in the general management of our undertakings, have done much to cheapen and popularize gas; and, as a consequence, it is being applied to all sorts of purposes where heat is required. Great as the increase has been in the past, I do not think there was ever a period in the history of our industry when purveyors of gas might more hopefully anticipate a large increase than at the present time. The multifarious uses to which it can be applied (for warming, for cooking, and as a motive power) have called into existence entirely new industries to provide expedients for its economical consumption. I have made very careful inquiry in my own district, with a view to ascertain what scope yet remains for the application of gas; and find we have 5300 inhabited houses—2375 consuming gas and 2925 using other illuminants. The quantity of oil used in our district last year was 121,400 gallons; and if we take 3 gallons to be equal to 1000 cubic feet of gas, we may reckon that gas is supplying four-fifths and oil one-fifth of the requirements for illuminating and heating purposes. As regards gas as a fuel—that is, as a heat producer—the field is much wider. Although Tunbridge Wells, being purely a residential town, does not offer the advantages of a business town to the many and varied applications of gas, still during last year, for domestic purposes alone, there were used, in addition to 8000 tons of coke, about 44,400 tons of coal, or nearly three times the amount used for making gas. Thus, notwithstanding the fact that we have 1304 stoves of various kinds in use in our district, it would appear we have scarcely entered on the field open to us. In most other towns, the possibilities in this direction are much greater, and afford scope for a marvellous development.

The process of carbonization has engaged a great deal of attention in recent years; and as the outcome of such labours, the system of direct firing is being gradually displaced by the more scientific method of gaseous firing. It is now no longer necessary to go to great expense in order to secure the advantages of this mode of firing, as the process has been much simplified in the light of modern knowledge and experience. In the year 1887, an installation of 16 conservator furnaces, to the design of our esteemed Past-President Mr. Valon, was brought into action at Tunbridge Wells. The retorts are Ω -shaped, 21 inches by 15½ inches, and were first arranged with seven in a bed. It was, however, found expedient to remove the middle retort, on account of local heating; and a combustion chamber was formed the full length of the setting. The furnace arch has nostrils, four on each side, and an air channel along the crown between the nostrils, with holes opposite to them through which heated air is supplied to consume the carbonic oxide. The air is heated by passing backwards and forwards along the sides of the furnace; and the arch over the furnace is cast as low down as possible. In this way, the bottom retorts get a fair

share of the heat by conduction through the walls of the retorts in immediate proximity to the burners. Those who have devoted much attention to the application of fuel in the gaseous form, have experienced more difficulty in properly distributing the intense heat than in constructing efficient generators. But by this arrangement no local heating is experienced; each retort is evenly heated throughout, and carbonizes the same weight of coal. Some of the retorts that were brought into action in the year 1887 are still in use, having been in actual work upwards of 1000 days.

I have lately given up the employment of steam for the generator furnaces, and have adopted ash-pans supplied with water which first trickles down trays of breeze placed in front of the coke. The change became imperative, on account of the enormous amount of steam required to keep the brickwork cool, and to prevent fusion of the ash. A moderate estimate of the coke required daily to raise steam for the supply of one furnace is 1½ cwt., which amounts to something considerable in a year. It must be remembered, however, that I was working under exceptional conditions, having to deal with coke made from limed coal; and the difficulty was increased by the fact that it was necessary at times to use more than the orthodox 2½ per cent. of lime. I may say that the presence of lime in coke for heating retorts is in no way objectionable where generator furnaces are employed, if careful attention is paid to the steam supply, and if the furnaces are occasionally pricked up in the usual way. The slow initial draught at which such furnaces are worked, and the precautions that are taken in clinkering, by using false bars to keep the coke *in situ*, prevent to a very great extent the lime from getting into the setting and fusing the brickwork. Each setting has its own independent furnace clinkered regularly every twelve hours. The operation is performed without the admission of cold air to the setting; and it is done so expeditiously that I do not think I should gain much by cleaning out less frequently. The furnace doors we use at present are home-made; and although not absolutely tight, they answer the purpose very well where there is so little heat. A sheet of iron, No. 6 gauge, slides in a frame made of 1½ inch by ¾ inch iron, and is actuated by a counterbalance weight. This door is fitted with a slide for the admission of primary air. In the second half of our retort-house, where the ordinary settings are converted into shallow generators worked from the retort-house floor, a different arrangement is in use. The furnaces are 3 feet deep, and have a door at the top for charging and another at the bottom for clinkering. These doors are placed on a hollow frame provided with slides, through which the secondary air is admitted, and passes down to flues running along the sides of the furnace, and then rises to meet the carbonic oxide at the openings in the furnace arch. These shallow furnaces are not quite so economical in fuel as the larger and deeper ones; but they can be worked at a low initial draught, and the same advantages of freedom from deposit in the setting, uniform heats, and durability of retorts are in a great measure obtained. Speaking generally of gaseous firing, the facility with which the heat can be regulated to the various kinds of coal used is a great advance upon the older system. This facility, however, is not without some drawbacks; and if we are not careful, the heat will get too high, and as a natural consequence stopped pipes will abound.

The question of mechanical stoking is one which has occupied a good deal of the attention of this and other Associations during the past year. My own experience has been with West's manual machinery, of which I cannot speak too highly. Apart altogether from economy, it possesses the great advantage of simplicity, and performs the work with constancy and greater expedition than by scoop or shovel. You may take a man quite unaccustomed to retort-house work, and after very little instruction entrust him with the charging of the retorts; and he will find no difficulty in carrying out the work satisfactorily. We have for the last twelve years depended entirely upon this machinery in the retort-house, and have never experienced any serious inconvenience through a breakdown. We, however, take the precautionary measure of periodically inspecting the machinery; and every Friday, whether it requires it or not, a careful examination is made by a mechanic, and in this way inconvenience is often averted. With mechanical stoking, I have found it desirable to work single retorts. Where the charges come together in the middle of the retorts, it is a difficult matter to deposit the full quantity of coal; and I have invariably found an increase in the trouble of stopped ascension-pipes. A 9-inch block dividing the retort in the centre meets the case; and if it has a hole filled up with loam and ashes, when scurving has to be done the stopping is easily knocked out, and the retort cleaned almost with the facility of a through one.

The question of how soon the tar and gas should be separated, is one upon which opinions differ. Some engineers prefer to separate them as early as possible—say, before the temperature gets lower than 130° Fahr.; while others allow them to remain together until the temperature has been gradually lowered. In this case, where gas is slowly condensed in the presence of the tar, there is a very marked freedom from naphthalene deposits, both on the works and in the district. But this immunity is only obtained at the expense of illuminating power; and I take it that our aim should be to retain by every possible means this illuminant in the gas. At Tunbridge Wells, the Livesey and

Tanner tar and liquor overflows have been in use in all the hydraulic mains for some years. This ingenious arrangement is well known to you; and I need only say that by means of it the tar and liquor are separated in the hydraulic main, and a seal secured at all times in liquor and not tar. Each hydraulic main becomes a washer—the perforated plate breaks up the tarry globules as they pass through it; and I find that about nine-tenths of the tar is extracted in this way. This is conducted in an independent pipe straight to the storage tanks; and by the separation at this early stage, we gain three-quarters of a candle in illuminating power, which has enabled us to abolish the use of cannel. On the side of each main a casting is fixed, having a window through which the tar and liquor can be distinctly seen. Working with high heats, I find it necessary to run a small quantity of tar out of each main daily; and for this purpose a 2-inch cock is fixed in the bottom of each, immediately under the tar outlet. Thus any thick tar that might otherwise obstruct the flow is readily removed. With this precaution, the apparatus works very well indeed.

In the year 1881, the late Mr. R. P. Spice read a paper before the members of the British Association of Gas Managers on the St. John's apparatus, and its application at the gas-works of the Rochdale Corporation; and in the year 1882, on his recommendation, one was erected at Tunbridge Wells, for the purpose of preventing the deposit of naphthalene. In that respect it was, in a measure, successful. My results, however, so far as illuminating power was concerned, did not agree with those obtained at Rochdale, where cannel coal was largely employed; for, instead of getting an increase, there was a distinct reduction. May not this point to the fact that, while it is a decided advantage, when using one class of coal, to separate the tar and gas as early as possible, with another class it may be advantageous to keep them together for a longer period?

Until recently, the steam-jet exhauster had been in continuous operation at Tunbridge Wells for eleven years. It possesses many advantages—requiring no lubrication, and very little attention, being silent in action, and maintaining a perfectly steady gauge. But, on the other hand, a larger quantity of steam is required to work it; and it is often accompanied by a serious deposit of naphthalene. In our case, the exhauster was placed immediately after the St. John's apparatus, and before the condensers. The gas entered at a temperature of 90° Fahr., and was raised to 160° Fahr. by the steam. It was no unusual thing to have to clean out the condensers every month during the winter; but having them in duplicate, it was a comparatively easy matter as long as the deposit was confined to the condensers, and did not extend to the connections beyond. The condensers in question are horizontal, and consist of fourteen lengths, each having an inclination downwards; and the deposit was removed by means of steam. The naphthalene was easily dissolved, and, being kept warm, ran out at the bottom in a thick fluid, which soon solidified, and separated from the condensed steam. When the steam-jet exhauster is placed after the purifiers, and a second condenser is employed, no trouble, I am told, is experienced from naphthalene. This knowledge, however, was not enough to induce me to continue the use of the steam-jet; and in the year 1889, when it became necessary to increase the exhausting plant, the steam-jet was abandoned, and a Donkin exhauster substituted.

The various methods of effecting the purification of gas, with special regard to the removal of the sulphur compounds, I shall not refer to, further than to recount my own experiences. As most of you are aware, the coal-liming process was in continuous operation at Tunbridge Wells for many years; and although volumes have been written on this subject, you will perhaps pardon me for referring to it now. In the "Gas Engineer's Chemical Manual," Professor Wanklyn says: "If coal-liming were perfectly carried out, the gas passing up the ascension-pipe out of the retort would be quite free from sulphur in every shape." How much can be realized in actual working is quite another matter. When the lime and coal are thoroughly mixed, so as to obtain the most intimate contact practicable, the effect produced on the crude gas at the entrance to the purifiers is a reduction of about 350 grains of sulphuretted hydrogen, and 16 grains of sulphur compounds; the carbonic acid remaining about the same as in the ordinary process. My experience with various kinds of coal justifies me in giving these figures as the result that may be expected from this process, whatever kind of coal is used. Take for example a coal yielding, under ordinary treatment, a gas containing at the inlet to the purifiers 600 grains of sulphuretted hydrogen, and 28 grains of sulphur compounds, the effect of liming this coal would be to reduce the sulphuretted hydrogen to 250 grains, and the sulphur compounds to 12 grains. If, however, the coal to be operated upon contains 1200 grains of sulphuretted hydrogen, and 45 grains of sulphur compounds, the result is very different, as, when the lime has done its work, there will still be 850 grains of sulphuretted hydrogen, and 29 grains of sulphur compounds, in the crude gas at the entrance to the purifiers. In the first instance, the crude gas from the limed coal is specially amenable to treatment by air; 1 per cent. being sufficient to consume the whole of the sulphuretted hydrogen, and keep the purifiers (in which no lime was used, but oxide only) in active operation for more than a year without raising a cover—the sulphur compounds being well within the usual limits. In the second example, Cooper's process is quite inadequate to deal with the conditions.

Had that process been equally applicable to all kinds of coals, there is no doubt coal-liming would have been very generally adopted.

When we gave up coal-liming, about a year ago, lime had, of course, to be used in the purifiers, to keep the sulphur compounds within the statutory limit of 20 grains. We have six purifiers, each 20 feet square, four of which are charged with lime, and work in rotation, while the other two contain oxide. About 2 per cent. of air is admitted to the purifiers through a meter; and this, together with what unavoidably gains admission up the ascension-pipes, is sufficient to oxygenate the lime. The crude gas at the inlet to our purifiers contains, on an average, 680 grains of sulphuretted hydrogen, 800 grains of carbonic acid, and 30 grains of sulphur compounds; and we employ lime of 86 per cent. causticity. When the gas is passing through the purifiers at about the rate of 30 feet per square foot per hour, it only requires two yards of lime to purify a million cubic feet of gas; but when the rate increases, as it does in my case, to 90 feet per square foot per hour, it requires 2½ yards. With larger purifiers, or if pure oxygen were used instead of air, this increase would not take place. This system has the recommendation of simplicity. We find no difficulty in keeping the sulphur compounds at about 10 grains (the average for the year being 9.40 grains); and when the spent lime is removed, there is no objectionable smell from it.

The last gasholder erected at Tunbridge Wells has Cutler's patent guide-framing, recommended by the late Mr. Spice, whose lamented death occurred soon after the work was commenced. The principle, so far as I am able to judge, is good; consisting as it does of a braced framework of cylindrical form, in which every member is doing useful work. In his desire to be on the safe side, the patentee has certainly put into our guide-framing a great deal more metal than is necessary; but as it was the first erected according to his patent, this excess is, I think, pardonable. I hope later on you will have an opportunity of inspecting the structure for yourselves.

Before leaving this subject, there is one thing I should like to draw attention to, and that is the desirability of having some arrangement to prevent the possibility of interruption to the supply of gas through a workman closing the wrong valve. I speak feelingly in the matter, as on one occasion we unfortunately had our town in partial darkness through a mistake of this sort. But I have since averted all danger on this score by introducing, between the inlet and the outlet of our gasholders, one of Messrs. W. and B. Cowan's safety or bye-pass governors, so adjusted that it will open when the pressure at its outlet falls below that of our lightest gasholder.

As the demand for broken coke increases year by year, the question of how to dispose of the breeze to advantage naturally engages more attention. Where generator furnaces are in operation, a good deal of coke breeze can be used up; and several furnaces—notably the "Perret" and the "Meldrum"—have been invented to utilize breeze for raising steam, and have deservedly found favour. I have not had any personal experience of these furnaces; but I have often seen them at work, and have heard them spoken of very highly. So far I have been able to use up all our surplus breeze in the boiler furnaces by a simple arrangement of the fire-bars. Our boilers are of the Lancashire type, 7 feet in diameter and 24 feet long. The area of each grate is 16 superficial feet; and the bars are ½ inch thick, with a windage of ¼ inch. With this arrangement, there is no difficulty in burning coke breeze, either alone or on the top of a layer of coke; but, of course, this plan would not answer if the area of the grate were much less than that I have just given.

The manufacture of sulphate of ammonia is a process which is now conducted at most gas-works. There are in the market many admirable plants by which this work can be efficiently and economically carried on. The apparatus known as the "close saturator and open evaporator process" of the original Abbott type was in operation at Tunbridge Wells for many years, producing a beautifully white salt, which generally contained 25 per cent. of ammonia. The process, however, was slow and extravagant in fuel; and some years ago I introduced, as a temporary device, a tube 3 feet in diameter by 20 feet high, filled with thin bricks laid on edge, with a space of an inch between, each layer being placed crosswise. This made a very good still for the elimination of the free ammonia. The liquor was pumped on to a dash-plate; having been heated on its way by the fumes from the saturator. The liquor passed down this still, then through the Abbott stills, where it was treated with cream of lime, and escaped through syphons to the settling-tanks. This expedited the work very much, and made the process continuous, so far as the distillation was concerned. The evaporation, however, was slow, and required much steam; but I found great advantage by a simple alteration suggested to me. It consisted in sloping the sides of the pan towards the centre, and placing the pipes near the top on brackets instead of at the bottom. By applying the heat near the surface, evaporation takes place more quickly, and the pipes are kept free from the salt. We have now replaced the "close saturator and open evaporator" by Dr. Feldmann's apparatus, which is more economical; and it is well known that an exceedingly good sulphate of ammonia can be obtained from common pyrites acid by the direct process—the ammoniacal gases being brought into the saturator as warm as possible. I have found it an

advantage to have the lime to be used in the stills occasionally slaked with the spent liquor, not as a substitute for the laboratory test, but as a ready and forcible means of revealing the state of the liquor to the man in charge.

The distribution department, I am sure you will all agree with me, is one of growing importance. Much has been done in the past, by skill and careful supervision, to reduce the leakage, or unaccounted-for gas, and with very great success. The many uses to which gas is applied make it necessary to devote more attention to this department, so that our consumers may secure an ample supply, and use it under the best conditions. The question of pressure is one of great moment to purveyors of gas, as well as to the consumers generally; and to secure the nearest possible approach to uniformity, engineers have resorted to various methods. Many of us who have undulating districts adopt the system of zones controlled by separate governors, and, where the works are not at the lowest level, carry the gas through a trunk main to that point before distributing. But even then some parts must necessarily be supplied at excessive pressures; and it behoves us to do all in our power to acquaint our consumers with the importance of regulating the pressure at the point of ignition, and to place within their reach suitable burners at the most reasonable prices.

It is now as necessary to have our show-room for stoves, cookers, and other appliances as to have an office in the town; and if this room is heated, lighted, and ventilated by gas in the most approved manner, it will not fail to impress those who enter it, and will do much to break down the prejudice which still exists in some minds against the use of gas for such purposes as those I have just indicated. The show-room should also be provided with means for demonstrating the influence of pressure upon the lighting power, and with the various burners and globes recommended. The articles should be sold at the lowest possible price either by the gas company or some accredited agent in the town. The latter is the plan just adopted at Tunbridge Wells. We send a man to fix the burners and globes free of charge; and, by means of this introduction to the house, he is often able to make suggestions with a view to improve the existing arrangements, and so give greater satisfaction generally. There is no doubt that excessive pressures at the point of ignition, by destroying the illuminating power and needlessly vitiating the atmosphere, give rise to many complaints; and I take it that it is our duty to do all in our power to prevent this by recommending the use of self-regulating burners. Here the difficulty of price comes in. While some consumers are willing to pay 1s. or 1s. 3d. each for such burners, many hesitate to do so; and the want of a cheaper form of automatic burner has long been felt. There is another thing which militates against the progress of gas, and which unfortunately in most cases is not under the control of gas companies or corporations. I refer to the internal fittings. It is much to be desired that the builders in our respective towns should adopt a standard size of fittings approved of by the gas authorities. I know this is a difficult thing to bring about; but the difficulty is surely not insuperable.

Gentlemen, we stand confronted at the present time with two rivals of a more or less formidable nature—oil and electricity. Petroleum at popular prices is a powerful competitor with gas. The improvements which have taken place in oil-lamps, both as regards their efficiency, safety, artistic appearance and cheapness, have certainly brought oil not only into more general favour as a supplementary agent to gas in shops, but these lamps of beautiful design are superseding gas in many drawing-rooms. It is a popular notion that the atmosphere of a room is more healthy where oil is used than where gas is employed. Of course, the degree of vitiation of the atmosphere by oil and gas respectively was settled long ago by the late Dr. Letheby; but in spite of that, we are constantly being met with the assertion that oil is a more healthy means of illumination. This is doubtless owing in a great measure to the fact that, when oil is used, a large part of the room remains in semi-darkness; whereas when gas is employed more light is made use of, and the whole of the room is illuminated. I have examined the various kinds of oil used in my own district, with a view of ascertaining the amount of sulphur given off in combustion as compared with gas. The oil was burnt in the Referees sulphur apparatus, and treated in exactly the same way as prescribed for gas. Comparing them on their relative illuminating value, the following are the results, taking 52·5 grains of oil as equivalent to 1-candle power per hour, and 1 cubic foot of gas as equal to 3·2 candles per hour:—

Petroleum Oils.

Sample No.	Retail Price per Gallon.	Sulphur in Oil equal to 100 Cubic Feet of 16-Candle Gas.	
		s. d.	Grains.
1	0 8	..	5·04
2	0 10	..	2·52
3	1 2	..	2·35
4	1 2	..	2·30
5	1 3	..	1·68
6	1 6	..	3·36

Paraffin Oils.

1	0 8	..	6·72
2	0 10	..	4·03
3	1 0	..	2·35
4	1 2	..	3·86

These results show the oils to be very pure so far as sulphur is concerned; and it behoves us to see that the sulphur compounds in our gas are kept well under. I cannot, however, believe that 10 or 12 grains can have any appreciable effect on the atmosphere of a room.

A word about the electric light. It will be within the recollection of all here with what a flourish of trumpets the telegraphic announcement was made of an important discovery by Edison in connection with the sub-division of the electric light. Then followed the promotion of many electric light companies; and in the year 1882, the Electrical Exhibition at the Crystal Palace. It soon became apparent, however, that a great deal had yet to be done before the light would be available for ordinary use; and much capital was frittered away in vain attempts to introduce crude and impracticable inventions, and many of these companies utterly collapsed. After ten years, we are again reminded of these events by another exhibition of a similar character; but during this period there can be no doubt that important improvements have been made in the machinery generally. The present exhibition is supplied with the electric current from a central station in the neighbourhood. There are several of these in London now, fitted with compact engines and dynamos on the same bed-plate; and it is the almost invariable practice at these stations to dispense with belting, and couple the dynamos direct to high-speed engines, of which there are numerous types. For small installations, gas-engines are very generally employed; and this I think we may regard as a hopeful feature from our point of view. It, however, places obligations upon gas companies that they are not always able to meet. I heard the other day of an engineer who was seriously thinking of abandoning gas-engines, simply because in foggy weather the pressure of gas is reduced to such an extent that he cannot work his engines properly when he has most need of the light. If electric motors come into general use (and there is every likelihood of much being done in this direction), it will have the direct effect of cheapening the light, as the current will be utilized by day. That the electric light is finding favour, we cannot deny; but I presume the public will judge it from the regularity of supply and price. How much dearer it is than gas is difficult to determine, but any comparison is greatly in favour of gas.

The wide field which has been opened up for gas as a fuel has taxed the skill and ingenuity of enterprising manufacturers to provide the many different appliances for the public needs. Great as have been the improvements in stoves, there is still a good deal to be desired; and I for one shall be glad when some means have been devised to render all gas-fires perfectly silent, and when all such appliances are sent out with automatic regulators to prevent the wasteful use of gas, which gives rise to dissatisfaction and handicaps us in the race. It is now imperative to keep inspectors who are thoroughly competent to advise consumers, not only as to the best means of lighting their houses, but on all points connected with gas as a fuel. Services should be laid free—or to such an extent as to make them practically free; and all appliances for heating purposes should be fixed free of cost to the consumers. I think we shall all agree that deposits should only be exacted in exceptional cases; and anything that constitutes a barrier to the extended use of gas should be as far as possible removed. I know of nothing that oil or the electric light can accomplish as an artificial means of illumination that cannot be equally well effected by gas. To maintain the supremacy, however, which it has so long enjoyed, our best energies must be devoted, not only to the cheapening of its production, but to the education of the public in its proper use. We must let the people see that their interests are inseparably bound up with ours; then, formidable as our rivals undoubtedly are, I am sure we need have no fear for the future prosperity of our industry.

And now, gentlemen, I feel I have trespassed long enough upon your patience; and, in conclusion, may I ask the members to do all in their power to make this year a useful one to the Association generally? When the great German poet Goethe lay dying, it is said that he kept uttering the words "More light! More light!" That, in a multitude of directions, and with every variety of meaning, is the great cry of the present day—"More light!" It is our function to provide men with light—physical, artificial light—and we want to do the best we can for them. In order to do this, let us diffuse among ourselves such intellectual light as we may possess; sharing freely with other members of our Association whatever new light we may gain to aid us in the industry which we serve, and which in turn serves us. There are subjects of paramount interest, that are now engaging the attention of our profession, about which many of us would be glad to have the benefit of the knowledge gained by those who have had practical experience of them. We have enrolled amongst our number engineers who are experimenting with inclined retorts, water gas, and other systems that have for their object the cheapening of the production of our staple commodity; whilst others are doing much to popularize it and bring it into the homes of the working classes. I trust these gentlemen will come forward and give us the benefit of their investigations, so that our Secretary may have no difficulty in arranging for papers during the ensuing year. For myself, I should not have ventured to occupy this chair, if I had not felt that the success of the Association depends chiefly on the members themselves; and as one of you, I must claim your kind indulgence for whatever may

be my shortcomings in performing the duties of the responsible office which you have seen fit to ask me to occupy.

Mr. E. BOTLEY (Hastings) said as a near neighbour of the President, and knowing that he was in charge of one of the model gas-works of England, he wished to congratulate him on his address, which was full of points, and comprehensively and admirably written. He was sure the members would accord him a hearty vote of thanks.

Mr. NORTON H. HUMPHRYS (Salisbury) had much pleasure in seconding the proposition. The President, he observed, had dipped very deeply into his private note-book, and had placed a large amount of personal information at the disposal of the members, for which their best thanks were due to him.

The motion was heartily concurred in by the members.

The PRESIDENT, in acknowledging the vote, said he had experienced the utmost difficulty in finding matter for the address; and if he had succeeded in interesting the members in any small degree, he was very pleased.

THE PENTANE STANDARD.

The PRESIDENT announced that Mr. William Sugg was present, and had a communication to make to the members relative to the pentane standard.

Mr. SUGG said that the Secretary had kindly invited him to the meeting; and, as he was present, he (the speaker) thought that perhaps the members would like to hear something about the pentane standard, and, he might say, that in all probability they would hear a great deal more about it before long. A Commission had been appointed to investigate the question of the standard of light; and it was no doubt due to Mr. George Livesey that a practical start had been made in the matter. For a number of years, they had been using candles for the purpose of testing gas; and there had been a considerable amount of difficulty and trouble with them. Gas companies were often condemned for supplying gas below the standard, when it was really above it. This had been going on for a long time; and he had been advocating the adoption of a different standard for a good many years. But had it not been for this new effort made by Mr. Livesey, he did not think they would have been any nearer to a change six years hence than at the present time. However, Mr. Livesey had been instrumental in getting the new Commission appointed; and it now looked as if they would get a standard which would be both useful and correct. He believed the greatest difficulty the Commission had to overcome was the determination of what a parliamentary candle was. It was a very hard matter, as most of the members were aware, to determine what amount of light a parliamentary candle (of six to the pound) should give. The candles varied a great deal; and they had done so from time immemorial. The only thing they had been able to do, to get anything like an approximation of the true value of their illuminating power, was to make a certain number of experiments, and divide the errors of the candles over them. Therefore, before a proper start could be made in the adoption of a new standard, the difficulty would be to decide what a candle really was. This had been tried by Mr. Vernon Harcourt. He (Mr. Sugg) believed that some time ago a paper was brought before the Association by Mr. Methven, in which he referred to the pentane standard as proposed by Mr. Harcourt. That was a single-candle standard. It was proposed to make a gas of pentane, which was mixed with atmospheric air in a gasholder. There was no doubt, by this means, they would have a standard gas which might be produced many times over, and at any time. There would be no possibility of a variation of the pentane to any extent; or, he might say, it would be so slight that it could be disregarded altogether. The gas gave a light very similar to that of a candle; but as to whether it represented a candle flame, it had been difficult to decide. Both Mr. Methven and himself thought the standard was greater in illuminating power than the parliamentary candle—that was to say, if they took a number of candles made by Messrs. Miller and Co., or Messrs. Brecknell, Turner, and Co. (say, 100), and tried a number of experiments, the result would be that the single-candle pentane standard of Mr. Harcourt would be found to be higher than the average candle. There was a way of getting over this difficulty, and finding out what a candle was. The French Government had had a standard in use since 1868—the Carcel lamp—in which a certain quantity of colza oil was burnt, and which had been found, by independent experiments, to be equal to 9.5 candles. This oil was so carefully manufactured and tested by the French Government, that there was very little doubt that they might take it as being more accurate than the spermaceti candle. The candle, as he had observed, was subject to variations. With oil taken from the head of a spermaceti whale or a bottle-nosed whale, there must be differences in the illuminating power of the oil thus produced, or at least it was believed so. Then in the manufacture, the sperm oil had to be pressed out; and, as far as he had been able to learn, none of the makers of spermaceti had ever noted what was the amount of pressure put upon the spermaceti-bag. Some used one pressure, and some another—there was no regularity in it, though there might have been a little since Mr. Miller's attention had been called to it. If the spermaceti was squeezed too much, they obtained from it more of the free oil. If they did not get out all the oil, and left the flocculent substance dry, it was certain that they lowered

the temperature at which the candle would melt; and consequently, the energy of the flame not having to melt it before being burnt, it gave a greater amount of light than if the spermaceti was very strongly compressed. Then there were difficulties with the cotton wicks, which he did not think it was necessary to refer to. Now with regard to the pentane, two ways had been proposed for making the gas. One was to put a certain quantity of pentane in a gasholder filled with a certain quantity of air. This might be done very readily by sealing up the quantity required for a charge in a bottle, and putting it into the holder; and, when the top of the opening in the holder was screwed down, they would always be certain of having the same quantity, and none would be lost. In the other plan, a gasholder was filled with air, which was passed through a carburetter. This was simply a flat box in which the gas passed backwards and forwards over pentane. The air took up a certain quantity of the latter; and made pentane air gas. This was much easier than the first-mentioned plan; but both arrived at the same result as regarded the standard light given, providing that the quantity of gas supplied was checked at the foot of the burner. The reason for this would be seen. If the gas happened to have a little more illuminating power than it should possess, less of it would be required to give the requisite height of flame in the burner; but if it was less than it should be, then more of it would be needed. This was a point which was most important. The standard seemed to be perfectly simple; and from a trial that had been made, it appeared to give accurate results. Some years ago there was a conference held of Engineers of the London Gas Companies on this question, to which he (Mr. Sugg) was invited. The matter was discussed at great length; and they decided that the pentane air gas would be the best standard to adopt in place of the candle, and the best way to use it would be in an Argand burner that would give the same amount of light as was required of the gas to be tested. Then they might have a burner at each end of the photometer and the disc in the middle; so that the effect of the state of the atmosphere and temperature and barometric pressure would be the same on both burners, and no correction would be necessary. This was agreed to; and he was asked to make a burner which would give a light of 16 candles. This was no difficult thing to do; and they made one like that which he had with him. [Mr. Sugg exhibited the burner, and explained its construction.] The burner was an Argand, with about 30 holes—a little smaller than they had for ordinary gas. Then there were two screens of blue glass to protect the eyes of the gas examiner from the flame, which was very bright. There was a cut-off line at the top part of the flame; and the light below that to the top part of the burner was equal to 16 candles. The rate of consumption per hour was about 1.8 cubic feet of air and pentane together. This appeared to be a surprisingly small quantity for the light given; but the pentane was very rich, and one pint lasted about three hours. There did not seem to be any variation from the start to the finish, except that the flame dropped down as evaporation of the pentane took place, and then all that had to be done was occasionally to turn the tap on a little to get the flame up to the line. There was another thing that should be borne in mind; and it was this: That if the flame was turned up too full, the illuminating power was reduced, and if it was turned down too low it was also reduced; so that all that had to be done was to keep it up to the 16 candles. Now, there was no doubt that here they had the standard; and to Mr. Harcourt belonged the credit of having proposed pentane for making the standard gas.

Mr. J. METHVEN (London), having been invited by the President to speak on the subject, said he was afraid this portion of the proceedings was to a certain extent informal. It was true he had had an intimation on the previous day that Mr. Sugg had kindly offered to give the meeting some information respecting this standard; but at the same time he did not expect to be asked to make any remarks on the question. There was one matter to which he might, however, allude; and it was this: That the difficulty the Standards of Light Commission had before them was, as Mr. Sugg had suggested, to ascertain the correct relation which existed between the various standards that had been proposed and the actual candle. It would be in the recollection of the members that, when he read his paper on photometry some two years ago, he explained that the screen which bore his name, and which was now rather extensively used, possessed a value (according to some experiments which he had made, and which were recorded in the paper) 2.8 per cent. higher than the candles which he used for determining the illuminating power of the gas. The system he adopted was to use the candles daily in the manner prescribed in the Instructions of the Gas Referees. The tests were made with three pairs of candles; and the screen was placed in position, and the value of the gas noted. The experiments were conducted over a period of thirteen or fourteen months; and the results of his records showed that the mean power of the screen was 2.8 per cent. higher than the candles. He maintained that this investigation was worthy of a considerable amount of attention, because the experiments were made daily, and extended over such a long period, which embraced every possible condition of the atmosphere during the year. There was another point, now that he was speaking, to which he might allude. The standard which Mr. Sugg had shown possessed great advantage, inasmuch as

they were comparing the light to be tested with a light something like its own power; and therefore, if there were any atmospheric conditions which operated on the one, they would naturally operate on the other, so no correction would have to be made in that way. There was a further point which Mr. Sugg might be able to explain, or perhaps he (Mr. Methven) might be wrong. It was this: That the difficulty he could see in using a 16-candle standard was—when they had a 16-candle light at one end of the bar, and the gas to be tested at something like 16 candles at the other end—how they were to estimate the difference between the two on the photometers at present in use. The travel, as far as he could then remember, between 16 and 17 candles was about $\frac{3}{8}$ inch. [Mr. Sugg: A little over that.] And he maintained that the distance the disc would have to travel would be so infinitesimally small that there would be some difficulty in estimating (say) a $\frac{1}{4}$ candle between the two. He might remark that he had not worked this out; and it might perhaps be all imagination on his part.

As the time allotted to the business portion of the meeting had expired, there was no further discussion on the subject.

The members and several friends then had dinner together; and an enjoyable evening was spent.

MIDLAND ASSOCIATION OF GAS MANAGERS.

The Fifteenth Annual Meeting of this Association was held at the Grand Hotel, Birmingham, on Thursday last. On the members assembling,

Mr. J. S. REEVES (Bilston) said a telegram had been received stating that the President, Mr. W. Littlewood, was seriously indisposed, and was unable to attend. He, therefore, moved that Mr. R. O. Paterson, of Cheltenham, should take the chair.

Mr. LEWIS seconded the motion, and it was carried.

The CHAIRMAN said he was exceedingly sorry to occupy the chair under these circumstances. He was sure they would allow him to say, on their behalf, that they sincerely sympathized with their President in his sudden illness. They could, under the circumstances, only take the formal business of the meeting; and if when this was transacted Mr. Hunt had arrived, he would introduce a discussion on the present methods of testing gas, which he had undertaken to bring before them. Mr. Hunt was, however, engaged for a time with his Committee; and this had prevented his arrival.

The HON. SECRETARY (Mr. C. Meiklejohn) said the telegram with regard to the President stated "Littlewood has been seized with sudden and serious indisposition, preventing his attending the meeting to-day. He had a letter of apology from Mr. Ellery, of Bath." The Secretary then read the minutes of the last meeting.

The CHAIRMAN said the only thing that arose upon the minutes of the last meeting was in relation to Mr. Elliott's retort-charging apparatus. Mr. Elliott was present and might, if he wished, explain the position of matters; but he (the Chairman) wished to intimate that the Sub-Committee appointed at the last meeting, had been endeavouring to have an investigation of Mr. Elliott's apparatus made at Ludlow. But after the last meeting of the Association, Mr. Elliott, finding that the Committee would have a useless journey to Ludlow to see the apparatus, unless he could completely isolate the continuous retorts from his other plant, and that very little good would be done, at once made arrangements to have this carried out. Owing, however, to the extreme strain upon gas-works in the winter, Mr. Elliott had been prevented carrying this out as speedily as was anticipated. He understood that Mr. Elliott had now completed the work, and lighted up his retorts; and the Committee would be able to report upon the subject at their next meeting, when the discussion on Mr. Hack's paper on Mr. Elliott's principle of continuous carbonization could be taken. With this explanation, he asked the meeting if it was their pleasure that he signed the minutes.

This was agreed to.

ANNUAL REPORT.

The annual report of the Committee for 1891, and statement of accounts for the same period were then presented, as follows:—

The Committee have pleasure in submitting the following report for 1891.

The annual meeting was held in Birmingham on March 5, 1891—the President (Mr. C. Stafford Ellery, of Bath) in the chair. After the disposal of the routine business, the President delivered his Inaugural Address, in which he ably reviewed the various departments, and apparatus employed therein, which go to make up a complete gas undertaking of modern times; touching, in passing, on methods of enriching coal gas, and the electric light as a competitor.

On the conclusion of the presidential address, which was listened to with pleasure and attention, a very interesting discussion took place on the paper read by Mr. J. T. Lewis (of Wellingborough) at the previous meeting of the Association; the subject being "Weekly and Monthly Payments for Gas."

Your Committee desire to express the hope that the members generally will take part in the discussion of the various subjects brought before the Association from time to time, believing, as they do, that in this particular direction "in the multitude of counsellors there is wisdom."

At this meeting an innovation was introduced by the informal discussion of a subject suggested during the meeting. Mr. R. O. Paterson raised the question as to "The effect produced on the illuminating power of gas by the introduction of small quantities of air in the course of purification." A very interesting conversation followed; and the opportunity this method of discussion presents of affording a solution to any difficult problem will prove extremely helpful, if the members avail themselves of it.

The spring meeting was held in Leamington and Warwick, in response to the joint invitation of Messrs. Cross and Tew, on May 21, 1891. A most enjoyable day was spent in visiting Warwick Castle, the Leicester Hospital, and St. Mary's Church. After partaking of light refreshment in the Market Hall, which was graced by the presence of Mrs. Cross and Mrs. Tew, the return drive through Milverton and Binswood brought the members back to the gas-works, Leamington, which were inspected under the guidance of Mr. Cross, who directed attention to the method adopted by him to render the spent lime inodorous before its removal from the purifiers. The members were subsequently entertained to dinner at the Manor House Hotel by the Directors of the two Gas Companies, and the thanks of the Association were tendered to Messrs. Cross and Tew for the trouble they had taken in making the visit so pleasant; and they were asked to convey to their respective Directors the thanks of the Association for their kindness and hospitality.

The third general meeting of the Association was held at the Great Western Hotel, Birmingham, on Thursday, Oct. 22, 1891. The following officers were unanimously elected: President, Mr. W. Littlewood, West Bromwich; Honorary Treasurer, Mr. P. Simpson, Rugby; Honorary Secretary, Mr. C. Meiklejohn, Oldbury; Auditors, Mr. W. W. Hulse, Longton, and Mr. J. C. Belton, Wellington. Committee: Messrs. Cranmer and Hughes were elected to succeed Messrs. Littlewood and Bell, who retire; and Mr. J. S. Reeves was elected in place of the late Mr. Deakes. A very able paper was read by Mr. Hack, on "Elliott's Process of Continuous Carbonization." But the discussion was postponed; and it was thought advisable to appoint a Sub-Committee, consisting of the President, Ex-President, and Messrs. Paterson and Hack, to examine the process at Ludlow in the meantime, and report to a future meeting. The members subsequently paid a visit to the Birmingham Oxygen Company's works, and were much interested in the manufacture of oxygen, and in seeing the columnless gasholder, erected on the Mason and Gadd principle by Messrs. R. and J. Dempster, for the storing of the gas.

Four new members have been added during the year, and the Association has lost one by withdrawal; and, with much regret, they have to announce one by death—Mr. Deakes, of Worcester.

On behalf of the Committee,

WM. LITTLEWOOD, President.

C. MEIKLEJOHN, Hon. Secretary.

The CHAIRMAN moved the adoption of the report and accounts.

Mr. LEWIS seconded the motion, and it was carried.

ELECTION OF NEW MEMBERS.

The SECRETARY said that the names of three new members had been considered by the Committee, and were recommended for election. They were: Mr. E. L. Adlington (Manager of the Worcester Gas-Works), Mr. James Gould (Manager of the Bewdley Gas-Works), and Mr. John M'Coll (Manager of the Halesowen Gas-Works).

The CHAIRMAN proposed that they be accepted as members of the Association.

This was seconded by Mr. TAPLAY and carried.

A vote of thanks to the Chairman closed the proceedings.

The members afterwards visited the works of Messrs. Thos. Piggott and Co., Hooper Street, Spring Hill, Birmingham, for the purpose of seeing the Sutherland arrangement of water-gas plant there, and witnessing the application of the gas for welding wrought-iron tubes.

On their return, they dined together at the Grand Hotel.

Mr. J. W. Auchterlonie, who has been for about twelve years in the service of the St. Andrews Gas Company, has been appointed, from a list of 46 applicants, Manager of the gas-works at Mullingar, County Meath, Ireland.

The Spontaneous Combustion of Coal.—At the Society of Arts last Wednesday week, Professor Vivian B. Lewes, F.I.C., F.C.S., read a paper dealing with the above subject. It was mainly on the lines of the communication he submitted to the Institution of Naval Architects about two years ago, a full abstract of which appeared in the JOURNAL. As to storing coal on land, the author recommended that the store should be well roofed in, and have an iron floor bedded in cement; all supports passing through and in contact with the coal to be of iron or brick. If hollow supports were used, they should be cast solid with cement. The coal should never be stored during wet weather; and the depth in the store should not exceed 8 feet, and should only be 6 feet wherever possible. Under no condition must a steam or exhaust pipe or flue be allowed in or near any wall of the store; nor must the store be within 20 feet of any boiler, furnace, or bench of retorts. No coal should be stored or shipped to distant ports until at least a month had elapsed since it was brought to the surface. Every care should be taken during loading or storing to prevent breaking or crushing of the coal; and on no account must a large accumulation of small coal be permitted. These precautions, if properly carried out, would, the author said, amply suffice to entirely do away with spontaneous ignition in coal stored on land. He then proceeded to describe in detail the measures to be adopted to prevent spontaneous ignition on board ship. He recommended the placing, in various parts of the heap of coal, of steel cylinders, containing liquid carbonic acid gas, having nozzels fitted with a plug of an alloy melting at 200° F., or 93° C. Should the temperature reach this point, the plug would melt, and allow the whole contents to be blown out over the surrounding coal—producing a large zone of intense cold. The initial cost of the steel cylinders once overcome, the expenses would not be worth considering; but he expressed the opinion that the precautions he suggested would never be adopted by the owners of colliers, unless pressure was brought to bear upon them, owing to the slight extra expense and trouble involved. The discussion which followed the paper dealt chiefly with the branch of the subject relating to the carriage of coal in ships.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

The Inclination of Foul Mains.

SIR,—My attention has been drawn to Mr. Humphrys' communication in your issue of the 8th inst. (p. 445), in which he says that he is much gratified to learn, from my Inaugural Address recently delivered to the Manchester District Institution of Gas Engineers, that my experiences fully support the views on the above subject laid down in his book on "The Chemistry of Gas Lighting," and also in a paper read by him before the South-West of England District Association of Gas Managers on Sept. 9, 1890. Now, suffice it to say that I have not seen Mr. Humphrys' book, neither am I acquainted with any portion of its contents. I have, however, referred to his paper, and find that his object in reversing the fall of the foul main is to convey the condensed matter back to the hydraulic main, to thin the pitchy matter deposited there, and cause it to flow off more readily. But no claim whatever is made for enriching the gas by reversing the fall of the foul main; neither is any heat employed or recommended in the manner described by me. I, of course, cannot allow any priority of claim, as my arrangement was erected in the summer of 1882, and no alteration or addition has been made since it was first put up. It has been in constant use (say) for a period of 9½ years, and has never occasioned the slightest trouble whatever.

I shall be pleased to show the arrangement to any of my *confrères*, and to give any information regarding its working. In fact, I should be pleased if anything could be done, by forming a Committee, to elucidate this most problematical question, which is of such vital importance to the gas industry.

Lancaster, March 10, 1892.

CHARLES ARMITAGE.

Regulating the Seal in, and Drawing off Tar from, Hydraulic Mains.

SIR,—In your issue of the 8th inst., you give a sketch of an arrangement, which has been patented, for drawing off the tar from, and regulating the seal of, the hydraulic main. Is that not an old friend, with not a new face, for which see the JOURNAL for Dec. 16, 1879? J. H.

March 12, 1892.

A Collapse of the Electric Light in the Crystal Palace Picture Gallery.

SIR,—Probably most of your readers who have visited the Electrical Exhibition now being held at the Crystal Palace have noticed the extensive incandescent lighting of the picture gallery, where a large number of lamps, arranged in groups of three each, are suspended in two rows running from one end of the gallery to the other. On Saturday evening last, I happened to be in the picture gallery when, at about 7.20, all the incandescent lamps mentioned suddenly went out, leaving the place in darkness. The gallery was fairly well filled with visitors at the time; and one of the officials, in order to prevent collisions, commenced calling out "keep to the right." This state of things lasted from five to ten minutes, when the lamps lit up again as suddenly as they had gone out; but enough time had elapsed for any mischievous person to have done considerable damage to the paintings without fear of detection. Upon inquiring of one of the Palace officials, he informed me that the light went out "quite accidentally."

The above would suggest, notwithstanding the large number of electric lights in the nave, that the possibility of a similar thing happening there is the reason why the management keep the old gas-jets near the roof just alight, which could be instantly turned up in the event of "the light of the future" failing in that much-frequented part of the Palace.

Croydon, March 14, 1892.

R. GARRAWAY RICE, F.S.A.

The London Smoke and Fog Plague and the London County Council.

SIR,—It is encouraging to know that the Progressive phalanx of the London County Council has inscribed on its banner of "Excelsior" the acquirement of the gas supply undertakings of Greater London. I trust that the consideration of this desideratum will now take precedence of the acquirement of the water-works.

It may be stated, with a near degree of accuracy, that every £1000 expended in the extension of the gas-works by the present Companies will involve an additional expense of double this sum—or £2000—whenever the gas-works have to be transferred; whereas the water-works are not likely to be extended before the time comes when their transference will be compulsory.

The delay which has occurred in acquiring the gas-works between the years 1860 and 1890 will cost the London ratepayers about £13,000,000 sterling; and it may be computed that another delay of ten years would probably mean an addition to the cost of the works equal to £5,000,000. A great part of this amount would be saved by immediate action on the part of the London County Council; and this saving alone would be a substantial advance towards the payment of the purchase-money for the water-works undertakings. In some quarters it is urged that only the net amount invested in the gas undertakings should be paid. But this would be palpably unfair, because a very great number of the gas shares have been purchased at a premium; and the present interest of 12 or 13 per cent. on the par or original value of the shares is only equivalent to 5 per cent. on the amount actually paid for the shares by many of the present owners.

The citizens of London have neglected their municipal duties in the past by not acquiring, like the citizens and burgesses of most of the flourishing cities and towns in England (such as Birmingham, Bradford, Manchester, Leeds, and Glasgow), their municipal undertakings; and this unfortunate neglect will have to be paid for. There is no shirking this fact.

The suggestion first made by me that a low candle-power gas should

be supplied has been supported and admirably supplemented by one of your contemporaries. It is, however, considering the present opinions of the majority of the members of the London County Council, very doubtful whether Parliament would allow the Gas Companies to supply a gas of lower standard luminous value than the present one until the gas undertakings are acquired by the London ratepayers. The present statutory candle power cannot be obtained from the English gas coal *per se*. The result is that cannel, which is becoming gradually exhausted and more costly in the measure of its exhaustion, has to be utilized, or in its place an expensive liquid hydrocarbon; and this adds considerably to the cost of the gas.

The standard or statutory candle power that could be fixed for English gas coal is 14½ or 14¾ candles. This value would enable the coals to be economically distilled; and it may be said that the reduction of the photometrical standard to the figure indicated would be a saving both for the public and for the gas shareholders. The proportion of gain could be divided between the consumers and the gas shareholders, in the relation of three to the former and one to the latter—a proportion that could be insisted upon, in return for the permission to reduce the photometrical standard. I have already shown, in my articles "On Luminous and Non-Luminous Combustion,"* that for luminous efficiency the more intimate the connection of the elements of hydrogen and carbon constituting the hydrocarbons, the better; but for thermic value this is not so. Non-luminous fuel gas can be produced to give a specific thermic or heat value for much less than the cost of the statutory candle gas of the London Gas Companies; and in the event of the acquirement of the London gas undertakings by the County Council, the first duty will be to discover what is the lowest photometric value that will give the best results both for lighting and heating purposes, and the general supply and use of this fuel gas will for ever abolish the smoke characteristics of London fogs.

The practical advantages following a scientific procedure in the use of fuel have been conspicuously demonstrated by Messrs. Brunner, Mond, and Co., Limited, who, thanks to the initiative of Mr. Ludwig Mond, have adopted a similar system to that advocated by the author as the one and only natural remedy for removing the curse of London—the smoke fog. Here, in these phenomenally successful works, the fuel is converted into a gaseous condition, the nitrogenous elements being recovered and converted into a condition suitable for agricultural assimilation. The effect is advantageous both from pecuniarily and naturally economic and hygienic grounds.

As already pointed out, the powers for creating "stock" would enable the London County Council to purchase the London gas undertakings; the shareholders would merely require to take County Council bonds in place of their gas company's scrip. When once the municipalization of the London gas supply undertakings is effected, the electric light distribution would follow, and the two handmaids for the benefit of man—one the fuel gas for domestic heating, for driving motors, for electric light generation in numerous and well-distributed centres; the other, the distribution of electric energy for light and power—would be controlled by the chosen representatives of the millions of units that compose the population of the Great City. Actinic light would then replace non-actinic luminosity, and pure mist fog would replace the deadly black and sinister pall-like fog.

Liverpool, March 4, 1892.

B. H. THWAITE.

The Supply of Hydraulic Power.—At the tenth annual general meeting of the Hydraulic Power Company, held recently, the Chairman (Sir J. J. Allport) stated that there had been the same progress in the Company's affairs during the past twelve months as had occurred in previous years; and he hoped this would continue. The increase in the number of machines supplied with hydraulic power was 1022 in 1889, 1256 in 1890, and 1503 in 1891. The number of gallons of water pumped in the three years was 163 million, 206 million, and 267 million; while the number of gallons registered was 30, 33, and 36 millions respectively. The length of mains in London was 38 miles in 1889, 46 miles in 1890, and 53½ miles in 1891; the gross receipts being £25,662 in 1889, £31,491 in 1890, and £38,377 in 1891.

The Grimwirth Reservoir of the Bradford Corporation.—At an important meeting held recently of the owners and occupiers of mills on the Rivers Wharfe and Dibb interested in the Grimwirth reservoir of the Bradford Corporation, a report was received from the three representative millowners appointed at the meeting held in December last to take action on behalf of the millowners generally for the enforcement of the obligations of the Corporation with reference to the restoration of the capacity of the reservoir, and for the obtaining of compensation for the loss sustained in the past through the deficiency in its capacity. The report stated that the representatives, acting under the advice of Counsel, had instituted proceedings against the Corporation for a *mandamus* to compel them to cleanse out the reservoir in accordance with the provisions of the Bradford Water-Works Act, 1854, and also to make compensation for the loss sustained in the past. They also reported that they had, together with the aid of their legal and engineering advisers, carefully examined and considered the provisions of the new Bill introduced this session by the Corporation, which contained several provisions affecting the interests of the millowners. They had entered into negotiations with the Corporation for the settlement of the action, and for the insertion of clauses in the Bill protective of their interests; and they were able to report to the meeting that terms of arrangement had been arrived at, which they were prepared to recommend the millowners to accept. Clauses for insertion in the Bill had also been agreed upon, subject to approval by the millowners. The effect of the proposed terms of arrangement and clauses was to restore the capacity of the reservoir by enlargement in accordance with plans deposited by them, in lieu of cleansing out; to enlarge one of the residuum lodges, so as to contain an area of about seven acres; and also to pay a specified amount to the millowners as compensation for the loss sustained by them in the past through the deficiency in the capacity of the reservoir. The action of the Committee was unanimously approved.

* See JOURNAL, Vol. LVI., LVII., and LVIII.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress was made with Bills last week :—

Bill read a second time : Llanbradach District and Aber Valley Water Bill.

Bills committed : Bristol Gas Bill ; Cleator Moor Local Board (Gas) Bill.

Bills referred to a Select Committee, consisting of Earl Ravensworth (Chairman), Lord De Ros, Lord Windsor, Lord Truro, and Lord Shute ; to meet on Tuesday March 15 : Ashton-under-Lyne, Stalybridge, and Dukinfield (District) Water Bill ; Barrow-in-Furness Corporation Water Bill ; Bradford Corporation Water Bill ; Oxford Gas Bill ; Southborough Local Board (Gas) Bill ; Swinton and Pendlebury Local Board Bill.

Petitions against the Llanbradach District and Aber Valley Water Bill were presented from Harry St. Aubyn Goodrich and others ; owners, lessees, and occupiers of lands, &c. ; and the Bedwellty Local Board.

HOUSE OF COMMONS.

Tuesday, March 8.

BIRMINGHAM CORPORATION WATER BILL.

Mr. J. CHAMBERLAIN, in moving the second reading of this Bill, said it proposed to obtain a supply of water for Birmingham and the neighbourhood from a district in Wales, where rose the head waters of the Elan and the Claerwen, two small tributaries of the Wye. It provided for the wants not only of the city of Birmingham, but also of important towns, villages, and hamlets all along the route for 15 miles on either side of the aqueduct. There were two towns of importance—Wolverhampton and Worcester—and, in addition to these, there was the possibility that other towns, such as West Bromwich, Wednesbury, and other places, might hereafter find it to their interest to take advantage of the Bill. Altogether, the population concerned at the present time was about 1,250,000 ; and the necessity for some additional provision for water supply was urgent. In fact, the action of the Corporation of Birmingham had been delayed owing to the magnitude of the task, and to their desire not to incur fresh responsibility before it was absolutely necessary. The city of Birmingham acquired its water-works in 1876 ; the average of the daily demand at that time being 8½ million gallons. Since then it had more than doubled, and was now 17 million gallons. The supply of the present works and reservoirs was about 20 million gallons per diem. Consequently, it was clear that the maximum supply would be insufficient for the average demand that would arise in the next few years, while it was now insufficient for any extraordinary demand ; and in a year of drought like 1887, the population would probably have to go short. It was calculated that the proposed works would take ten years to complete ; and it was evident that, before they were finished, if they were undertaken immediately, the town and the district would be exposed to considerable difficulties in respect of water. In endeavouring to supply the deficiency, the Corporation, in the first instance, considered their local resources ; and naturally so, because if these had been sufficient, gigantic expense would have been avoided. The water was now derived partly from rivers, but chiefly from one small river called the Bourne, and partly from deep wells sunk in the sandstone. There was reason to fear that, with the increase of the population, these sources would no longer yield water of the absolute purity now required by the sanitary authorities. It consequently became necessary for the Corporation to seek a supply at a distance ; and they were confined within a very limited area for certain physical reasons. The average height of Birmingham was 400 to 500 feet above the sea-level, and therefore any supply of water by gravitation must itself come from a height of 800 feet above the sea-level. The lands proposed to be taken were at the top of the watershed of the head waters of the Wye ; and, being at this level, they could supply Birmingham, while the watershed generally would be incapable of doing so, although it would supply many other large towns. The particular position selected was recommended some 20 years ago by Sir R. Rawlinson, C.B., who had been employed by the Corporation to report on the water supply, and was adopted by Mr. J. W. Gray, M. Inst. C.E., the City Engineer. The Bill providing for a supply of water from this district contemplated a conduit which would ultimately contain five great pipes, although it was proposed only to lay down two at first and to add more as might be required. It was proposed to take the whole of the watershed, which covered an area of 70 square miles, in order to secure absolute control over the purity of the water ; but it was not intended to interfere more than was really necessary with the use of the land or with any persons having rights therein. The Bill contemplated the ultimate outlay of £6,000,000, although in the first instance the expenditure would be about £3,000,000. It was hoped to provide the money for the undertaking partly by an increase in the water-rate, although this increase would not be equal to the decrease which had taken place in the rate since the Corporation had acquired the water-works. Some opposition to the Bill had been announced in the name of the honourable member for Merionethshire (Mr. T. E. Ellis) ; but he thought this was a Bill eminently fitted to be dealt with by a Committee. He was glad to have had an interview with the representatives of the London County Council, when he explained to them the circumstances under which the proposal was promoted. He pointed out that, in consequence of the peculiar position of Birmingham, they were only taking the crown of the watershed—that was to say, 70 square miles—and that, as the whole of the watershed extended over 700 square miles, they were leaving 630 square miles for the purposes of any other populations which hereafter might find themselves in want of water. He was happy that they had satisfied their London friends. He had seen a statement that honourable members from Wales were promoting their opposition to the Bill rather in the hope of getting an instruction to the Committee than with the view of opposing the

second reading. He should like to ask the honourable member for Merionethshire if this statement was true.

Mr. T. E. ELLIS said the instruction did not cover all their objections, but only part.

Mr. CHAMBERLAIN supposed he must deal with the general principle, which seemed to him to be involved in the opposition to the second reading. This principle, which had been stated in the public Press, was "Welsh water for Wales ;" and he must say that, in the whole course of his experience, he had never heard of such an extraordinary and peculiar development of nationality. The water was not Welsh water, for it came from heaven and went to the sea. As to the objection that Wales might be in need of water, he had been informed that it was want of works for storing and distributing it, and not want of the water itself, which was troubling Glamorganshire and South Wales. Even if they took everything required for the Midland districts, there would still remain an enormous watershed. The only streams they proposed to take were the Elan and the Claerwen and their tributaries. Some anxiety had been expressed on behalf of the commoners whose rights might be interfered with ; but the Corporation of Birmingham did not desire to interfere with any right which had hitherto existed, or which could be shown to exist. The only restrictions which it was desired to make related to the purity of the water, which, as everybody was aware, was a subject of the very first importance. When the Corporation had expended their six or seven millions sterling upon this scheme, they would wish to feel sure that the water was wholesome, and was not polluted in any way whatsoever. There were one or two ways in which rights of common might interfere, though he did not think they actually did so, as at present used. They were not dealing with private, but with public interests ; and the sole object of the Corporation was to secure the purity of the water. When this had been secured, they would be satisfied.

Mr. ELLIS said that, although it was true this was a Private Bill, its provisions and scope were so extensive, that it became of public, and even of national importance. It was, therefore, well that the House should know upon what grounds, and by the extinction of what rights, the powers included in the measure were to be obtained. It was said that the details could be examined in Committee ; but there were principles underlying the Bill which ought to be first brought to the knowledge of the House. When the matter of water supply, especially in regard to London, came to be looked into, it was clear that the sources of supply were strictly limited. The last census showed that the population of Birmingham had not increased so rapidly during the past decade as, for instance, parts of Glamorganshire and Monmouthshire. As matters at present stood, the Rhondda Valley and Swansea were frequently within measurable distance of a water famine ; and now it was proposed to take this large supply from the Elan and the Claerwen, the two principal tributaries of the Wye. How far ought this to be allowed, having regard to public health and safety ? The public rights and privileges which would be interfered with by the Bill were considerable. Did the House realize that, amongst the powers sought, was that of acquiring some 65,000 acres of land, of which no less than one-half was commonage ? He maintained that the House, before consenting to the second reading of the Bill, ought to examine the powers asked for in the light of the provisions of the Commons Preservation Act of 1876. The Bill was not only for the purpose of supplying the municipal water demand of Birmingham ; there was a proposal to supply water to local authorities and county councils within 15 miles of the line. In fact, it was a great money-making and commercial concern, and Birmingham was to be a sort of universal water provider for the million. If the Bill were read a second time, the instruction to the Committee that was to be moved ought to be enlarged, in order that the immemorial privilege of free fishing in the waters to which the measure applied might be safeguarded ; and also to secure that some proper compensation should be made to the County Councils of Radnor and Brecon, as well as to individuals whose rights would be affected. He moved that the Bill be read a second time that day six months.

Sir J. BAILEY seconded the amendment. He held that the waters of the Wye should be used in the first place for the benefit of the population of the valley of that river. The city of Hereford, which he represented, had, he said, undertaken costly drainage works, in order to preserve the purity of the stream. Heaven had sent water to Hereford and not to Birmingham. If Birmingham were allowed to absorb the principal part of the waters of the Wye and of the rivers to which the winter flooding was due, it would be a matter of great difficulty to ensure purity in the water supply of Hereford. It was proposed to raise across the river a dam 130 feet high ; and there was great danger connected with such enormous weirs. In this case, if an accident occurred, it would possibly cause serious injury in three counties—Brecon, Hereford, and Monmouth ; and there would be no means of making the Corporation responsible. Every interest in the valley of the Wye would be affected by the proposal. Among the opponents to the Bill were the London County Council and the Corporation of the City ; and what could be their object ? Simply that they were looking forward to obtaining their water in future from this district. In the circumstances, he thought those who disapproved of the Bill were well within their rights in asking the House to protect them against the second reading, seeing that it was opposed by five counties—in short, by every interest down the Wye. They did not complain of Birmingham seeking to get its water where it pleased ; but they did complain that the Bill was promoted in the interests of Birmingham, to the direct exclusion of all those of the neighbourhood.

Mr. SHAW-LEFEVRE said he might have to move on another occasion the instruction of which he had given notice ; and he wished now merely to explain his position. He had not any intention of opposing the second reading of the Bill, for he thought a good case had been made out for referring it to a Select Committee ; but he wished to ensure, when the Bill went before Committee, that every opportunity should be given to those whose interests were affected of appearing and giving evidence. On the understanding that this instruction would be accepted, he would not oppose the second reading.

Sir JOHN LUBBOCK, having thanked the right honourable member for West Birmingham (Mr. Chamberlain), on behalf of the London County Council and of honourable members representing Metropolitan

constituencies, for his courtesy in postponing the second reading of the Bill for a few days, in order that they might give it consideration, expressed regret that the Bill had been introduced at the present time. The population in England was, he said, increasing so rapidly, and the areas suitable as gathering-grounds for the water supply of the great cities were being so steadily appropriated, that it was becoming a matter of great national importance that water supply should be economized as much as possible. Unfortunately, some important mistakes had already been made. Liverpool ought, according to the wise recommendation of the Duke of Richmond's Commission, to have drawn her supplies from the Westmoreland Lakes; whereas she had been allowed to come south and appropriate the Vyrnwy in Wales, which ought to have been reserved for the central and southern districts. The Committee of the House which sat last year reported that—

In view of the possibility of its being ultimately established that the present sources of supply cannot be extended, and that additional sources are required, and in view also of the fact that the possible fresh areas of supply are limited, and are already being drained for other large communities, your Committee think that Parliament may well consider, before granting any powers for further encroachment upon those areas, how far provision ought fairly to be made for the possible requirements alike of the Metropolis and of the other large populations upon the lines of supply.

In consequence partly of a representation from the London County Council, and partly, no doubt, on account of this recommendation of the Committee, Her Majesty's Government were about to appoint a Royal Commission to inquire and report on the question of the water-bearing areas. Under these circumstances, he should have been glad if all important appropriations of such areas could have been suspended until the Commission had reported. At the same time the Metropolitan members were very reluctant to oppose any measure which was for the advantage of the people of Birmingham. Perhaps he should be asked what they had to do with it. In fact, the remark had been made to him that they could not complain that Birmingham should move, if London could not make up its own mind. But London was not allowed to make up its own mind. London was denied powers which every other municipality enjoyed. London, and London alone, was precluded by law from introducing a Bill dealing with its own water supply. They had a Bill this session again—and they had one last year—removing this disability; but at present they lay under it. This was very unjust to London. They were compelled to sit with their hands behind them and see other cities appropriating the water-bearing areas one after the other. There were now comparatively few left; and this Bill took one of the best. It seemed very doubtful, and, as he understood, was hardly maintained even by Sir T. Martineau, that the matter was urgent. In his speech to the Corporation, he alluded to the Bourne, which would be a natural source of supply for Birmingham; and he said that their Engineer (Mr. Gray) "could not conscientiously say that it would last over a longer time than 20 years." Why, then, this great hurry? They asked the representatives of Birmingham whether the very reason why this scheme was pressed forward just now was not on account of their action in London. This was positively contradicted; but he had within the last two hours received an official copy of a speech made by Sir T. Martineau to the Corporation of Birmingham on the 7th of April, 1891, and he based his support of this Bill on the ground that London was at present moving in the matter. He said:

There is a most imperative reason for not dallying with the matter, . . . and that is what is being done by London. No doubt London is in the initiary stage. No doubt a great deal will have to be done before any Bill can be got into shape for a supply from a distance, or even a nearer source, for London. In some shape or another, it will have to be settled which of the governing bodies of London, in case the Companies are bought out or superseded, is to have the control of the water supply. Therefore, we have a little time before they begin to be our rivals. But I think we must bear this in mind: Our rivals they will be, sooner or later; and we have just now an opportunity of running before them, and getting hold, if we can, of these valuable rivers for the supply of Birmingham.

The population of the Metropolis was increasing with great rapidity. Already the consumption reached 200 million gallons a day. In a few years an additional supply would be a necessity. Of course, it would be out of place to go into this question now; but he alluded to it to explain the doubts they felt about the Bill. Metropolitan members could not support, but were reluctant to oppose, a Bill which they were told by the promoters was urgently required for Birmingham. At the same time, they heard from Birmingham that, in the opinion of a great many there, the present supply was sufficient, and even ample, for years to come, and that, if needed, much more might be obtained in the district itself. While, therefore, they did not feel that they ought to oppose the second reading of the Bill, they hoped that the Committee would satisfy itself—first, that Birmingham urgently required an additional supply; and, secondly, that no such supply could be obtained within the district.

Mr. R. COOKE opposed the second reading, on the ground that, because the London County Council had not the power to deal with its own water supply, Birmingham was being allowed to steal a march upon London.

Sir H. JAMES said he believed it would be very strong action to reject the Bill, and, in order to facilitate its progress, he gave notice that he would move the following instruction should the second reading be agreed to: "That it be an instruction to the Committee to whom this Bill is referred that provisions be inserted in the Bill reserving the substantial use and enjoyment to the public of the waters of the Wye, and other rivers affected by the Bill, to the same extent and in like manner as if this Bill were not passed, or a full equivalent for such use and enjoyment."

Mr. COURTNEY pointed out that all the questions raised in the course of the discussion could be examined by the Committee.

The discussion having been continued by Mr. Burdett Coutts, Mr. Stuart, Mr. Dixon-Hartland, Sir H. Vivian, Mr. Kendrick, and Mr. Lawson,

Mr. CHAMBERLAIN said that since he had addressed the House in moving the second reading of this Bill a totally new appearance had been given to the question by what had fallen from the right honourable

gentleman the member for the University of London (Sir J. Lubbock), and had been taken up by other London members. When he had moved the second reading, he had been confident, not only that there would be no opposition on the part of London members, but that they would have the support of every member for a London constituency, because it was perfectly clear that their interests were the same. His right honourable friend, however, had made a speech which, in his opinion, had given rise to a good deal of misapprehension. He said—no doubt with perfect accuracy—that when they had had a conference between Birmingham members and London members, the latter had represented to them that they would greatly prefer that this matter should stand over until they also were prepared to give it consideration, and would only withdraw their opposition if they were satisfied that the case of Birmingham was urgent; and they had also asked whether Birmingham was proceeding in any fear of the rivalry of London. As a matter of fact, the urgency would be exactly the same if there was no London in existence. Birmingham's need was urgent, because, as he had stated, the existing average demand was 17 million gallons; and at present the maximum supply was only 20 millions. In two or three years the average demand would be up to the maximum supply, as already the maximum demand was above the maximum supply. It was indisputable that, from some source or other, Birmingham must get a further quantity of water. The tract of country which it wished to acquire was the only land suitable for the purposes of that town. For the wants of London, however, there was any amount of suitable land; for London, being on the sea-level, could get its water from a very much lower position than Birmingham could. The tract of land now in question would not be convenient in the case of London, and could only be required by the Capital after it had exhausted all supplies of water from much more suitable districts.

After further discussion,

Mr. RITCHIE said, with regard to the general question, he understood that there was no dispute at all that there was a plentiful supply of water in Wales for both London and Birmingham, and that Wales did not object to the water being taken, subject to the protection of her interests. The question seemed entirely one for inquiry by a Committee; and if there was no compromise arrived at, the Bill could be dealt with when it came back to the House. He did not think he was at liberty to vote against the second reading. If it was the general wish of the House that the Bill should go before a Hybrid Committee, he did not suppose there would be any objection.

Mr. CHAMBERLAIN said there would be no objection on the part of the promoters. He was not prepared to accept the suggestion of Sir H. James, which he had not had time to examine sufficiently.

The House then divided, and the numbers were: For the second reading, 244; against, 102—majority, 142.

The Bill was then read a second time.

Mr. ELLIS then gave notice that he would move that the Bill be referred to a Hybrid Committee.

Mr. SHAW-LEFEVRE also gave notice of his intention to move an instruction with regard to the rights of commoners under the Bill.

Thursday, March 10.

LONDON WATER COMPANIES AND THEIR POWERS.

Mr. LABOUCHERE asked the Secretary of State for the Home Department whether, in view of the fact that by law the water-rates become due quarterly, and on the first day of each quarter, in advance; and that persons neglecting to pay the rate when it becomes legally due are liable to have their water cut off (with the result that most householders are usually legally in arrear, owing to the custom of the water-rates being demanded only half yearly, when one quarter has expired and another is partly due) and to the abusive power that this difference between law and custom places in the hands of the Water Companies, he contemplates legislative action to amend the law on this point.

Mr. RITCHIE: The Acts of the Water Companies usually provide that the water-rates shall be paid in advance by equal quarterly payments; and I believe that it is the case that the rates, as a general rule, are only demanded half-yearly. The Acts also empower the Companies, where the rates are payable by the occupiers, to cut off the supply if the rate is not duly paid at any of the times of payment specified in the Act. The result of these provisions would appear to be that a Company might cut off the supply if the rates were in arrear, although they had not actually been demanded. The question as to the continuance of this power is, I think, one which should be considered when there is further general legislation with regard to Water Companies. At the same time, I may say that I have never had brought under my attention any case where this power has been abused by a Company.

Friday, March 11.

BIRMINGHAM CORPORATION WATER BILL.

Mr. ELLIS, in accordance with notice, moved that the above Bill should be referred to a Hybrid Committee.

The motion was agreed to.

Mr. SHAW-LEFEVRE then moved—"That it be an instruction to the Committee to whom this Bill is referred that they have power to inquire and report to the House whether it is necessary to extinguish the rights of the commoners and the user of the commons by farmers over so wide a district, and whether provision should be inserted for securing to the public free access to the commons proposed to be acquired, other than so much as is required for reservoirs and other works." He said that in his opinion the matters to which he had referred in his motion could not be fully dealt with by the Hybrid Committee unless they were specially instructed.

Mr. CHAMBERLAIN said that if the right honourable gentleman would withdraw the motion, he would give him an assurance that a clause should be inserted in the Bill affording the public full rights of access.

Mr. SHAW-LEFEVRE said he must press his motion.

The SPEAKER, in answer to a question by Mr. Chamberlain, having expressed the opinion that the instruction was necessary, although it might have the appearance of acting from excess of caution,

The motion was agreed to.

Sir H. JAMES, who had on the paper, in the interest of the city of Hereford, an instruction with reference to the water proposed to be taken from the Wye, said he did not propose to move it, as the promoters of the Bill had promised to reserve to Hereford all the rights they now have.

The following progress was made with Bills last week :—

Further Standing Orders complied with : Southend Gas Bill.

Bills referred to a Select Committee consisting of Mr. H. Gladstone (Chairman), Mr. W. F. Lawrence, Mr. A. C. Corbett, and Mr. Dunn ; to meet on Thursday, March 17 : East Grinstead Gas and Water Bill ; London County Council (Subways) Bill ; London County Council (General Powers) Bill ; Southend Gas Bill.

Bills referred to a Select Committee consisting of Sir W. Houldsworth (Chairman), Sir J. Colomb, Mr. Craig, and Mr. J. O'Connor ; to meet on Tuesday, March 15 : Airdrie and Coatbridge Water Bill ; Blackburn Corporation Bill ; Lanarkshire (Middle Ward District) Water Bill ; Ormskirk Gas Bill.

A petition against the Blackpool Improvement Bill was presented from the St. Anne's-on-the-Sea Gaslight and Coke Company.

Mr. John Fentiman, who some time ago was with Messrs. T. Fletcher and Co., has accepted an appointment as representative of the new firm of Fletcher, Russell, and Co., Limited.

The Price of Gas at Haslingden.—At a meeting of the tradesmen of Haslingden, held last Wednesday, a resolution was passed unanimously refusing to accept the reduction of 2d. per 1000 cubic feet in the price of gas recently conceded by the Gas Company (mentioned in the JOURNAL last week) as being satisfactory ; and it was decided that unless the Directors make a further concession, the whole of the tradesmen will cease to use gas. It was decided to ask the Mayor to convene a meeting of the ratepayers to reconsider the matter, with the view to the introduction of electric lighting.

Lecture on Gas-Meters.—Last Wednesday, a lecture was delivered to the members of the Birmingham and Midland Institute Scientific Society, by Mr. S. R. Barrett, of the Birmingham Gas Department, on "Gas-Meters, Wet and Dry." The lecturer, whose address was illustrated by diagrams and experiments, said the original gas-meter was produced in 1815 by Clegg, and was practically identical with the wet meter in use at the present time. He told his audience that it was a mistake to suppose that a meter had anything to do with the pressure or quality of the gas which passed through it. The secret of low gas bills was the adoption of better burners.

John Wright and Co., Limited.—According to the report to be presented to the shareholders of the above Company at the general meeting to be held on Thursday, the trading account shows a balance of £18,621, which, after various deductions have been made, leaves for disposal the sum of £14,888. This the Directors recommend should be appropriated as follows : To pay a dividend at the rate of 6 per cent. per annum for the past half year on the preference shares, less income-tax, thereby making up the dividend to 6 per cent. for the year, £1170 ; to pay a dividend at the rate of 10 per cent. per annum for the past half year on the ordinary shares, free of income-tax, thereby making up the dividend to 10 per cent. for the year, £2000 ; commission to Managing Directors, £1854 ; to carry to a reserve fund, £7000 ; to carry forward to next year, £2863.

Gas Affairs at Longton.—The minutes which were presented by the Gas Committee at the meeting of the Longton Town Council on the 3rd inst., contained a letter from Alderman A. G. Prince, tendering his resignation as Chairman, owing to the recent action of the Council in twice refusing to allow the matter of meter-rents to be referred back to the Committee. The resignation was accepted with extreme regret. In consequence of a statement made at the previous meeting of the Council, to the effect that the gas-works were not being properly managed, and that gas was not being made as cheaply as at other works in the country, the Committee also submitted a comparative statement, showing on an average of similar gas-works owned by local authorities as follows : Capital, £82,997 ; price of gas, 2s. 10½d. per 1000 cubic feet ; gross profits, £5013 ; net profits, £1018 ; quantity of gas sold 80,801,688 cubic feet ; gross profits per 1000 feet, 1s. 2½d. Longton, capital, £110,000 ; price of gas, 3s. ; gross profits, £7183 ; net profits, £2234 ; quantity of gas sold, 85,405,300 cubic feet ; gross profits per 1000 feet, 1s. 5½d. The Committee stated that they felt the Council should make it clear by resolution whether they wished them to manage the works for the benefit of the consumers only, or for the ratepayers generally. A long and rather acrimonious discussion followed upon the subject, and ultimately the minutes were adopted, with the words forming the last paragraph omitted.

Actions against the South Metropolitan Gas Company.—Last Friday, Mr. Justice Stirling had an application made to him by Mr. Graham Hastings, Q.C., for an injunction to restrain the South Metropolitan Gas Company from committing a nuisance ; and as the question for decision was one of fact—viz., whether or not a nuisance was committed—he thought the case should be tried once for all. His Lordship suggested that the pleadings should be completed, and liberty given to apply to advance the trial. Mr. Hastings said, as both parties had gone to considerable expense in preparing affidavits, it would be as well to take advantage of this by using the affidavits at the trial—each party having liberty to cross-examine. The Solicitor-General (Sir E. Clarke, Q.C., M.P.), who appeared for the Company, said he did not think this course would save time. Mr. Hastings said the action was brought by the owner of 400 houses out of an estate of 600 in Bermondsey ; and it now appeared that the owner of the remaining 200 houses had commenced proceedings in another branch of the Court. He proposed that this action should be transferred to his Lordship's Court, or abide the result of the present one. The Solicitor-General thought it should be transferred and then stayed. Mr. Hastings asked to have inspection of the defendants' works upon the usual terms of giving reasonable notice. The Solicitor-General remarked that his friend would not have to complain of any difficulty in this respect.

MISCELLANEOUS NEWS.

THE SUGGESTED MUNICIPALIZATION OF THE LONDON GAS AND WATER UNDERTAKINGS.

Our readers are aware that the most prominent feature in the programme of the Progressive Party, who form the large majority of the newly-elected County Council for London, is the municipalization of the gas and water undertakings, in conjunction with the docks and tramways. It was unnecessary to reproduce in our columns the arguments adduced by the various candidates in support of this project, or those brought forward against it by the Moderates. One speaker, however, on behalf of the latter party (Sir H. James), stated that London stood to lose tens of millions by such "rash and hazardous speculations" as those above referred to. This remark called forth the letter to the *Pall Mall Gazette* to which reference was made in our editorial columns last week. It may be of interest to reproduce the communication, as well as the one sent in answer to it. The first letter was as follows :—

At present London pays £4,500,000 a year for gas which costs £3,250,000 to produce. Result, £1,250,000 apportioned to the benefit of gas shareholders. To the Water Companies' shareholders London pays about £750,000 over the cost of service. In gas and water dividends it pays in cash about £2,000,000 per annum. The rates levied in London amount now to £8,000,000 per annum—averaging, on the figures for 1891, 5s. 1½d. in the pound. The gas and water dividends add 25 per cent. to this total, and, regarded as rates, raise the average of 5s. 1½d. to 6s. 4½d. in the pound.

It is estimated that London could supply itself with water at a capital cost of £14,000,000 ; and, at present values, if it took over the gas undertakings, their cost would be £25,000,000. If the County Council borrowed the £39,000,000 at 3 per cent. (it could get the money at 2½ per cent.), the annual interest charge on London would be £1,170,000 ; and the consequent relief to the ratepayers' pocket—assuming either that no profit was made on supply, or that profits were made as at present, and applied in direct relief of the rates—would be £830,000. This would credit the average of 5s. 1½d. with a reduction of over 8 per cent.—that is, it would bring it down to about 4s. 8½d. But it is unlikely that we should pay more than £19,000,000 for our gas. Therefore the annual charge would be 3 per cent. on £33,000,000—that is, £660,000 ; and the annual relief to the rates, on the previous assumptions, would be £1,010,000, or over 10 per cent. Thus the average rate would be reduced by about 10 per cent., or from 5s. 1½d. to 4s. 7½d. But the average rate, when increased by gas and water dividends, amounts to 6s. 4½d. Therefore the total reduction on the present rating burden would be 1s. 6d. ; and the contrast would work out as follows :—

Present average rate charge on London	s. d.
householder	= 6 4½ in the pound.
Future average rate charge on London	
householder	= 4 7½ "

Advantage to householder from municipalization of gas and water . . . = 1 9½ "

As to the "rash and hazardous speculation" of the matter, take the analogy of some of our largest provincial municipalities supplying themselves with gas and water. The seven Municipalities of Manchester, Leeds, Nottingham, Bradford, Leicester, Oldham, and Bolton form a highly respectable and unspeculative group of self-suppliers. The rateable value of these seven towns aggregates to £10,000,000. The rates collected over the group appear to amount to £1,500,000—say, 3s. in the pound. Returns for 1888 show that the water revenue of the group was £630,000. If all this was, as it might be, applied directly to the relief of rates, the average in the pound would be reduced by 42 per cent.—that is, to 1s. 9d. On the other hand, if the water supply were in the hands of private companies, earning (say) 8 per cent. dividend, the addition to the average rate of 3s. would be considerably more than the reduction capable of being effected by municipal ownership. The group in question paid £11,250,000 for their water-works and capital outlay up to 1888. If we take £11,250,000 as their value in private hands, then £900,000 would be required for an 8 per cent. dividend. That, on a total rate collection of £1,500,000, equals a 60 per cent. rise on 1s. 9½d. ; thus bringing up the average to 4s. 9½d. The contrast works out as follows :—

Rate charge on householder if the water supply is in private hands	s. d.
With water supply municipalized, and if water profits are directly applied to the relief of the rates	4 9½ in the pound.
	1 9 "

Advantage to householder from municipalization = 3 0½ in the pound.

Now take the gas statistics for the seven Municipalities. The capital cost of supplying their own gas up to 1888 amounted in the aggregate to £6,250,000, the interest on which represents £187,000. If the gas were in the hands of private companies earning 8 per cent. on the £6,250,000, the extra charge on the ratepayer would be £313,000. This would raise the average rate by over 20 per cent., bringing it up from 3s. to 3s. 7½d. On the other hand, the Municipalities, by being their own purveyors, make a net annual profit of £213,000. If this amount were applied directly in relief of the rates, the average would be lowered by 14 per cent., or to 2s. 7d. in the pound. We have now the following results : Municipalized water supply potentially reduces the rate of 3s. by 1s. 3d., and municipalized gas supply potentially reduces the rate of 3s. by 5d., therefore the total potential reduction is 1s. 8d.—reducing the average rate to 1s. 4d. in the pound. On the other hand, private water supply would raise the rate of 3s. by 1s. 9½d., and private gas supply would raise it by 7½d. ; making the total rise 2s. 4½d., and bringing the rate up to an average of 5s. 4½d. in the pound.

The following was the reply to the foregoing letter :—

Your correspondent has clearly discovered "the newer arithmetic," since, under the rules of arithmetic *secundum* Colenso, the utmost possible saving in poundage to a ratepayer which his own figures, after adding (say) the low figure of 3 per cent. for the "service" of his proposed £39,000,000 of gas and water stock, can be made to show is a paltry 4½d. He has fallen into the fundamental and fatal error of thinking that the cost of municipal administration under existing heads will fall *per se*, in consequence of the acquisition of the gas and water undertakings by the London County Council.

The present cost of municipal administration, *plus* gas and water rentals, is as follows :—

	s.	d.
Municipal administration	5	1½
Gas and water rents	1	3½
Total	6	4½

The cost of municipal administration under his scheme, *plus* service of gas and water stock, will be as follows :—

	s.	d.
Municipal administration	5	1½
Service of gas and water debt of £39,000,000, at 3½ per cent., say	0	10½
Total	5	11¾
Profit	0	4¾
Present cost	6	4½

His whole case is, however, bound up with the notion that a Gladstonian majority, with a House of Lords to face in a matter where "going to the country" or creating Peers *ad hoc* would be out of the question, and containing a due proportion of the Isaac Holdens, Brunners, Peases, Besses, Cyril Flowers, and other rich men of the Parliament of 1886, will either wipe out the water undertakings without any compensation, or compel the Companies to sell for what is much less than half the market value of their stock to-day. Suppose that the utmost even a Gladstonian majority will do be to deduct from the market value of the water stocks the capital value of the increased and improved supply which a Royal Commission *ad hoc* may pronounce requisite—and this, I believe, is what Sir Thomas Farrer proposes—and that London has to buy its water for (say) £22,000,000, the service of an increased gas and water stock of £47,000,000 will swallow up just 2d. in the pound of the total relief of 4½d., which is all your correspondent's scheme promises. Whether a London County Council, "bossed" by Messrs. Costello, Burns, Quelch, Webb, and Co., are likely to hold out against demands on the part of gas and water employees for increased wage and leisure, which, if granted, would swallow up the 2½d. that would be left to them "to play" with, is another question.

Our contemporary *Industries* deals with the question, but upon a different basis, in the following article which appears in the current issue :—

The recent London County Council election has resulted in a large working majority in favour of the municipalization of those monopolies which are at present in the hands of private companies, and which, although regulated and controlled by legislation, are worked primarily in the interests of the shareholders. The Progressive programme of the recent election laid particular stress on the need for a good supply of water for London, owned and directly controlled by the representatives of the ratepayers. It has, however, been repeatedly urged that this important step is one which must be taken with all due precaution; and, until it is decided what is the best supply for London, progress in this direction must necessarily be delayed. Next to water, the municipalization of the gas supply appears to be the problem which deserves immediate attention. It is somewhat remarkable, however, that, although a good and ample supply of gas for a large city is of primary importance, yet past legislation, in insisting on the principle of the sliding scale, has practically conceded the point advocated by those persons who desire the complete control of the gas industry in London. That the reward of the shareholders should be inversely proportional to the price of gas, admits that the gas supply is for the benefit of the consumer; and thus municipalization of the supply must logically follow this concession. In former articles on the lighting of London in connection with the fog and smoke question, we have already shown that the present machinery of the Gas Companies is well adapted for the requirements of London, and that there is now no real ground for objecting to their acquisition by the controlling authority. Just now, when coal is at famine prices in London, the advantages of a cheap and economic gas supply, available at all times and under public control, is obvious.

At present we have in London an altogether anomalous condition; for during the last few days a considerable influx of orders has been given for gas-stoves for heating purposes, notwithstanding that the present quarter shows a considerable increase in the price of gas. Increased consumption with increase of price must be very gratifying to The Gaslight and Coke Company and its shareholders; but no householder in London can possibly look upon this state of affairs with satisfaction. Although this question was made a party one at the recent election, it is noteworthy that, at a recent important public meeting at Chelsea, the Progressive and Moderate candidates for that division were equally strong in their condemnation of the present condition of affairs in the area supplied by The Gaslight and Coke Company. Not only at a crisis in the coal trade, like that at the present time, do the shareholders in gas companies benefit at the expense of the public in the sale of gas, but their attitude in increasing the price of coke is directly antagonistic to the interests of the public, and even opposed to the policy put forward by Mr. Livesey, the Chairman of the South Metropolitan Company. It may be recollected that, at the last general meeting of this Company, Mr. Livesey drew attention to the fact that coke was not only apparently, but really, the cheapest fuel in London; and that he hoped, by maintaining the low price of coke, to succeed in obtaining coal in London at

a cheaper rate. If the price of coke is simultaneously raised with the price of coal, as has recently been done, surely this laudable object on the part of Mr. Livesey and his co-Directors of the South Metropolitan Company is frustrated.

Municipalization of the London gas supply appears to us to be the only way out of the difficulty; and we hope that the new Council will proceed to a consideration of this question at once, and fulfil their pledge to the electors on this point while the investigation on the water question is being carried on. The question of purchase should be an easy one to solve. Even the most faint-hearted members of the Council, when they fully realize the advantages which have accrued to Manchester, Bradford, and Birmingham from the acquisition of the gas-works by the town, should not hesitate in taking this step. The Gas Companies in London have no legal monopoly; and the County Council can obtain parliamentary powers to construct a competing supply, unless the Companies consent to transfer their works on equitable terms. Our own view as to what might be meant by equitable terms is based on the consideration that the market value of the Gas Companies at the present time is what their works and plant would bring as a means for heating, not lighting, London. In a recent article we have given our views on this subject at some length, and have since had the pleasure of noticing that our contemporary, the *JOURNAL OF GAS LIGHTING*, thinks our view that a diminution in the illuminating power of London Gas—arranged on a sliding scale, so that a cheaper gas for heating purposes may be obtainable—is worthy of consideration. We have all along protested that there is no virtue in 16-candle gas. Why the number 16 was chosen we do not remember; but all that can be urged in its favour is that it is easily divided by two. If a standard illuminating power is required, let 10 candles be the parliamentary limit, and let the gas be correspondingly reduced in price. We hope that those who have been advocating a 16-candle standard will not further continue this advocacy. Although we do not think that the proposition of a 16-candle standard finds favour with the Committee at present considering the standard of light, it is well that the possibility of a reduction in the parliamentary limit in London, which is at present exceptional, should be remembered. Apart from the pecuniary profit which would accrue from a municipalization of the gas supply, and a corresponding diminution in the municipal rate, the service, when controlled by a representative public body, would undoubtedly be more efficiently carried out.

THE LONDON FOG AND WATER QUESTIONS.

At a Meeting of the Sanitary Institute held last Wednesday in the Parkes Museum, Margaret Street, W., under the presidency of Sir T. Crawford, Dr. Louis Parkes, Medical Officer of Health for Chelsea, and Lecturer on Public Health at St. George's Hospital, dealt with the above questions in a paper bearing the interrogative title of "The Air and Water of London: Are they Deteriorating?" He said that, with all its sanitary improvements, the air and water of London was undergoing continuous degeneration. Fog was not to be wondered at when it was considered that there were some 800,000 houses in London, each with half-a-dozen or more chimneys in communication with an open fireplace, and that about 7,000,000 tons of coal were burned annually in the Metropolis, or 20,000 tons per 24 hours—on a cold winter's day as much as 40,000 tons were said to be consumed—of which quantity 200 tons would escape into the air as fine carbon or soot, with probably an equal amount of sulphur as sulphurous acid. There were also produced something like 60,000 tons of carbonic acid to help to vitiate the air. Fogs, however, were but exaggerated types of what London air was throughout the whole of the winter months. As regarded the water supply of London, he was afraid people were working within a vicious circle. One of the special drawbacks of the Water Companies drawing their supplies from the Thames and Lea was the compulsion they were under to take in water when the river was in flood, owing to the insufficient capacity of their storage reservoirs. All would agree that the supply of London, with its 4½ millions of inhabitants, ought to be independent of exceptional circumstances of all sorts. As a matter of public health, it was not a wise policy, and it was certainly not a scientific proceeding, to take in grossly polluted waters, such as were those of the Thames and the Lea when in flood, and then attempt to render them potable by storage and filtration through sand and gravel. The endeavour was not always a successful one; and surely they had a right to ask that the water supplied to them for domestic purposes should be, like Cæsar's wife, above suspicion. In the remarks following the paper, Major Flower, the Engineer to the Lea Conservancy, expressed the opinion that the use of smokeless coal was one of the best solutions of the fog question, and that they could also do very much by applying chemicals. With regard to the water question, he was not of opinion that it would be necessary to go to the Welsh mountains for a supply; there was abundance stored in the bed of the Lea and in the Thames. What they wanted at once was to have inspectors of sources of supply appointed to prevent waste and pollution. Mr. Rogers Field agreed in recommending the use of smokeless coal. He moved a resolution expressing the opinion of the meeting that Parliament should withhold all appropriation of water-bearing areas in Wales or elsewhere until after the Royal Commission about to be appointed on the water question had reported. The Chairman stated that he agreed in the expediency of passing the resolution which had been proposed; and said he hoped the water of Wales would not be diverted before the report of the Royal Commission was published. The motion was then agreed to. Mr. Kenwood proposed that the subject of London fogs should also be inquired into by a Royal Commission. This was passed, and the meeting terminated.

With reference to the statement made by the reader of the paper noticed above, as to the Thames and Lea Companies being compelled, owing to the inadequate storage capacity of their works, to draw water from those rivers in times of flood, Mr. I. A. Crookenden, Secretary of the East London Water Company, wrote to the paper which contained the report, denying, on the part of his Company, any such practice as that alleged against them, and characterizing as *brutum fulmen* the "alarming superstructure" built upon the assertion.

CRYSTAL PALACE DISTRICT GAS COMPANY.

The Half-Yearly General Meeting of this Company was held last Friday at the Albion Tavern, Aldersgate Street, E.C.—Mr. FREDERIC LANE LINGING in the chair.

The SECRETARY (Mr. Magnus Ohren) read the notice convening the meeting; and it was agreed to take as read the report and the accounts for the six months ending Dec. 31 last. In the former, the Directors stated that the result of the working showed a balance to the credit of revenue account of £5476. The decrease in the profit on the half year, as compared with that of the corresponding period of 1890, was due to two causes—viz., the continued high price of coal, and the great falling off in the value of coke. The deficiency would, they said, be met by the balance brought forward from the previous half year, amounting to £6142, and by taking the sum of £2459 from the reserve fund. Having referred to the proposal to increase the price of gas to 2s. 9d. per 1000 cubic feet from the close of the present quarter, the report stated that the final call on the new ordinary 7 per cent. shares had produced £18,351. The whole of the shares were now paid in full; and the Directors would take power, under the Companies' Clauses Act, 1845, clause 61, to convert the share capital into ordinary 7 per cent. stock and consolidate the ordinary 7 per cent. stocks. The Directors recorded, with regret, the death of Mr. Charles Newton, one of the Auditors; and mentioned that Mr. A. G. Hounsham and Mr. W. Westcott were candidates for the office.

The CHAIRMAN said the results of the half-year's working were before the shareholders as represented in the accounts, which showed a balance of £5476. This, he need scarcely say, was very disappointing to the Directors; but it had arisen from circumstances in a very great measure beyond the control of the Board. One of the principal causes for their position at the present time was the depression in the value of coke and other residuals. As regarded coke, they had received £4252 less than in the corresponding period of 1890, and for sulphate of ammonia and ammoniacal liquor £623 less. Thus, in two items alone, they had lost a sum of nearly £5000. If they had received the same prices for residuals as in the December half of 1890, with the balance brought forward from June, and with the reduction they obtained on the last coal contract, the Directors would have undoubtedly realized their expectations. The depression in coke had been general throughout England. The reason why coke had been so depreciated was that the cement trade had been in a bad state for some time past. The cement manufacturers were the largest buyers of coke; and the lesson the Company had had lately showed that they would have some difficulty in disposing of the whole of the coke they produced if they had to depend upon the consumption for domestic purposes. The country had been passing through a very serious ordeal during the last two years. The gas companies, of course, had felt it very much; and when, from circumstances beyond the control of any management, they were compelled to increase the price of gas, they had those detractors, in the shape of critics, who at once flew out and said: "Here is a company raising the price of gas, while they are paying inflated dividends." Now they knew very well that gas companies did not pay inflated dividends at the present time; and these remarks, sweeping as they were, were extremely injurious to the gas interests. He took the opportunity of mentioning this, because the public would not take the trouble of ascertaining whether or not such remarks were true; they saw them in print, and accepted them. He did not call attention to this on behalf of their own Company, but in support of gas companies generally. In their own case, they were not under the sliding scale; but their capital was regulated by Act of Parliament. The £400,000 which they had called up was represented under three heads. There was only £75,000 at 10 per cent.; £275,000 at 7 per cent.; and £50,000 at 6 per cent. With regard to the last-named amount, they could have issued it at 10 per cent., and placed the money in the pockets of the shareholders. But the Directors some years ago thought it would be better to get the capital out at as low an interest as possible; and, with the sanction of the shareholders, it was issued at 6 per cent. They thus placed in the hands, or, he might say, at the disposal of the consumers £2000 a year; and this had been going on now for a considerable time. He thought this was pretty good evidence that the Company had not misapplied their capital. They had been in a position to supply gas at a very low rate. The time, however, had come—and the Directors regretted it beyond measure, but it was no use shirking the matter—when they had to state that, with the present cost of coal and labour, they could not supply gas at 2s. 6d. per 1000 cubic feet; and they had therefore given notice to increase it to 2s. 9d. from the close of the present quarter. The Directors felt assured that the consumers, knowing their feelings in regard to the question of price, would not make any objection; and from what he saw in the local papers, the expressions towards the Company were most favourable. Adverting to the capital, he said that it only realized £7 8s. 9d. per cent.; and this he believed the most critical authority would admit was not a very high rate, considering they were a manufacturing company. Buyers of gas property only obtained about 5 per cent. on their investment; and this could not be regarded as a very high rate, when they had their troubles and vicissitudes to meet, as they had on many occasions. This, he added, was the first time they had ever had to raise the price of gas since the Company had been in existence. Continuing, he said it was mentioned in the report, in reference to the amount of gas sold during the half year, that it showed a decrease when compared with the same period of 1890. But this was not a fair comparison, for this reason—that October, November, and December of 1890 would not apply to the same months of 1891. In the former period, the frost was extremely severe; the atmosphere was dull; and an immense demand for gas was made upon them. In the same months of last year, the weather was mild and light; and the consequence was that the requirements of the consumers fell off. But if they carried the comparison to 1889, then it would be found that they had in favour of the past half year an increase of nearly 30 million cubic feet in the quantity of gas sold. This showed that they were not standing still, but were very progressive. He was happy to be able to report that the assessments were now all settled; and he supposed they ought to consider they had been favourably

arranged—at all events, they were obliged to be satisfied with them. As regarded the additions to the plant, he made allusion to the subject at the last half-yearly meeting; and he might now remark that they were nearly finished, with the exception of the gasholder, which they hoped to have in their possession in a short time. In the notice calling the meeting, reference was made to the capital, in connection with which the Directors wished to ask the shareholders to grant them further powers. The matter stood thus to a certain extent: They possessed £125,000 of 7 per cent. stock, and £150,000 of 7 per cent. shares; and, at a subsequent stage of the meeting, he should submit a resolution empowering the Directors to convert the shares into stock, so as to consolidate the 7 per cent. capital into one stock. The Directors proposed this because they believed it would be in the interests of the shareholders, as it was rather awkward in Stock Exchange transactions to have two separate 7 per cents. As to the details of the working, the Chairman stated that, under the head of coal, they had saved £3438 (which, however, was not so much as they expected); and in purification, £242. He came to an item which was very large, and which he regretted very much—that was, the renewal of works, retorts, and other things; and here they had an increase of £1278. This was a very large advance; but charges of this kind could not be regulated half year by half year. They must at times vary; and, unfortunately, the item had increased when the Company could least bear it. In other respects, on the debit side of the account, there was nothing on which he need comment. Having stated that the gas-rental had decreased by £538 when compared with the corresponding period of 1890, he said he had, with great regret, to call attention to another matter. Since it had been his privilege to occupy the chair, he had made a point of communicating to the shareholders everything he thought would be to their interests—he had never offered the least reticence. If things were good, the shareholders had known it, and if things were bad, he had never attempted to hide them; and he should pursue the same principle now. Painful as it might be, he had to inform the shareholders that their engineering arrangements had not been of the satisfactory character that they certainly expected. They had used nearly 2000 tons more coal than in the corresponding period of 1890, and yet the revenue was reduced, and there was a decrease of 3,680,000 cubic feet of gas sold. They had only sold 8814 feet per ton of coal carbonized; while the amount ought to have approached 9500 feet. Their Engineer (Mr. Gandon), who had held his position for a good many years, had been singularly fortunate in his management. The gas unaccounted for had been 5, 5½, and 6 per cent. at the outside; but, at one fell swoop, he had to contend with 10·56 per cent. These were results he could not hide. They had come upon the Engineer with great suddenness; and he was certain, from what the shareholders knew of him, they would feel how much he regretted it. He would ask him to give some explanation of these matters later on, so that the shareholders might know there was nothing materially wrong in the management. The Chairman concluded by moving the adoption of the report.

Mr. GEORGE LIVESY, in seconding the motion, said with regard to the increase in the charge for gas, that—having the reserve fund full, and as the prosperity of the Company required it—they had reduced the price to the consumers year after year, until at last adverse times had come upon them. They had no margin and no possible savings; and the Directors had therefore been under the necessity of increasing the price of gas, in order to pay their way. The Chairman had stated that the average dividend was £7 8s. 9d. per cent.; but during the past half year, they only earned 3 per cent., and in the previous half year 2 per cent. They had therefore been using up their reserves for the benefit of the consumers; and, having at last come to the point when they could not use them any further, they found it imperative to call upon the consumers to bear a portion of the burden. He thought it was only right to tell the shareholders that they did not expect in the present half year to come out level, seeing that they had only raised the price of the gas from March, and consequently they would only get the increase during the summer quarter, besides which the high price of coal would continue through the greater part of the half year. In the December half, however, they had good hopes of coming out level, or very nearly so—at any rate, they would not have to dip largely into the reserve fund. The Chairman had stated with regard to the additional quantity of coal carbonized that it was 2000 tons; but the figures, to be exact, were 1829 tons. It was unaccountable to him, as it was to every one else, how it was that the unaccounted-for gas had gone up to the extent it had. In 1890, the average was 5½ per cent.; and in 1891, 9½ per cent. Taking the figures for each half year: In the first half of 1890, it was 4·9 per cent.; in the second, 6·2 per cent.; in the first half of 1891, 8·9 per cent.; and in the second half, 10·5 per cent. There was only one way in which he could account for a considerable portion of this. He firmly believed the gas was not made—that, in fact, since the advent of the Gas Workers' Union, the stokers had not worked nearly so well. Complaints to this effect were made to him by managers in different parts of the country. The principle on which the Gas Workers' Union acted was to reduce the amount of work done by each man as much as possible, in order to increase the number of men employed. He believed, in the case of every company that came under the baneful influence of the Union, that the men did their work in a worse manner; and he thought it was quite possible that, though they were now comparatively free from the hands of the Union, still the system they inaugurated had been to some extent continued. The Directors were quite aware of the difficulties in which the Company were placed at the present time; and they would do everything they could to remedy the defects—at any rate to try to find out how it was the unaccounted-for gas had gone up to the present point. As to the relation of the sale of coke to the cement trade, he might add to the Chairman's remarks that he had some figures shown him a few days since comparing the quantity of cement imported into New York during the last decade. Ten years ago the imports from England and other countries—Germany, Belgium, and France—were about equal—140,000 packages or barrels. This went on neck and neck, as it were, until, four years ago, it came to 500,000 from England and 490,000 from other countries. And what was it now? The imports last year amounted to 900,000 from foreign countries and 300,000 from England; so that, while they were about level four years

ago, New York now took three times as much cement from foreign countries as they did from England. This happened just when coke rose so materially in price in this country. The cement makers had had to pay 50 per cent. more for coke; and this no doubt had been the crippling factor in decreasing their business. Gas companies were at the present time face to face with further difficulties in regard to coal; but he did not anticipate there would be much to fear on that ground. The price was falling considerably; and the Directors therefore hoped, when they next met the shareholders, they would be able to tell them they had overcome their difficulties, and were returning to the ordinary prosperity of the Company.

Mr. CORBET WOODALL observed that, in common with others, he had noticed a reduction in the returns from the coals used; and it occurred to him there was another explanation besides that which Mr. Livesey had given. It seemed to him that, coincidentally with the increase in the cost of coal, there had been (he had heard of it not only in one place but in many) a distinct reduction in the quality of the coal. It was not quite fair, he thought, to put the whole burden of the blame in a matter of this sort on the men. A large increase of the cost of the coal—much the greater proportion, in fact—had gone into the pockets of the owners of the collieries; and he did think they were honourably bound to give a quality of coal equal to that which gas companies were receiving in the days of lower prices, and therefore they ought, although it might involve a larger expenditure, to see that the coal was sent out in a proper, and not dirty condition. It seemed to him that the Engineer of the Company, as well as of many other companies, was put into the position of the men who had in the olden times to make bricks without straw; and it was impossible for them to keep up results if the coal was not in an equal condition to what it was previously. He believed his view of the matter was supported by this fact—that not only had they used this extra coal in order to make the same amount of gas, but they had consumed a considerably larger quantity of fuel to heat the retorts. About 1000 tons of coke had been consumed in excess of that used in the corresponding period of last year; and this pointed to the fact that the coal had not been yielding so well. There was one good thing that came out of these bad times—that was, that little matters were now receiving an amount of attention from those who had the management of gas companies which, in the halcyon days, when dividends were earned and large sums were carried forward to the undivided balance, hardly called for attention at all. He congratulated the Directors that they had delayed the increase in the price of gas as long as they had done. It was only in 1889 that they were able to put something by for a rainy day; and it would have been foolish to have raised the price earlier.

Mr. GANDON said he was afraid the Chairman had given him a somewhat difficult task to carry out; and he must confess that he was utterly unable to explain satisfactorily the reason for the large increase in the unaccounted-for gas. Mr. Livesey had suggested that part of it might be due to the inferior labour they had now; and Mr. Woodall had hinted that the quality of the coal was not the same as in times past. He admitted that they suffered from both these causes; but, to his mind, they did not explain the large increase in the unaccounted-for gas, because a certain quantity of gas had been measured into the gas-holders. Therefore it was not that the gas had not been made, as it had been sent into the holders—of course, presuming that the meters through which it was measured were correct. He might say that they had had their four station meters tested by the makers last year; and they had themselves checked them by comparing the quantity of gas they were registering as indicated by the rise and fall of the holders, and, so far as he could see, there was nothing to show that the meters were working inaccurately. Therefore he could only imagine that the gas had gone in some way in the district. They were cudgelling their brains to find out the cause; and he wished he could say they had arrived at some definite conclusion in regard to it. There were, however, one or two causes from which they had suffered. They had been laying a considerable mileage of large mains; and in work of this nature, a considerable amount of gas was always lost. They had also had a mishap with one of the holders; but he could not say this accounted for the whole of the difference. They were now searching all over the district to find out any defects there might be in the distributing plant; and he was in hopes of being able to show a better result in the present half year. This was a matter which had caused him great uneasiness; and the sooner he saw an improvement, the more comfortable he should feel. There was one point on which he should like to correct Mr. Woodall. He had stated that the fuel account was very heavy compared with the corresponding half of 1890. In that period they used as fuel 71,960 gallons of tar, and therefore they burnt less coke; so that really the fuel account was now much the same as it was then. The Chairman had referred to the item of maintenance of works and retorts, which had been unusually heavy this year. Everything seemed to fall together. Their locomotive had to be repaired at a cost of nearly £400; and they had to put in two new boilers to replace others that were worn out. Another defect in the working was the increased quantity of coal that had been used; and this, to his mind, must be looked into in connection with the unaccounted-for gas. He assured the shareholders that he felt as dissatisfied with the results of the half year as he well could do; and he should do the best he could to bring about an improvement.

The motion was then carried unanimously.

On the proposition of the CHAIRMAN, seconded by Dr. HETLEY, a dividend for the past half year was declared at the following rates per annum—viz., 6 per cent. on the preference stock, 7 per cent. on the ordinary 7 per cent. stock, 10 per cent. on the ordinary 10 per cent. stock, and 7 per cent. on the new ordinary 7 per cent. shares, all less income-tax.

The retiring Directors (Mr. G. Livesey and Dr. Hetley) having been re-elected, the next business was the appointment of an Auditor to fill the vacancy caused by the death of Mr. C. Newton.

Mr. CORBET WOODALL moved, and Mr. ROBERT MORTON seconded, the election of Mr. A. G. Hounsham; and Mr. J. HILL proposed, and Mr. C. H. SHOPPEE seconded, the appointment of Mr. W. Westcott.

The result of the voting, with the proxies sent in, showed that Mr. Hounsham had received 21,654 votes, and Mr. Westcott, 15,395 votes;

and the CHAIRMAN declared that the first-named gentleman had been elected.

A good deal of discussion between Mr. Westcott and the Chairman ensued, arising out of a request by the former that he might be furnished with the number of shareholders, apart from the Directors, who had voted in his favour, but the information was declined.

Mr. HOUNSHAM having thanked the shareholders for electing him,

A resolution was passed, on the motion of the CHAIRMAN, seconded by Mr. HORATIO BROTHERS—"That the new ordinary 7 per cent. share capital be converted to ordinary 7 per cent. stock, and be consolidated with the existing ordinary 7 per cent. stock."

Mr. BROTHERS, in proposing a vote of thanks to the Chairman and Directors, referred to the question of the unaccounted-for gas; expressing the opinion that the gas could never have been made, and that there was something wrong with the registration.

Mr. MORTON seconded the motion, which was unanimously agreed to.

A similar compliment was paid to the Auditors and officers of the Company; and this was responded to, on their behalf, by Mr. ALFRED LASS, F.C.A.

The proceedings then terminated.

THE GAS-WORKS PURCHASE QUESTION AT BIDEFORD.

The Bideford Town Council met last Wednesday—the Mayor (Mr. R. Dymond) presiding—to receive the reply of the Gas Company to the offer to purchase the gas-works by valuation in the usual way. The communication consisted of the minutes of a special meeting of the Directors held on Feb. 29, when it was resolved that the Council be informed that the Board had no power to enter into a sale of their works without obtaining the consent of the shareholders; that a meeting of shareholders would be immediately convened, and held on the 12th inst.; that the Directors would recommend to that meeting the following basis of settlement, it being distinctly understood, however, that the Company would proceed with their application for the Provisional Order: "That a contract be entered into for the sale of the works at a price to be fixed by two arbitrators and an umpire; that in estimating such price the arbitrators and umpire take into consideration the expenses the Company have been put to in applying for the Provisional Order, and allow the Company such a sum as they might consider fair for what virtually amounted to a compulsory sale; that the purchase be completed from Midsummer next, or such other day as might be decided upon; that all questions be finally decided by the arbitrators and umpire; that in the event of the sanction of the Local Government Board not being obtained, and the contract not being completed by the time agreed upon, that the Local Authority pay all the costs incurred by the Gas Company in applying for the Provisional Order, and in connection with the negotiations." As time pressed, the Directors suggested that the Town Clerk should prepare a draft contract; and, having obtained the sanction of the Council to the same, should submit it to the Directors in time to be laid before the shareholders at their meeting. The report of the Sub-Committee of the Council recommended the Council to inform the Solicitors to the Gas Company that the Town Council would adhere to the former resolution adopting arbitration, upon the terms suggested by the Directors in December last. Mr. T. Pollard, in moving the adoption of the report, said they repudiated the suggestion that there should be compensation for compulsory sale. It was the Company who originally insisted on arbitration; and the Council agreed to that course, and meant to adhere to it. The Company declared their intention of proceeding with their application for a Provisional Order; and he therefore thought the Council should send copies of all correspondence and resolutions passed to Major Marindin, who held the inquiry recently on behalf of the Board of Trade (see *ante*, p. 452), in order that he might see exactly what the Council were doing. This would strengthen their opposition to the Gas Company. Mr. Hookway seconded the motion. Mr. Ascott thought it ridiculous that the Company should clamour for compensation. Several other members concurred in this opinion; and the motion was carried *nem. con.* The following resolution was also agreed to: "That in the letter to Major Marindin, with copies of the proceedings of the Corporation relating to the negotiations for the basis whereon to found a contract for the purchase of the Gas Company, he be informed that failing negotiations the Town Council intend seriously to take into consideration and to adopt the lighting of the town by themselves; and, therefore, that the Town Council are more than ever convinced that the only practical way of settling this question is to take into their own hands the management and control of the public lighting of the town. And that the terms named by the Company for handing this over to the Corporation will be seen by him (Major Marindin) to be framed in such a manner as to render a settlement almost impossible; the only equitable way appearing to be that named by the Company themselves on Dec. 24 last, and which the Council have since adopted."

The Quality and Price of Gas in Melbourne.—Great complaints are being made at the quality of the gas supplied in Melbourne, especially in view of the fact that, at the recent meeting of the Metropolitan Gas Company, a dividend of 21 per cent. was declared and the charge for gas raised. Amidst the general dissatisfaction which prevails, there is heard a proposal to form an anti-gas league, the members of which will, as far as practicable, burn only mineral oil.

Increased Demand for Gas-Stoves.—The *Financial News* says: "It is an ill wind that blows nobody good, and the coal panic has caused a large influx of customers to the gas companies. Never has the demand for gas-stoves for cooking and heating purposes been so great as during the last few days. Of course, if the price of coal continues to go up, the price of gas is bound to follow. But, once in, the gas-stoves will, no doubt, stay; and the gas companies will thus secure a permanent increase of business in a department to which they are wisely devoting a good deal of energy just now."

PROVINCIAL GAS COMPANIES.

From the financial statements and reports of meetings which have reached us during the past week, the following particulars relating to Provincial Gas Companies have been extracted.

A very satisfactory account of the year's working of the Cheltenham Gas Company is given in the report presented at the recent annual meeting. The Directors stated that the higher cost of coal had been met by an unprecedented increase in the consumption of gas and the improved receipts from the residual products. The Company have done well in the matter of the sale of coke; the amount received exceeding one-third the expenditure on coal. For domestic use the sale of coke as a fuel has been much cultivated by the Company; and sulphate of ammonia has been sold at very remunerative prices. The full statutory dividends were declared.

The report presented by the Directors of the Dover Gas Company to the shareholders at the ordinary general meeting on Monday last week was very short. In the half year ending Dec. 31 last, there was a slight increase in the consumption of gas; and the profit realized was sufficient to pay the full dividend of $7\frac{1}{2}$ per cent., and leave a few pounds in hand. The total receipts from all sources amounted to £16,384, of which £12,431 was for gas; and of the £13,672 expended, £7375 went for coal, £2909 for repairs, and £1140 for wages. The Chairman (Mr. W. Mannering), in moving the adoption of the report, said the accounts showed an increased revenue of £189 as compared with the latter half of 1890; and although the total expenditure had been £203 more, coal really cost less by £539. Repairs, &c., including labour, were more by £742. During the half year, 8045 tons of coal were carbonized, or 46 tons less than in the corresponding half of last year. The quantity of gas sold was 80,691,000 cubic feet, as compared with 79,790,100 cubic feet, or equal to 10,030 cubic feet per ton of coal. He expressed pleasure in again testifying to the efficiency of the staff. He said that a more able, willing, and painstaking body of officers and men could not be found; and they well deserved the best thanks of the proprietors for their continued faithful services. The motion was carried: and the proceedings closed with a vote of thanks to the Chairman and Directors.

The annual meeting of the Goole Gas and Water Company was held last Friday week. The Directors' report showed that, after providing for interest on loans, amounting to £473, and the payment in July last of an interim dividend at the rate of 4 per cent. per annum (which absorbed £900), there was, including £454 brought forward from the previous year, a disposable balance of £3159. The Directors recommended that a dividend be paid at the rate of 8 per cent. per annum for the past half year, which would, including the income-tax, require £1800, and make a dividend of 6 per cent. for the year. The report was adopted.

The half-yearly meeting of the Lewes Gas Company was held last Friday week. In submitting the accounts for the six months ending Dec. 31, the Directors stated that the revenue account showed a profit of £1450; and after providing for interest on mortgages, &c., the balance of net revenue was £1958. The Directors recommended that a dividend of 5 per cent. be paid, amounting to £1310, and leaving a balance of £648 to be carried forward. On the motion of the Chairman (Mr. J. Broad), the report was adopted, and the dividend declared. A special meeting was afterwards held, at which the Directors were authorized to re-borrow by statutory mortgage, the sum of £1450, to meet the requirements of the Company on capital account.

The report of the Directors of the Milnrow Gas Company shows a profit on the past half year of £681, which is, however, reduced on the profit and loss account to a disposable balance of £605, out of which the Directors propose the payment of the usual 8 per cent. dividend, which will absorb £600. The income from gas and meter rents was £1854; and from the sale of pitch, coke, oil, and ammonia, £340.

The annual meeting of the shareholders of the Redcar and Saltburn Gas Company was held last Saturday week. The balance-sheet, which was of a satisfactory nature, was adopted; and a dividend of 5 per cent. was declared, making, with the interim dividend paid last half year of 3 per cent., 8 per cent. for the year. Since the reduction in the price of gas three years ago, the annual consumption has risen from 19 million to 32 million cubic feet; and the number of consumers has doubled. The report and accounts were adopted; and a special resolution was passed authorizing an issue of £4000 of capital in shares.

In anticipation of the annual general meeting of the Sheppy Gas Company, to be held to-morrow, the Directors have issued the report and accounts for the past year. The former, which is signed by the Secretary (Mr. A. W. Marks), opens with the satisfactory statement that the quantity of gas supplied during that period was 3 million cubic feet more than in the preceding twelve months. This was the largest yearly increase yet shown; the average during the past ten years having been a million cubic feet per annum. This result is a proof of the growing appreciation of the use of gas for lighting, cooking, and heating purposes. The plan of fitting up houses for the use of gas, and also the supply of cooking and heating stoves, on the three years system, is very popular. This has been one means of inducing a larger consumption of gas, by securing new customers. At Sheerness, as elsewhere, trouble is caused to the Company by the use of the steam-roller. Not only has the loss of gas by leakage from broken mains and services been considerable, but the expenditure in repairs thereby entailed has been heavy. Besides the actual waste of gas, in several instances there was risk of serious accident. The coal contract for the year ending June 30 next was effected at an advance of 2s. 3d. per ton; but owing mainly to the increased use of gas, this additional outlay has not reduced the profit on the year's working so seriously as was anticipated. The return for residuals was better; and this helped to compensate for the higher cost of coal. Further capital expenditure is contemplated, to meet which a call is to be made on the "C" shares. The accounts accompanying the report show that 46 million cubic feet of gas were sold last year for private consumption, and 200,000 cubic feet for public lighting, producing £7057; the sale of residuals realized £2021; and the total receipts were £9781. Of the £6597 expended, coals cost £3461; and wages came to £769. The balance available for division is £2263; and the

Directors recommend the payment of full dividends. The quantity of coal and cannel carbonized was 5074 tons; the residuals being 5125 chaldrons of coke, 50,233 gallons of tar, and 111,500 gallons of ammoniacal liquor.

The half-yearly meeting of the Sutton Gas Company was held recently—Mr. C. R. Mead presiding. The report of the Directors stated that, owing to the mildness of the winter, as compared with that of 1890, the consumption of gas had fallen slightly. The receipts from gas amounted to £6102, and from residuals to £1545; showing a profit, after meeting expenses, of £2087. The maximum dividends of 10 per cent. on the original stock, and 7 per cent. on the additional capital were declared, leaving a balance to be carried forward on the profit and loss account of £2896, and on the reserve fund account of £5398.

HALIFAX CORPORATION GAS AND WATER SUPPLY.

Local Government Board Inquiry.

A Local Government inquiry was held last Thursday week at Halifax, by Mr. T. Codrington and Mr. E. P. Burd, into an application by the Town Council for a Provisional Order, required for the purpose of amending the water charges, and also for increasing the borrowing powers of the Gas Department.

The TOWN CLERK (Mr. Keighley Walton) explained that the amended water charges were desired in order to do away with certain existing anomalies by graduating the prices. Some of these he pointed out—mentioning, for instance, that persons rated at £20 and £30 rental actually paid less at present than those rated at £19 or £29. With regard to the gas-works, he informed the Inspectors that the consumption of gas (which amounted to 72 million cubic feet in 1861) had increased enormously; the consumption last year reaching 539 million feet. The capital expenditure per million feet, on the other hand, had decreased from £1266 in 1861 to £618 in 1891. There had also been a considerable alteration in the prices charged for gas. In 1861 it was 4s. for the town and 5s. for the out-districts; and last year 2s. 2d. and 3s. 2d. respectively. The increased borrowing powers required, the Town Clerk added, were for £100,000. Of this, £17,655 referred to the purchase of land needed for the extension of the works; £11,988, to workshops, offices, &c., to be erected upon it; £30,356, to new retort-houses, &c.; and £40,000, to extensions of mains, &c., connected with the present property. The land, he explained, had been purchased at different times during the past eight or nine years.

Mr. BURD asked if the Gas Department had exhausted their present borrowing powers?

The TOWN CLERK stated that they had expended £953 beyond their powers; and this formed part of the cost connected with the recent enlargement, at a cost of £7000, of the Stoney Royd Gas-Works. He further mentioned that it was hoped the new works would be entirely completed before 1896.

Mr. Brook, the Chairman of the Gas Committee, said they were now at the far end with regard to meeting the demands upon them.

Mr. BURD inquired how it was the Corporation had not made application before this?

The TOWN CLERK said that the former Engineer submitted a report two years ago, stating that the Corporation would have very great difficulty in lighting the town during the following winter, and there was some difficulty.

Mr. BURD said that was all the more reason why the Corporation should have made their application sooner.

Mr. T. Holgate, the Manager of the gas-works, explained that an expenditure of £1000 had been forced upon them in supplying Dean Clough Mills.

Mr. BURD went on to point out that some of the property required was proposed to be leased from the Railway Company. The Corporation might eventually be able to buy this property; and he asked whether, under these circumstances, they had not better provide for the purchase in their present application, so as to avoid the necessity of seeking another Provisional Order.

The TOWN CLERK said they had no objection to doing that.

The Mayor said he certainly thought it would be a good thing to make provision for the purchase; and he suggested that their application for additional borrowing powers should be increased by £20,000.

The INSPECTOR asked that the Town Council should pass a resolution on the subject. They would be unable, he said, to borrow the money without another inquiry; but the granting of the increased powers now would save the Corporation the trouble and cost of a further Provisional Order.

The Lighting Bill of the House of Commons.—While the electric light has been applied in the House of Commons at an annual cost estimated for the coming year at £1800, the gas bill increases rather than diminishes. Last year it was £3000; for the coming year it is believed it will not be less than £3200. There is some slight reduction on the bill for oil-lamps, which before the introduction of the electric light used regularly to amount to £2000 a session. Last year this charge was reduced to £1900; and it is hoped that in the coming year the amount will not exceed £1550. This, says the *Daily News*, is a beginning in the right direction; but a mystery still surrounds the oil-lamps.

New Joint-Stock Companies.—The London Leeds Stove and Deimel Light Company, Limited, has been registered with a capital of £25,000 in £1 shares, to acquire certain patents, patent rights, &c., relating to improvements in gas burners, stoves, &c., and to develop and work them. The Comet Lighting and Heating Syndicate, Limited, with a capital of £18,000, in £1 shares, is to carry into effect an agreement entered into between J. M. L. M. Murtrie and W. E. Smith of the one part and E. C. Kock, on behalf of the Company, of the other part, for the acquisition of certain patents relating to producing, dealing in, storing, using, and supplying liquids of every description for lighting, heating, and motive power.

ELECTRIC LIGHTING FATALITY AT CHATHAM.

On the evening of Friday, the 4th inst., a fatal accident, caused by electricity, occurred at Chatham. It appears that, shortly before six o'clock, the workmen of the Chatham Electric Lighting Company were summoned to the premises occupied by Messrs. Taylor, a firm of outfitters in the High Street, to remedy a defect in the electric lighting apparatus. While the Company's foreman (a man named Readwin) was in the cellar beneath the shop examining the fittings, he pulled one of the wires to see where the looseness was. In doing so, he slipped off the board on which he was standing, and, his hand and foot touching the wire, he received a severe shock. Attracted by his cries, a cutter named Jay, in the employ of the firm, with others, descended and removed Readwin to the shop, he having lapsed into a state of stupor. Shortly afterwards sparks were emitted by the transformer; and Jay, thinking the premises were on fire, rushed into the cellar with an iron bar, saying he would beat the fire out. As he entered the cellar, he held up the bar in a striking attitude, as if to beat out the flame; but immediately afterwards dropped it, and fell back into another man's arms. He was removed from the cellar, and died in five minutes. At the investigation into the matter held by the Coroner for Kent (Mr. W. J. Harris), on the following Monday, at which Major Cardew was present, as representative of the Board of Trade, Dr. Walter Buchanan stated that he had made a *post-mortem* examination of the body, assisted by three other medical men; and they found all the principal organs in a deeply congested condition, and the blood had turned black. Death was due to asphyxia; and the appearances were entirely consistent with death from an electric shock. Mr. Albert Maund, an electrical engineer, stated that he examined the wires and transformer immediately after the accident, and found that there was no insulation on one of the wires, except a slight covering of india-rubber. One of the primary fuses had melted; and, judging by the discoloration of the wall, there had evidently been some "sparking." After a long investigation, the jury returned the following verdict: "The jury are unanimously of opinion that the deceased came to his death through an electric shock by misadventure; and in their opinion greater care should be observed by the Electric Lighting Company in providing switches to turn off the current from the various circuits of wires as occasion requires, and that they should strictly prohibit workmen from executing repairs while the current is on." The man Readwin is lying in the local hospital in a precarious condition; and it is feared that it will be necessary to amputate his hand and foot.

The following version of the occurrence is given by the *Builder*, as the result of special inquiries made to ascertain the real facts of the case: "Messrs. J. W. Taylor and Co., on whose premises the accident occurred, being unable to get any light, complained to the Chatham Electric Light Company, who sent Readwin to see what was the matter. During his investigation, he caught hold of one of the leads coming from a high-tension fuse. One of his feet was on the wet floor of the cellar, and he had omitted to put on his insulating gloves. The covering of the wire was moist; and sufficient current passed through his body to give him a severe shock, and cause him to fall to the ground. In doing so, he jammed the wire between the fuse-box and the cellar wall. Readwin has blistered his hand and foot; but he appears to have received no serious injury. The leakage from the wire to the wet wall was great enough to make the insulation smoke. Jay heard of this, became wildly excited, and rushed to the cellar with an iron rod, intending to beat out the supposed fire. He was followed by a companion, into whose arms he fell senseless while still several feet from the apparatus—dying a few minutes afterwards. Readwin deserves as much sympathy as a gas-fitter who, called upon to stop a gas leak, takes a naked light into a room filled with an explosive mixture of air and gas. The verdict of death by electricity through misadventure, returned by the Coroner's jury, is not to be wondered at; but, in view of the facts that Jay was several feet from the apparatus when he fell insensible, that his body showed no marks of any burn, and that the doctors who gave evidence were not familiar with the signs of death by electricity, we shall be strongly of opinion, until further evidence is produced, that his death was caused solely by excitement."

With the view of eliciting some authoritative statement from the Board of Trade as to their intentions in regard to the introduction of measures to prevent the recurrence of such fatalities as that above recorded, Mr. Patrick O'Brien had a notice on the paper of the House of Commons last Friday to ask the President of the Board whether his attention had been called to the accident, and to the censure of the Electric Light Company by the jury for not having provided proper switches to turn off the current from the wires while repairs were being executed; also whether, in consequence of these cases, and the great dangers experienced from electricity in America, as shown by the correspondence which had taken place between the Foreign Office and the Board of Trade, he would take steps to induce or compel electric lighting companies and others to adopt every possible safeguard for human life. The question was, however, postponed till last night.

Longtown Gas Company.—Mr. Wilson, a local gentleman, has been appointed Secretary of the Longtown Gas Company, in succession to the late Mr. Dixon.

Waller's Patent Combined Exhauster and Gas-Engine.—In the paragraph on this subject which appeared in the *JOURNAL* last week (p. 436), the capacity of the exhauster attached to the 1-horse gas-engine was inadvertently given as 500 instead of 5000 feet per hour. With the lower quantity, a $\frac{1}{2}$ -horse engine would, of course, be sufficient.

Strike at the Leicester Corporation Gas-Works.—A number of the general labourers employed at the Aylestone Road Gas-Works of the Leicester Corporation struck work on Monday of last week. They applied for an increase of $\frac{1}{4}$ d. an hour some time ago; but the Gas Committee refused the advance. A second application was made a few days since; and, on this being refused, the men, to the number of about 50, struck. Little inconvenience was caused at the works, as their places were quickly filled.

THE BIRMINGHAM CORPORATION WATER SCHEME.

In our "Parliamentary Intelligence" to-day will be found a report of the proceedings in the House of Commons, so far as they have gone, on the Bill promoted by the Corporation of Birmingham to increase the water supply of the city by drawing upon the sources of the Wye. As our readers are aware, the project is viewed with a certain amount of suspicion by the Metropolis, inasmuch as it will, it is believed, interfere with the contemplated water scheme for London. But apart from this, it is encountering great opposition on all sides. There are some 30 petitions presented against the Bill, from Welsh and other county councils and local authorities, from landowners, owners of fishing rights, and a certain number of Birmingham ratepayers and water consumers. Most of the petitions from Wales and the western districts deny the need of any extended water supply for Birmingham, or affirm that sufficient water can be found in her own district. The petitions group themselves into a few broad divisions. First, there are those presented by owners whose property is to be acquired under the scheme; and to support the proposed acquisition Birmingham will have to prove such urgency as to justify compulsory sale, if purchase by agreement cannot be effected. Secondly, there are the claims of owners and public bodies along the line of route, from whom way-leave has to be obtained. Given the proof of necessity, these are, of course, persons to be settled with by arrangement. Next come the claims of owners of fisheries; and then the petitions of the railway companies whose lines may be interfered with. Further, there are the petitions of the Corporation of London and the London County Council, asking for the postponement of the scheme until a Royal Commission has reported. These depend upon the proof of urgency; and if this can be clearly shown, as the promoters think it can, the petitioners may abandon opposition to the preamble of the Bill, and ask for clauses to meet their requirements. The next division comprises the two Local Boards of Northfield and King's Norton. Last of all comes the petition of the ratepayers and others, whose *locus standi* before the House appears to be somewhat uncertain, seeing that they are bound by the result of the poll which sanctioned the promotion of the Bill. These petitioners make two assertions—viz., that the Welsh water is of inferior quality, and that a full and ample supply can be obtained by an extension of the present sources. This, of course, they will have to prove to the Committee who will consider the Bill.

The two vital questions in this matter are those of urgency and new sources of supply; and they are put by the *Birmingham Post* in the following form: (1) Is it a matter of urgent necessity; (2) Is it impossible to obtain an adequately extended water supply without going to Wales for it? The first contention, that of urgent necessity, will not, says the above-named paper, be disputed by anyone who knows the actual condition of the water supply, and the immediate prospect. A very few figures will demonstrate the case. The present area supplied from the Corporation water-works is 83,000 acres; there are in it 129,000 inhabited houses; the population is close upon 650,000; and the population now actually supplied is 548,000. This area is gradually filling up; the houses are becoming steadily more numerous, and the population is fast increasing. The demand upon the water supply is growing at a great pace. In 1876, when the works were acquired by the Corporation, the annual consumption was 3031 million gallons—a daily average of about 8 $\frac{1}{2}$ million gallons. In the year ending March last (1891), the annual consumption was 6141 million gallons; and the daily average nearly 17 million gallons. The present daily yield of the rivers and wells is 17 $\frac{1}{2}$ million gallons; and by drawing upon storage supplies from the reservoirs, this may temporarily be increased to 20 $\frac{1}{2}$ million gallons. At the present rate of increase of consumption, Birmingham will in 1893 be close upon the maximum yield. In 1900 she will consume nearly a million gallons daily in excess of the fullest present yield; and this excess will thenceforward rapidly increase. Consequently, in ten years from the present time the city will suffer from a water famine, unless the sources of supply are extended; and, as adequate works will take nearly, if not quite, ten years to construct, there is really not a day to be lost. This is confirmed by the experience of Manchester, which obtained its Thirlmere Act in 1887, and of Liverpool, which obtained its Vyrnwy Act in 1880; and neither city has yet obtained water from these sources. As to the possible local sources of additional supply, it is shown that it would be practicable to extend the reservoirs in the valley of the Blythe and the Bourne, and to sink more wells in the sandstone; but, as to the former plan, the cost would be heavy—probably a million, which would be ultimately thrown away—and, after allowing for extra compensation water, the increased storage capacity (even if aided by fairly-yielding wells) could not possibly suffice for 20 years at most. There is a fatal objection to the extension of river supplies and the storage of water so obtained—viz., that the rivers available run through highly manured and cultivated districts, studded with villages and farms, and consequently yield water liable to rapid deterioration in quality, and likely to be ultimately condemned as unsafe for domestic purposes. Being thus practically shut out from safe and adequate extensions of river supplies, the question arises, What can be done by means of additional wells in the sandstone? The wells yield so capriciously as to indicate that the sandstone is not an unfailing reservoir. It has been tested at various points, and this has been the result shown. It is found that continuous pumping at the existing wells diminishes their average yield, and that intervening wells are affected. These facts seem to prove that local sources of supply cannot be depended upon; and that the Corporation will be forced to go further afield for any additional water they require.

With regard to the position taken up by local authorities likely to be affected by the scheme, a few weeks ago there appeared every likelihood that the Wolverhampton Corporation would be an opponent of the scheme; but an amicable arrangement has been entered into, by which the Birmingham Corporation have agreed that, should the eventuality arise, the Wolverhampton Corporation will be permitted to tap one of the mains by which it is proposed to carry the water from Wales to Birmingham, and thereby serve Wolverhampton. This town and the district are now supplied from wells at Cosford; and, under the arrangements with the Birmingham Corporation, should

these wells run dry, they would have the option of taking a supply from the mains. Wolverhampton will therefore support the measure, as will also Worcester and Kidderminster, on condition that provision is made for local authorities within 15 miles of the aqueduct to have a supply of water therefrom.

LEICESTER CORPORATION WATER SUPPLY.

Proposed New Reservoir—Arbitration Proceedings.

Mr. R. Clutton, C.E., the Umpire agreed upon to hear evidence in the arbitration between the Leicester Corporation and the Earl of Lanesborough with respect to the price to be paid by the Corporation for land at Swithland required for a new reservoir, sat for that purpose at the Surveyors' Institution, Great George Street, S.W., on Monday, the 29th ult. Mr. Bidder, Q.C., and Mr. A. T. Toller appeared for the Corporation; the Solicitor-General (Sir E. Clarke) and Mr. Bremner represented Lord Lanesborough. In opening the case, the Solicitor-General stated that the land in question was required for establishing the Swithland reservoir for the purpose of supplying Leicester with water. In 1890, the Corporation obtained an Act authorizing them to construct new works; and there were provisions in it affecting the Earl of Lanesborough. The area of the watershed was 3500 acres, so that Swithland covered the larger portion of that area. The Corporation were proposing to take 225 acres of the estate, which, added to some 55 acres they had obtained from a neighbouring landowner, gave them the site of the reservoir. It had been shown by the Corporation themselves that this was a place of exceptionable value for a reservoir. The quantity of water that could be stored there had been put at 630 million gallons; and it would supply Leicester for some time to come with water of an exceptionally good quality. The effect of taking the 225 acres of land was that a piece was practically cut out of the middle of the estate, which was divided into two separate parts. The estimate they put upon the loss and injury Lord Lanesborough would sustain was £58,000 or £59,000. The estate was very attractive for sporting purposes; and its value for selling after the portion required had been taken away would be considerably lessened, besides which the drainage of the land around would be materially prejudiced. A new railway was to be brought very near to Swithland Hall, passing along some of the land which would remain to Lord Lanesborough, and also over a substantial part of the property which the Corporation were going to take; and it could not be denied that this proposal would induce the owner to refuse to sell the land at the price which he would if there was no likelihood of a railway coming within 10 miles of it. Concluding, he contended that something must be allowed for personal inconvenience to the vendor and expenses of living elsewhere during the progress of the work; and he thought £5000 would be a fair sum. The first witness called was Sir J. Whittaker Ellis, who expressed the opinion that the Corporation scheme would completely alter the character of the estate. He gave details of a calculation by which he arrived at £53,158 as the consequential damage by the Corporation to the property, to which he added £5000 for personal inconvenience and cost of another residence during the progress of the work, and £3000 as the value of the timber. Witness was cross-examined at considerable length by Mr. Bidder; and then Mr. Tewson (of Messrs. Debenham, Tewson, and Co.) gave evidence at some length, the substance of which was that he calculated the total sum to be paid by the Corporation to Lord Lanesborough at £58,546. Another of the witnesses—Mr. Oakley, a land surveyor, of London—estimated the total amount at £52,175, exclusive of the timber. The proceedings were continued on Tuesday; and Mr. Lofts, a land agent, gave evidence showing that the proposed works would destroy the estate as a residential property. Before the case for Lord Lanesborough closed, the Solicitor-General announced that they had agreed to a valuation of the timber at £2700. Mr. Bidder then called his witnesses; Mr. J. W. Beadel, M.P., being the first. He admitted that there would be a certain amount of severance of the estate, for which compensation should be paid. He also agreed that there would be some temporary inconvenience to the owner during the progress of the work, which must also be paid for. He thought, however, that, when the reservoir was completed and in good working order, it would improve the residential character of the estate rather than otherwise. Mr. J. F. L. Rolleston stated that, in his judgment, the reservoir would be no detriment whatever, but rather an improvement to the estate. He gave a number of figures, which, summed up, showed that he computed the amount to be paid to Lord Lanesborough at £17,622, or, with timber added, at £20,372. Mr. Goodacre, Mr. Vigers, and Mr. German also considered the reservoir would be an improvement to the estate; and the last-named witness allowed £17,131 as the total amount of the compensation. Mr. Bidder afterwards addressed the Umpire; being followed by the Solicitor-General, with whose remarks the proceedings terminated.

THE WATER SUPPLY OF BILSTON.

The Town Commissioners and the Wolverhampton Corporation.

A public meeting of ratepayers was held at Bilston last Wednesday to consider the water question, more particularly as to whether the Town Commissioners should conclude their negotiations for cancelling the subsisting agreement to take water from the Wolverhampton Corporation and construct water-works for the town at an estimated cost, including compensation to Wolverhampton, of £40,000. The Chairman of the Commissioners (Mr. T. Johnson) having briefly opened the proceedings, Mr. T. Holcroft said one of the questions that had to be settled was whether or not the Commissioners should proceed with their appeal to the House of Lords against the decision given in favour of the Wolverhampton Corporation.* If the Commissioners won, they would then not have to take the surplus water from Wolverhampton, who would have to pay the costs; but personally he was in favour of coming to reasonable terms rather than going to

law. Two years ago, when the Commissioners went to Parliament with a view of securing powers to supply the town with water, a scheme was prepared which showed that the water could be obtained for 2½d. per 1000 gallons, as against 5d., which was now being paid to Wolverhampton. Mr. Baldwin Latham at that time estimated that the cost of obtaining a supply of 500,000 gallons per day would be £19,000. What it was now proposed to do was to put down plant to obtain 1,000,000 gallons a day; and, including £9000 which it was proposed to pay to the Wolverhampton Corporation to release the Commissioners from the existing agreement to take water from that body, the estimated cost was £40,000. If it was decided to apply for parliamentary powers, the Wolverhampton Corporation, for the payment of the £9000, would assist the Commissioners. The site of the water-works would be at Wombourne. It was proposed that powers should be obtained to repay the £40,000 in thirty years; and this would require £2200 a year. Adding to this £500 for pumping and distributing the water, the annual expenditure would be £2700; but as the receipts at the present time amounted to about £3400, this would give a profit of £700 a year on a distribution of about 400,000 gallons a day. The Commissioners would still have 600,000 gallons a day to dispose of; and if they could sell it at 4d. per 1000 gallons, a profit would accrue of between £4000 and £5000 a year. There was a good deal of discussion on the subject; and in the end a resolution was passed approving of the action taken by the Commissioners in their negotiations with the Corporation of Wolverhampton for cancelling the agreement for the supply of water to Bilston.

Gas or Oil at Hucknall Huthwaite.—At a meeting of the Hucknall Huthwaite Local Board last Tuesday, further steps were taken to oppose the application of the South Normanton and Blackwell Gas Company for a Provisional Order; and instructions were given for several street-lamps to be at once experimentally lighted with oil.

The Electric Lighting Scheme for Antwerp.—The Communal Council of Antwerp have agreed to the proposals of MM. Moris and Van Rysselberghe in regard to lighting the city by electricity. The undertakers will have to pay down at once 500,000 frs. by way of security, and a similar amount before the expiration of six months. They are to furnish a supply of water at a pressure of 10 atmospheres to produce the current, and they may also supply electricity direct by means of underground cables. The municipal authorities may, within four years, call upon the concessionaires to provide electric lighting for the public thoroughfares on a descending scale, which will reduce the cost to *nil* in 25 years. In this event the concessionaires will not have to pay any tax to the city; and they will be allowed to employ overhead wires instead of underground cables.

Londonderry Gas Company.—The ordinary general meeting of this Company was held on Friday, the 4th inst.—Mr. R. W. Newton, J.P., in the chair. The Engineer and Secretary (Mr. J. Macnie, Assoc. M. Inst. C. E.) having read the notice convening the meeting, the report and accounts were presented. The Chairman, in moving their adoption, stated that, after providing for all expenses, there was an available balance of £4003, out of which the Directors recommended a dividend at the rate of 10 per cent. He alluded to the high price of coal and cannel; but stated that as there had been a large increase in the consumption of gas and a better return from residuals, he believed that all need for advancing the price of gas had been averted. Referring to the electric light, he said the shareholders were aware that the Corporation had obtained powers to supply electricity in the city, and that there was a movement on foot to put these powers into operation. However, unless the conditions of Londonderry were more favourable for the development of this source of light than those found in other towns where the light had been adopted, he believed the shareholders had no cause for alarm. He then went on to say that it was within the knowledge of the Directors that a desire to acquire the Company's business had recently been expressed; and if the Corporation, following the example of some other local authorities, wished to become owners of the works and to control the gas supply of the city, the Directors would be willing to consider any proposals made to them with this object in view. Mr. W. Tillie seconded the motion, and it was adopted. The retiring Directors and Auditor were then re-elected; and the proceedings closed with votes of thanks to the Directors and to Mr. Macnie for the attention they had given to the affairs of the Company.

Lecture on Coal Gas.—In connection with the Hexham Wesleyan Mutual Improvement Association, a lecture on "Coal Gas" was delivered on the 29th ult., by Mr. Herbert Lees, the Manager of the Hexham Gas Company. It was illustrated with models and diagrams. After giving the history of coal gas, and describing its manufacture, the lecturer remarked that whatever the future of electric lighting might be, there was not the slightest indication that it would ever seriously affect the consumption of gas. Its use was almost entirely confined to the houses of the wealthy, and the front premises of large business establishments. Gas had been, and would continue to be, the poor man's light—using this phrase in its widest sense; and they might rest assured that this class of people would always be with them. But the present use of gas was not by any means confined to lighting. As a cooking agent, it stood first and foremost; and no well-managed establishment should be without a gas cooker. It was cheaper, cleaner, and in every respect better than the coal range. Then there was the field for motive power for gas, which was capable of expansion in a variety of ways; not the least important of its uses in this direction being its application for the generation of electric light. As a ventilating agent, it was now extensively adopted with great success. A few years ago the great cry was for electric light in the streets; for outdoor lighting it was supposed to be infinitely superior to gas. This fallacy had been exploded long ago; but it was never more patent than during the very heavy fogs in London during Christmas week, when the superiority of gas for penetration was abundantly proved. In concluding, Mr. Lees showed the advantage, from an economical point of view, of using regulator burners. At the close of the lecture, which was most instructive as well as interesting, a hearty vote of thanks was accorded to Mr. Lees.

* See JOURNAL, Vol. LVII., p. 650.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

I am afraid I cannot keep always drumming away at the common-stair lighting question; but for this week yet I must drag it in, because it has been made the subject of a judicial decision, and has been mentioned at meetings of two public bodies—the Town Council and the Trades Council. The judicial proceedings took place in the Small Debt Court. In this case, the pursuer, Mr. James Shaw, the owner of property in Buccleuch Street, claimed £12 from the Gas Commissioners as damages in respect of breach of contract, which he alleged the Commissioners had been guilty of in the cutting off of the gas in the stair. Along with the Gas Commissioners, there were also called as defenders the Town Council and the Inspector of Lighting; but the Gas Commissioners undertook the defence of the action, and the others were not represented in Court. Mr. Jack, the Clerk to the Gas Commissioners, conducted the defence; and he carried the war into the enemy's country by averring that there had been breach of contract on the pursuer's part, in paying for gas to be burned till 11 o'clock and allowing it to be used after that hour. In Mr. Jack's hands, the pursuer was made to admit that he had contracted for gas to be burned only till 11 o'clock, and that the Commissioners reserved power to cut it off if it was burned after that hour; and he also stated that when he received the first warning from the Gas Commissioners, he communicated it to his tenants. He believed that his tenants turned off the gas regularly, but that someone lighted it afterwards. There was no attempt, however, to prove that this had taken place; and the Sheriff dismissed the action, but without expenses—I suppose, because the Commissioners had practically incurred none, as their Clerk defended the action. His lordship, at the same time, took it upon himself to deliver a short homily on the subject, in which he stepped out of his sphere, and, I fear, talked without book. He said it had been stated that there were five tenants on each flat of the stair. It was quite obvious that some arrangement must be made between them by which the duty of turning out the gas should be taken in turns. It was quite possible that there was a hardship; but it was a matter that should be taken up by the public authorities. He could see that it was impossible to work out a system of that kind when it was left to a class of tenants such as those, who could not be got to do what was necessary as a matter of regular habit; and it would be necessary to adopt some system whereby the lamplighter or the policeman, or some independent person, would take in hand the extinguishing of the lights on such stairs.

At the Town Council, the subject was brought up by a deputation from the Social and Sanitary Society, who, headed by the Rev. R. Henderson, presented a memorial urging, in the interests of morality, that the time had come when the Corporation should take the lighting and extinguishing of lights in common-stairs into its own hands, and that the lights should be kept burning the whole night. Their method of doing the work was by the appointment of resident caretakers. Bailie Macpherson, as the Americans would say, fixed the memorialists with the question of who was to pay the caretakers; and all the reply he could get was that they left it to the discretion of the Council. The subject was referred to the Cleaning and Lighting Committee.

The Trades Council, a democratic body, were for exercising no discretion in the matter; but thought the cost of stair-lighting should be thrown on the rates. Even they, however, sent the subject to a Committee for consideration. With all this ado over a question which is purely one of administration, surely some solution of it will be arrived at which will give more satisfaction than the present method; albeit, it is to be observed, the present method works well enough in tenements where the people are honest, and that the relief which is proposed is for the benefit of those who are not honest.

Important extensions in the retort-house department of the Dawsholm gas-works have lately been resolved on by the Gas and Electric Lighting Committee of the Glasgow Corporation, and approved of by the Town Council; and it is thus seen that even the sanguine "electric lightists" of the Committee are of opinion that the days of coal gas are not yet numbered. At the end of January of the present year, Mr. Foulis submitted to the Sub-Committee on Works a plan showing certain extensions which he proposed to make in the retort-house and adjoining coal-store at the works named; and after the Sub-Committee had given consideration to the matter, they approved of the proposed extensions, and authorized him to prepare the necessary specifications and schedules for the work. The tenders have been received and were opened this week—six for the brickwork, masonry, excavations, &c., and three for the roofing and other ironwork. In the case of the former, the amounts of the tenders are said to range from about £7750 up to nearly £2000 more, from which figures it seems as if there had been a little "wild" tendering. The tenders sent in for the iron roofing, &c., were received from three well-known and old-established firms—the Barrowfield Iron Company, Messrs. P. and W. Maclellan, Glasgow, and Messrs. Hanna, Donald, and Wilson. It may be said that, roughly, the proposed extension works will not cost much short of twenty thousand pounds.

Mr. A. Smith, the Manager of the Aberdeen Gas-Works, has submitted proposals to his Committee for the improvement of the works, which include the removal of a small gasholder from the works to a site in the recently-acquired suburb of Woodside. There is at present a gasholder in the district; but the consumption is growing fast, and it is found to be difficult to send the gas from it down to the famous paper mills of the Messrs. Pirie, on the banks of the River Don. The new holder will be on the low level, and will provide for the additional demand of the district as well as for the better supply of the mills. The existing tank in the works will be retained and covered over to serve as a store for tar or liquor. Mr. Smith also proposes to remove the existing workshops to another part of the works, on account both of their present defective accommodation and the danger of fire which arises from their being situated quite close to the tar wells and other apparatus. On their site, he proposes to erect additional purifiers. The Gas Committee are to report on the subject.

The Police Commissioners of Inverness have lost no time in proceeding with the work of extending the gas-works after clearing away the electric lighting phantasy. They had before them on Thursday

night offers for the construction of the tank and the erection of a new gasholder; and they resolved to accept that of the Thorncliffe Iron Works, Sheffield, the amount of which was £6180. For the erection of purifiers, the contract was given to Messrs. Ashmore, Benson, Pease, and Co., Limited, the amount being £999. Mr. Roderick Fraser, a local tradesman, has been selected to do the masonry and other work for £1112 15s. These sums amount to about £1000 below the estimate of Mr. Thomson, the Gas Manager. The Gas Committee had recommended that power should be taken to borrow £15,000; but, inasmuch as the cost of the new works had turned out to be less than was expected, and that they have still power to borrow to the extent of £3000, it was resolved to take powers for the borrowing of only £12,000. A Sub-Committee have been asked to consider whether it will be necessary to raise the price of gas; the feeling being that an increase might be made, particularly upon consumers outside the burgh boundaries.

A Police Bill is being promoted for Dundee this session; and at a meeting of the Police Commission on Thursday, the subject was raised of the desirability of amalgamating some of the public bodies in the city. There is at present a Town Council, a Police Commission, a Gas Commission, a Water Commission, and a Harbour Trust, all with different staffs—certainly a very costly method of conducting the business of a community. The Town Clerk ruled that it was now incompetent to insert a fresh clause in their Bill; but that power to amalgamate was proposed to be given in the General Police Bill for Scotland, which was expected to be passed by Parliament this session. There is a great anomaly in the constitution of the Gas Commission, in respect that the Chamber of Commerce, the Nine Trades, and the Three Trades, which are impecunious bodies, send representatives to it. It was pointed out that if the Gas Commission were to become bankrupt, those bodies who sent representatives to it had no funds, and it would be the ratepayers who would have to bear the burden. This is very true; and an amendment of the constitution of the Gas Commission can only be a matter of time.

At the ordinary monthly meeting of the Coatbridge Town Council which was held on Thursday last, there was submitted a report by Councillor Chisholm on the local Gas Company's accounts; and the calling for such a report would appear to indicate that the relationship between the Gas Company and the Town Council is still of a somewhat unfriendly character. The report stated that the accounts had been drawn up as usual in statutory form, and had been duly audited. During the year, an additional sum of £2000 had been borrowed on mortgage, raising the loan capital to £4000. On addition to plant, mains, and meters, there had been expended the sum of £1183; and during the year there was an increase of 3,270,000 cubic feet of gas sold, while the amount received for public lighting had been increased to the extent of £136. The total amount received for the sale of gas, public lighting, and rent of meters was £12,668; being an increase of £1950 over the income in the previous year from the same sources of revenue. (I may parenthetically remark that Councillor Chisholm's report does not take any cognizance of the income derived from the sale of coke, tar, and liquor.) The report goes on to say that the price of gas was raised 5d. per 1000 feet at the beginning of the year, and that, along with the larger sum received for public lighting, produced £1440, thus showing the natural growth of the revenue to have been £510. Dividends in full, less income-tax, had been paid. The additional sum realized by the increased price of gas appeared (to the reporter) to have been required to meet the increased cost of production, as the net amount at the credit of profit and loss account is £17 less than in the preceding year; but the amount was still £253 more than was authorized by Act of Parliament.

Tenders have been received this week for the central electric lighting station which the Glasgow Corporation have agreed to erect at the corner of Waterloo Street and Mains Street. Ten firms of local contractors have tendered for the excavation work, mason work, &c., and eight for the roofing and other ironwork. I need not go into any details with regard to these tenders; but I am informed that well nigh £10,000 will have to be expended upon the erection of the station as designed by the combined heads of Professor Kennedy and Mr. Foulis. Of course, the equipment in the shape of boilers, engines, dynamos, &c., is a subject for future consideration; but it certainly means an expenditure of a considerable amount more money.

The experiment now in progress in the town of Hawick in respect of street lighting by electricity, seems to have made some impression on the local "powers that be;" but whether or not it will lead to an extension of the use of electricity for that purpose instead of gas, is another question. At the invitation of the Town Council of Hawick, Mr. Henry A. Mavor, the leading member of the electrical engineering profession in Glasgow, is to give a lecture in the Town Hall on Monday evening, on "The Various Applications of Electricity to Public, Industrial, and Domestic Purposes." It is by Mr. Mavor's firm that the street-lighting experiment is being carried out; and I may mention, by the way, that there is some hope that local water power may eventually be utilized in developing the electrical energy required for the permanent lighting of the town by the new illuminant. It may be stated, however, that the Directors of the Hawick Gas Company have not got into a condition of fear and trembling over the prospect of the street lighting being taken from them. Still, there is room for believing that it might have been good policy for the Gas Company to have done something before this time, in the way of meeting the growing demand for the new illuminant in the headquarters of the Scotch hosiery trade—a demand which had already shown itself by some of the local millowners having started installations for themselves.

Projected Extension of the Hindley Gas-Works.—At the meeting of the Hindley Local Board last Tuesday, the Gas Manager (Mr. W. Dickenson) reported an increase of 887,800 cubic feet in the consumption of gas in the preceding four weeks, as compared with the corresponding period of last year; and he recommended that additional plant should be provided. It was resolved that he should sketch out the requirements of the gas-works and report thereon; and, further, that he should visit places where generator furnaces are in use, with the view of obtaining particulars as to their working results.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, March 12.

Sulphate of Ammonia.—A little more activity was noticeable at the beginning of the week, and a fair business resulted. But the market has once more become lifeless; and this is perhaps not to be wondered at, seeing the unsatisfactory surroundings. The again late season causes many of the dealers to resell the sulphate previously contracted for in anticipation of a good demand this month; and low prices have to be accepted for such forced sales. Then the speculators are assisting the market down by sending quotations about broadcast considerably under the already very low values; their action naturally causing the frightened consumer to halt for fear of paying even now too dearly for his nitrogen. Thus time drags on; and we are rapidly getting past the best part of the season. There is still ample opportunity for making up for lost time; but the improved demand must now come quickly and sharply. Meanwhile the speculators are leisurely covering in their short sales, and the stocks are not increasing. Hence the position in itself cannot be said to be any worse; and milder weather would no doubt speedily change the complexion of the market. Prices are still at £10 5s. Hull and Leith, and £10 2s. 6d. Liverpool. Nitrate—also suffering from the adverse season—is very slow at 9s. 4½d.

LONDON, March 12.

Tar Products.—With the exception of pitch, which is moving off briskly, and for which there is some inquiry for forward delivery, business in this market is as bad as it well can be. Benzols have lost the advance they obtained recently, and other products are practically unsaleable. Important contracts for tar have been booked at prices ranging from 12s. to 15s., which, in the present position of the market, is ample enough for it. Prices are: Tar, 12s. to 15s. Pitch, 30s. Benzol, 90 per cent., 2s. 3d.; 50 per cent., 1s. 8d. Toluol, 1s. 4d. Solvent naphtha, 1s. 3d. Crude benzol naphtha, 30 per cent., 11d. Creosote, 1d. Naphthalene salts, 25s.; pressed, 45s. Carbolic acid, crude, 60's, 1s. 0½d.; 70's, 1s. 4d. Crystals, 5d. Cresol, 8½d. Anthracene (30 per cent.), "A" quality (nominal), 1s.; "B" quality, 8d.

Sulphate of Ammonia.—There is no relief from the deep depression which seems to have settled down on this article. It is difficult to sell, and buyers are continually wanting lower prices. The little business that has been transacted has been done at £10 to £10 5s., less 3½ per cent. discount. In some quarters, 2s. 6d. more is offered for forward delivery. Gas liquor, 10 oz., is quoted at 6s. to 7s. 6d.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—During the past week, the coal trade of this district has been settling down again into something like reasonable condition; and the altogether unnecessary panic which so disorganized the market has completely subsided. The very general belief now is that the stoppage of the pits will not extend over a week; and this, so far as the miners of Lancashire are concerned, is confirmed by resolutions which have been passed at some of the district meetings of the Federation, to the effect that the delegates be instructed not to support anything beyond a full week's cessation of work, but to advocate a restriction of the output to five days per week during the summer. The pressure of demand for the better qualities of round coal has altogether disappeared; but colliery-proprietors are necessarily considerably in arrears with delivery on account of the orders already booked. With regard to the lower qualities of round coal for iron-making purposes, most of the forges are ceasing operations during the stoppage of work at the pits; and this is necessarily counteracting the temporary stoppage of supplies. With regard to engine classes of fuel, the pressure for extra supplies to carry works and mills over the cessation of work at the pits, has not shown so much abatement as in other descriptions of fuel; but with the large quantity of coal that has been recently taken out of stock, it is not likely that there will be any great scarcity of either burgy or slack. In fact, considerable stocks are still held at many of the collieries; and altogether there has been quite an unnecessary anxiety on the part of consumers, with regard to their supplies. Many of the principal firms have continued all along the supply of their regular customers at old rates; but in the open market, advances of 1s. 6d. to 2s. per ton upon round coals, and about 2s. to 2s. 6d. per ton on engine fuel, have been readily obtained, and still represent the basis of prices, which, however, can only be temporarily maintained. At the pit-mouth, current prices in the open market may be quoted at about 13s. to 14s. for best coals; 11s. to 12s. for seconds; 10s. for common coals; 8s. to 9s. for burgy; 7s. to 8s. for the best qualities of slack; and 4s. to 5s. for the inferior descriptions. The demand for shipment has not been out of the way; but with such high prices obtainable on inland sales, only limited quantities have been offering at the ports, and to secure supplies, special prices have had to be paid—11s. 6d. to 12s. 6d. having been readily obtained for steam coal, delivered at the High Level, Liverpool, or the Garston Docks.

Northern Coal Trade.—The coal trade in the north is now determined in its prospects by the decision of the Durham miners to strike; and the decision must greatly influence the gas-coal trade. Northumberland miners will continue to work on; and this will lessen the effects of the strike in Durham. Northumberland coal has, however, increased in price, best steam being now 11s. to 12s. per ton, f.o.b.; but prices will be influenced by the extent of the competition with Wales and Scotland. Small steam coal is firm, at from 5s. to 5s. 6d. per ton, f.o.b.; but the output in Northumberland will be large, and the consumption will be reduced by the closing of some works in the North. There are two or three gas-coal collieries in Northumberland; but their output is limited to the needs of the trade. Some sales have taken place of gas coal by one of these collieries at about 11s. per ton, f.o.b. in the Tyne—2s. 6d. above the price of three weeks ago; and it is certain that 12s. per ton is now asked, and may be paid in a few days unless the situation should

be speedily changed. As to the duration of the strike, it is not expected that it will be prolonged; because it is known that the leaders of the miners are against it, and it is believed that the funds of the Union are not equal to the financial needs of the 50,000 members who are entitled to strike pay. There have been stocks of coal laid up in the last week to some extent; but there will also be a closing of iron-works, which will materially lessen the consumption. Durham produces on the average over 500,000 tons of coal weekly; and it is at once evident that there will be a serious effect from the stoppage, though there is no doubt that the output of Northumberland will be increased in some degree. This is the position; but it is quite possible that it may be altered by the meeting of the miners' delegates in London in a few days. Coke is steadier, especially blast furnace coke, which has been sold at 17s. per ton, f.o.b. in the Tyne.

West of Scotland.—The coal trade in this district is firm for prompt delivery; but there is comparatively little forward inquiry. Business with the Continent is at a standstill, foreigners waiting until the Durham miners come to some determination as to what course they will adopt. There is some uncertainty as to how the miners will act in the Slamannan district, owing to the action of the leaders, who, it was stated, were making arrangements to have the district picketed yesterday (Monday) morning. At a meeting of the Slamannan coal-masters on Wednesday afternoon, those present expressed themselves as still determined to resist the attempts being made to induce the men in that district to join the holiday movement. Apart from the strike difficulty, the outlook for the future is said not to be very cheering for the trade. Prices in Glasgow may be quoted: Main, 8s. 3d.; ell, 8s. 6d. to 8s. 9d.; splint, 9s.; and steam, 10s. 3d. to 10s. 6d. The shipments of Scotch coal for the past week reached a total of 117,428 tons, as against 115,564 tons for the previous six days, an increase of 18,642 tons. For the year up to date, the exports total 962,404 tons, an increase of 154,633 tons.

Messrs. Richmond and Co., Limited, have removed from their temporary premises in Basinghall Street, to No. 93, Cheapside, E.C.

Gas Exhibition at Newcastle-on-Tyne.—Encouraged by the satisfactory results of the exhibition held in September last, Messrs. Richmond and Co., Limited, of Warrington and London, have been holding another during the past fortnight in the Northumberland Hall, Newcastle-on-Tyne. Cookery lectures have been given by Miss Owen, of South Kensington, and a French chef. The audiences have been large, and the exhibition has been very successful. Last Tuesday afternoon, Mr. E. W. T. Richmond delivered an address on "The Use and Abuse of Gas as a Fuel."

The Crisis in the Coal Trade.—Telegraphing last night, our Bolton Correspondent said: The only feature of interest to-day in connection with the stoppage in South-East Lancashire is the extreme quietude which prevails throughout the colliery district. Some little difficulty was anticipated with the non-unionists, who number about 5000 out of a possible 21,000 in this district; but returns at head-quarters show that they have combined with Union men, and not resumed work. Underground operations, in fact, are entirely suspended at all the pits, save where day men are employed keeping roads clear and repairing, in view of work being resumed on Monday next. As the resolution of the Manchester conference simply prohibited coal being got, many of the men are engaged unstacking and loading at the pit banks.

The Bradford Corporation Water and Lead-Poisoning.—At a meeting of the Eccleshill Local Board last Tuesday, Dr. Aston, the Medical Officer of Health, read a special report on lead-poisoning in the Eccleshill district, in which he affirmed that during his thirty years' experience he had never encountered cases of so grave a character as now. This, he said, was really a lead-ridden community. Twenty-five samples of water had been taken from different parts of the township, and had been reported upon by Mr. Rimmington, the Borough Analyst, who stated that twenty-three contained lead averaging ¼ grain per gallon, and in one case ¾ grain per gallon. He (Dr. Aston) has seen six or seven cases of lead-poisoning per day. The members were of opinion that these matters should be laid before the Bradford Corporation Water Committee.

The Supply of Water to High Levels.—The Barnstaple Magistrates recently had before them a case involving a point of interest to the Water Company and to their customers in the high levels of the town. Mr. W. E. Pitts-Tucker, a solicitor, was summoned for the non-payment of water-rates, amounting to £2 2s. The sum of £1 15s. had been paid into Court; the remaining 7s. representing an additional charge of one-fifth which the Company claim to be able to levy on high-level consumers. The case raises the question whether section 6 of the Company's Act of 1888 empowers them to charge one-fifth extra for water supplied by means of their works. The Town Council last year submitted the section to the Attorney-General and the Recorder of Barnstaple, who decided that it did not confer the power. The section in question is as follows: "In the cases in which the Company shall supply water at a pressure above or greater than that afforded by gravitation, either from the now existing reservoir or from any other reservoir supplied otherwise than by pumping from a reservoir or pumping-station at a lower level, the Company may demand and take, in respect of such supply, an additional rate not exceeding one-fifth part of the charge authorized by the Act of 1858." For the Company, it was maintained that the section was eminently fair and equitable, inasmuch as they were put to great expense in providing for the supply of water to the higher levels. The section was ambiguous; but the governing idea of the section was that an extra charge might be made where the supply was by pressure greater than that afforded by gravitation from the now existing reservoir. When two contradictory interpretations could be arrived at, the Court was permitted to consider the consequences of the interpretations. The common-sense reading was in favour of the Company. For the defence, it was urged that the section specially provided against the levying of an additional rate on water supplied from the new reservoir at Pickard's Down, to which the water was pumped from the old reservoir. The Bench, with one dissident, decided in favour of the defendant; but they granted a special case.

Clevedon Water Company.—At the recent ordinary general meeting of this Company, the Directors' report and balance-sheet were passed, allowing a dividend of 6 per cent. per annum, free of income-tax. The receipts amounted to £2302, including £2081 for water-rents. The profits were £1294, of which £1020 was absorbed in dividend.

Gas Exhibition in York.—In the presence of Mr. C. Sellers and a large audience, the High Sheriff of York (Mr. Forster) opened on Monday evening last week an exhibition of gas appliances, promoted by Messrs. Richmond and Co., Limited, of Warrington and London, in the Central Hall, Exhibition Buildings, York. Mr. E. W. T. Richmond gave an amusing sketch of "Gas versus Coal in Our Kitchens." In spite of the very heavy snowstorms and the inclement weather prevailing, the exhibition was a decided success.

Electric Lighting at the Mansion House.—An installation of electric lighting has just been completed at the Mansion House for the Corporation of the City of London, and a private view took place on Monday last week. The installation consists of 825 glow lamps ranging from 5 to 50 candle power, which have been fitted over the whole of the Mansion House; the chief rooms being the Egyptian Hall, the Venetian room, the long parlour, saloon, state drawing-room, the Lady Mayoress's boudoir, and the justice-room. The work has been carried out to the specification of Mr. W. H. Preece, F.R.S., by the Planet Electrical Engineering Company; and the current is supplied by the City of London Lighting Company.

Visit of the Manchester Gas Committee to London.—The Gas Committee of the Manchester Corporation came to the Metropolis last week on a visit of inspection. The deputation comprised the Chairman (Mr. J. Brooks), Deputy-Chairman (Mr. R. Gibson), the Superintendent of the Gas Department (Mr. C. Nickson), and seventeen members. On Wednesday morning they visited the works of the City and South London Railway Company at Stockwell, for the purpose of seeing the dynamos, engines, and boilers at work. They then took a trip on the railway to the City; and subsequently went to the Crystal Palace to inspect the Electrical Exhibition. On Thursday they went down to Beckton to see the large four-lift holder, capable of containing about 8 million cubic feet of gas, in course of erection there by Messrs. C. and W. Walker.

The South Essex Water Company and the Supply of Water to Re-let Houses.—Last week, an application was made to Justices Cave and Collins, in the Queen's Bench Division, on behalf of the above Company, for a rule nisi calling upon the local Justices to show cause why they should not state a case for the opinion of the Court by way of appeal from a conviction against the Company for having cut off the supply of water from a certain house at Brentwood. The facts were reported in the JOURNAL for Oct. 13 last (p. 679); and it may be remembered that the Company were ordered to pay a fine for a considerable time, with costs. The Justices had declined to state a case in the form which the Company deemed necessary in order to raise all the points of law. The case arose upon a question as to whether certain connections should be made by the Company or by the occupier of the premises. Their Lordships held that the Justices had already stated a case, and that the Court could not interfere. The application was therefore refused.

The Sewage Question at Cambridge.—The question of the diversion of the sewage of Cambridge from the River Cam has occupied the attention of the Local Authority for upwards of a quarter of a century; but at length a complete scheme has been resolved upon. The Town Council adopted some time ago a scheme of main drainage upon lines laid down by Mr. J. T. Wood, of Liverpool; and the important question of the disposal of the sewage recently came up for decision. Acting upon the advice of Professor Dewar, the Jacksonian Professor of Natural Experimental Philosophy, the Committee having the subject in hand recommended the acquisition of 67 acres of land at Chesterton, for the purpose of precipitating the solids and utilizing and purifying the effluent. The Chesterton Rural Sanitary Authority are to be invited to join in this scheme, which is a compromise between broad irrigation and a system of precipitation pure and simple. The subject provoked a long discussion; but in the end all the Committee's recommendations were adopted by large majorities. Instructions were given to prepare the plans for the completion of the whole scheme; and application was ordered to be made to the Local Government Board for leave to borrow the money. The plan now adopted will cost about £20,000; and the main drainage scheme will involve something like £98,000—making a total of about £120,000.

Opposition to the Swinton Gas Bill.—A meeting of the Eccles Gas Opposition Committee was held last Thursday, to consider what support should be given to the Eccles Local Board in their opposition to the Swinton Gas Bill. A letter was read from Mr. George Trenbath (Clerk to the Local Board), stating that the Committee appointed by the Board to oppose the Gas Bill would carry out the ascertained wishes of the ratepayers. A resolution was passed by the meeting appointing a Sub-Committee to give evidence on behalf of the Committee against the Bill, with instructions to accept no alternative scheme. The Committee felt that the position of the Swinton Local Board was untenable, and that, in face of the 8th clause of the petition of the Salford Corporation, the Gas Bill would certainly be thrown out. This clause reads: "Your petitioners object to be compelled to sell the outer gas undertaking to the Swinton Local Board alone. Your petitioners submitted, subject to certain conditions, to sell it to the two Local Boards whose districts comprise the greater part of the outer gas undertaking; but your petitioners had no intention to do that which the Bill requires, but which the section does not direct them to do—viz., to sell to one of the Local Boards whose district comprises only a small part of the gas undertaking, and who are thereby seeking to place themselves, so far as regards the Eccles district, in the same position which they allege was so objectionable in the case of your petitioners supplying the Swinton district. Amongst other things, had the Bill been promoted in conformity with such section, your petitioners would have had the security of the two Local Boards for the payment of the purchase-money and costs of arbitration, whereas the security under the Bill—viz., a charge on the general district rate of the Swinton Board—is quite inadequate."

Gas Exhibition at Blackpool.—At Blackpool last week, under the auspices of local firms, an exhibition of Messrs. John Wright and Co.'s gas cooking appliances was held with great success. In the absence of the Mayor (Mr. H. Buckley), it was opened on Tuesday by Mr. T. Bickerstaffe. Demonstrations in cookery were given each afternoon and evening by Mrs. J. B. Thwaites; and a strong argument brought forward by her, in advocating the use of gas cookers, was that they are very much cheaper than the fire cooking-ranges, now that the price of coal, owing to the action of the miners, has advanced so greatly.

The Smethwick Gas Undertaking.—At the meeting of the Smethwick Local Board last Friday, the Gas Committee reported that they had received tenders for the alterations required to be made in the retort-house at the gas-works by the adoption of the system of regenerator firing; and they recommended the Board to accept that of Mr. T. Vale, of Stourport, for £1440. The Committee further recommended the acceptance of the tenders of Messrs. Mobberley and Perry and Messrs. King Bros., for retorts, fire-clay, goods, &c.; the contracts to be divided between the two firms. The Committee submitted their annual report and statement of accounts, noticed in the JOURNAL last week, and they were adopted.

Shutting Off Gas at Fires.—On the occasion of a serious fire which recently occurred at Charleton House, Montrose, the Manager of the Gas Company (Mr. T. D. Hall) earned commendation in the local press for having promptly had the gas turned off at the meter, which was situated about half a mile from the mansion. In connection with this event, attention is called to a simple arrangement devised by Mr. Hall for shutting off the supply of gas at a fire in case access could not be obtained to the meter. Mr. Hall proposes to do this by means of a box inserted in the main, and closing the connection with water. The natural property of water to rise to its own level is taken advantage of in this case; and as soon as it reaches the level of the valve, it immediately stops the supply of gas. The water can be afterwards ejected by means of a small hand-pump. The application of this principle to fires is believed to be entirely new, and experiments have in every case proved the plan to be successful. It has the advantage of not entailing much alteration of the piping.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 480.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon invest. ment.
£			p. c.					£ s. d.
GAS COMPANIES.								
590,000	10	15 Oct.	10½	Alliance & Dublin 10 p. c.	10	16—17	..	6 3 6
100,000	10	"	7½	Do. 7 p. c.	10	11½—12½	..	6 0 0
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105—107	..	13 5
100,000	20	27 Nov.	8	Bahia, Limited	20	12—14	..	11 8 6
200,000	5	12 Nov.	7½	Bombay, Limited	5	6½—6¾	..	5 11 1
40,000	5	"	7½	Do. New	4	4½—5½	..	5 14 1
380,000	Stock.	26 Feb.	12½	Brentford Consolidated . . .	100	105—115	..	5 14 1
150,000	"	"	9½	Do. New	100	153—158	..	5 17 1
220,000	20	11 Mar.	11½	Brighton & Hove Original . .	20	35—41*	..	5 12 2
888,500	Stock.	11 Mar.	5	Bristol	100	95—100*	..	5 0 0
320,000	20	15 Oct.	11½	British	20	43—45	..	5 0 0
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	10	19—20	..	5 15 0
51,510	10	"	8½	Do. 7 p. c.	10	14—15	..	5 13 4
328,750	10	"	—	Buenos Ayres (New) Limited	10	5½—6½	+½	—
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	93—96	..	6 5 0
150,000	20	26 Feb.	8	Cagliari, Limited	20	24—26	..	6 3 1
550,000	Stock.	15 Oct.	13a	Commercial, Old Stock . . .	100	244—249	..	5 4 5
165,000	"	"	10a	Do. New do.	100	190—195	..	5 2 7
130,000	"	30 Dec.	4½	Do. 4½ p. c. Deb. do.	100	118—123	..	3 13 2
800,000	Stock.	30 Dec.	13	Continental Union, Limited .	100	221—226	-1	5 15 1
200,000	"	"	10	Do. 7 p. c. Pref.	100	185—195	..	5 2 7
75,000	Stock.	16 Sept.	10	Crystal Palace District . . .	100	190—200	..	5 0 0
486,090	10	29 Jan.	10	European, Limited	10	19—20	..	5 0 0
354,060	10	"	10	Do. Partly paid	7½	14—15	..	5 0 0
5,470,820	Stock.	12 Feb.	12	Gaslight & Coke, A, Ordinary	100	210—215	..	5 11 8
100,000	"	"	4	Do. B, 4 p. c. max.	100	91—97	..	4 2 5
665,000	"	"	10	Do. C, D, & E, 10 p. c. Pf.	100	244—249	-1	4 0 4
30,000	"	"	5	Do. F, 5 p. c. Prf.	100	116—121	..	4 2 9
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	169—174	..	4 6 2
1,300,000	"	"	7	Do. H, 7 p. c. max.	100	150—154	..	4 10 11
463,000	"	"	10	Do. J, 10 p. c. Prf.	100	241—246	..	4 1 3
476,000	"	"	—	Do. K, 6 p. c. Prf.	100	145—150	..	4 0 0
1,061,150	"	11 Dec.	4	Do. 4 p. c. Deb. Stk.	100	113—116	..	3 9 0
294,850	"	"	4½	Do. 4½ p. c. do.	100	118—123	..	3 13 2
908,000	"	"	6	Do. 6 p. c. do.	100	163—168	..	3 11 5
3,800,000	Stock.	12 Nov.	12	Imperial Continental	100	220—224	-1	5 7 2
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4—4½	..	5 13 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p. c. Deb.	100	108—110	..	4 10 11
541,920	20	27 Nov.	6½	Monte Video, Limited	20	14½—15½	-½	8 7 8
150,000	5	27 Nov.	10	Oriental, Limited	5	8½—8¾	-¼	5 14 3
60,000	5	30 Sept.	7	Ottoman, Limited	5	4—5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited	10	2½—3½	..	—
People's Gas of Chicago—								
420,000	100	3 Nov.	6	1st Mtg. Bds.	100	100—105	..	5 14 3
500,000	100	1 Dec.	6	2nd Do.	100	100—105	..	5 14 3
150,000	10	15 Oct.	10	San Paulo, Limited	10	9—10	..	10 0 0
500,000	Stock.	26 Feb.	15½	South Metropolitan, A Stock	100	266—271	..	5 14 5
1,350,000	"	"	12	Do. B do.	100	220—225	..	5 6 8
200,000	"	"	13	Do. C do.	100	232—237	..	5 9 8
725,000	Stock.	30 Dec.	5	Do. 5 p. c. Deb. Stk.	100	138—143	..	3 10 0
600,000	Stock.	11 Mar.	11½	Tottenham & Edm'ton, Orig.	100	—	..	—
WATER COMPANIES.								
729,331	Stock.	30 Dec.	10	Chelsea, Ordinary	100	240—250	-7½	4 0 0
1,720,560	Stock.	15 Oct.	8	East London, Ordinary . . .	100	198—203	-5	3 18 10
544,440	"	30 Dec.	4½	Do. 4½ p. c. Deb. Stk. . . .	100	136—140	..	3 4 0
700,000	50	11 Dec.	8	Grand Junction	50	95—100	-2½	4 0 3
708,000	Stock.	12 Feb.	10½	Kent	100	255—265	-2½	3 19 3
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max. . . .	100	210—221	-6	4 6 0
406,200	100	"	7½	Do. 7½ p. c. max.	100	187—192	-2	3 18 1
260,000	Stock.	30 Sept.	4	Do. 4 p. c. Deb. Stk.	100	120—123	..	3 5 0
500,000	100	12 Feb.	12½	New River, New Shares . . .	100	325—335	-2½	3 12 4
1,000,000	Stock.	29 Jan.	4	Do. 4 p. c. Deb. Stk.	100	124—127	..	3 3 0
902,300	Stock.	30 Dec.	6½	S'thwk & V'xhall, 10 p. c. max.	100	135—145	-6½	4 9 8
126,500	100	"	6½	Do. D 7½ p. c. do.	100	140—145	..	4 9 8
1,155,066	Stock.	11 Dec.	10	West Middlesex	100	242—247	-2	4 1 0

a Next dividends will be at this rate.

Water-Works for Southminster.—The Local Authority of Southminster are proposing to construct works for the purpose of supplying water to the district at a cost of £2000. At a Local Government Board inquiry held on the subject, by Colonel C. H. Luard, R.E., last Friday week, it was shown that the present supply was derived from wells, which had been pronounced by the Medical Officer (Dr. Thresh) both as unfit and inadequate for the wants of the inhabitants. The Inspector did not give much encouragement to hope that the Local Government Board would accede to a request that the repayment of the borrowed money should be spread over a period of 60 years instead of 30 years.

Sales of Shares.—At a recent sale by auction, Messrs. Penney and Clark, sold the following shares in the *Portsea Island Gas Company*: Two £53 shares "A" series, which realized £113 each; seven £50 "B" series which produced £106 apiece; and eight £50 "C" series which yielded from £100 to £102 each.—Last Tuesday, Messrs. Balls sold at Halstead 48 debentures bands of £50 each in the *Halstead Gas Company, Limited*, bearing interest at 4½ per cent. The bonds were put up in lots of two each; the prices realized being from £100 to £102 per

lot.—Last Thursday, £105 stock of the *Dover Gas Company* was sold for £174; four £10 shares, for £17 2s. 6d. each; 49 similar shares, at £17 to £17 2s. 6d. per share; and a £200 mortgage for £207.

Improvements at the Wallasey Gas-Works.—Last Friday week, a Local Government inquiry was held at Egremont, by Mr. T. Codrington, C.E., and Mr. E. P. Burd, Inspectors of the Local Government Board, into an application by the Wallasey Local Board to acquire certain land belonging to the Midland Railway Company and Mr. R. C. de Vyner, on which to erect and maintain gas-works; to authorize the borrowing of additional money for gas and ferry purposes; and to make amended provision with regard to the depreciation fund established under the Wallasey Improvement Act, 1872. Mr. Danger, the Clerk to the Board, stated that the Gas Engineer (Mr. H. Ashton Hill) had reported as to the insufficiency of the gas-works; and it was found absolutely necessary that the plant should be extended to meet the requirements of the district. A provisional contract had been made for the purchase of 12 acres of land, at a cost of about £18,000. If it was found that electricity could be supplied as cheaply as gas, they might use the land for that purpose. There was no opposition.

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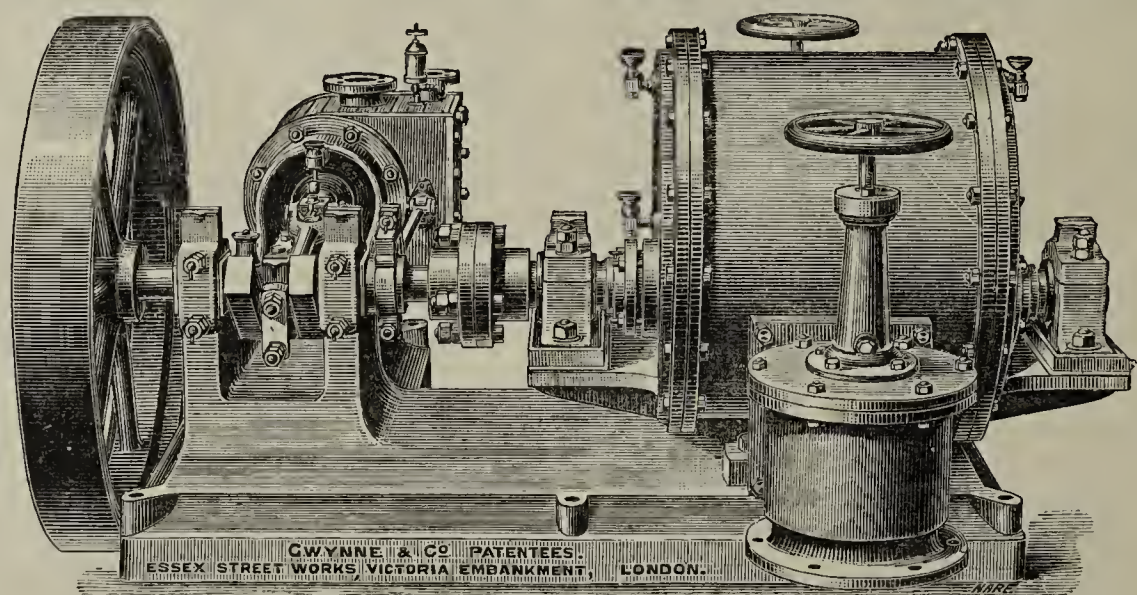
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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MARCH 22, 1892.

Municipalism.

THE striking circumstance of the ratepayers of London having returned for their County Council a body of whom the majority are known to be in favour of "municipalizing" all kinds of public services hitherto rendered by trading companies, is a sign of the times that has its teaching not only for Londoners, but also for townspeople and ratepayers all over the kingdom. For it is very obvious that this idea of the so-called municipalization of public services must be referred, for its origin and support, to the examples of some great cities and towns of England and Scotland. If the new London County Council aim at controlling the water supply, the police, the gas supply, the tramways,

the docks, and similar necessities of Metropolitan life, it is only because the same thing is actually done in different parts of the country, and because in all probability these enterprises have, in the case of London, been left to private initiative through the absence of any municipal organization for the whole Metropolis, which might otherwise have taken them in hand. The sweeping victory of the self-styled "Progressive party"—the party of municipalization and of many other ideas—over their so-called "Moderate" opponents at the recent County Council polls, may be explained in a variety of ways; but there is one explanation of the result which, whether or not it is sufficient to account for everything, is certainly good so far as it goes. It is simply this: The Progressives had a programme, such as it was, and their opponents had none. It has thus been demonstrated once more that a policy of simple negation—of keeping things as they are, and pretending that everything is all right as it is—will not do to fight an election upon. In the estimation of the poor and less comfortable majority, to whom political power has been committed, there is a great deal in modern town life which is anything but right. The voice of London in this regard is very likely to be the voice of Glasgow, Manchester, Liverpool, and Birmingham when the same issue is raised. The party that promises to do something to improve the common lot is certain to gain more votes than the party which has no ideals. Your Progressive may not be certain of being able to create a new heaven and a new earth out of the old materials. But, at any rate, he is ready to promise to "have a good try;" and this is the policy that catches the multitude.

It may be admitted at once that the highly-important question of municipalizing the Metropolitan Gas Supply hardly entered as a practical issue into the recent County Council elections. Yet it cannot be denied that the party which won at these elections is the party that has deliberately inscribed the acquisition of the gas undertakings in its "program"—not to be taken in hand just yet, but not to be lost sight of. There is not the slightest doubt that those municipal politicians who think at all to the purpose respecting this subject. are quite willing to allow the Gas Companies and the Electric Light Companies to fight it out between themselves for a few years, until it is made manifest to what extent they are able to interfere with, or to help each other. The latter are safe for their 42 years; and by that time much may happen to the Gas Companies, who are meanwhile kept up to the mark by the sliding scale. We are, however, concerned to point out that, after a few constitutional preliminaries are settled, the question of the gas supply may at any moment be forced to the front by unforeseen influences. Let any one or more of the London Gas Companies come to grief, or be plunged into serious trouble from any cause arising from within—such as mismanagement of sufficient importance to discredit the existing settlement—and it would speedily appear that London has at last a local authority strong enough to take a hand in the future control of the gas supply.

The London County Council has, of course, much to do before it can approach the gas question in the regular way. The continued existence of the City Corporation as an independent organization has to be considered; and the same remark applies to the *status* of the Vestries, which, so long as they discharge their present functions, will effectually prevent the County Council from attaining to the powerful position from which it can alone expect to successfully attack the larger items of its ambitious "program." Whether or not the County Council is to itself absorb all the other Metropolitan local governing bodies, or is to act the fashionable part of a "pioneer" organization for the establishment of a new London Corporation, remains to be seen. Most of the light and airy critics who argue that the County Council ought to become a Parliament for London, and who prattle, in the political jargon of the day, about the desirability of "Metropolitan "Home Rule," forget that a County Council is not even a Municipality. It may or may not be found necessary to consolidate the various local governing bodies having concurrent powers in London; but for the time being, at any rate, these are distinct.

It is absolutely impossible to ignore the growth of the feeling which inspires modern self-governing communities in favour of doing as much as possible for themselves, and dispensing with the once universal "farmer," or contractor.

We have ourselves argued for the elimination of the contractor, or middleman, from the conduct of gas supply; and it is not for us to dispute the view that a statutory gas company is actually a species of contractor to the community which it supplies, enjoying a certain sanction upon the tacit understanding that it is able to serve the public better than could be done by the public themselves through their representatives. Time was, as we know, when public bodies did very little for themselves beyond endeavouring to keep the peace. As the possibilities of the device of raising loans for capital purposes upon mortgage of the rates became explored, and the municipal spirit grew more commercial than warlike, so the work of the town was taken in hand more and more by the town's representatives, until it has come about that the manifold responsibilities (say) of the Lord Provost of Glasgow have stretched year by year to embrace matters that would have appeared foreign indeed to Bailie Nicol Jarvie. We name Glasgow merely because it is one of the most highly-developed of modern municipalities; but like observations may be applied to other British towns.

Having accepted the proposition that municipalism is capable of extension upon the Glasgow model, and more—for even Glasgow is not quite perfect—we must be allowed to hold that the degree in which the proposition shall be applied in any particular case is wholly a question of expediency. When a municipality proposes to acquire, or to create, any undertaking for supplying the community which it represents with a necessary of civic life, the first thing to be done is to prove the expediency of the scheme to the satisfaction of Parliament. And it should be the same with the first and ultimate tribunal known as Public Opinion. There ought to be no attempt on the part of leaders in politics or in philosophy to prejudice the question of expediency by asserting a general principle which takes insufficient account of experience. Yet this is constantly done, not only by the smatterers who presume to draw up "London programs," but even by really great thinkers like Mr. W. S. Lilly. In his latest book "On Shibboleths"—which, by the way, everybody who does not desire to be led away by the claptrap of the day should read—this author declares that "the monopolies 'enjoyed by railway and water companies—to give only 'two examples—are utterly wrong in principle. Such 'great public works ought to be owned by public authorities, and to be administered for the public benefit, not 'for private profit.'" He also quotes from Mill a denunciation of the granting of "practical monopolies" to private companies.

It is an interesting example of the difficulty of practising what one preaches, that Mr. Lilly, who in all his works is most careful to teach the purely ethical signification of the word "ought"—which he says is a word that can never arise out of materialistic or necessitarian considerations—falls here into the error of using this transcendental term in regard to what is, after all, a question of expediency. The world wants railways, towns want water and gas, tramways, and many other services. The only question is, as we take it, how these wants can be best supplied. There is no question of principle in the matter; but different expedients may be adopted, which we can judge by their results. If the State, or the Municipality, can serve the community better than a private undertaker or a semi-public company, let them do it; but let us be quite sure that this result will follow before we take the irrevocable step of extinguishing private initiative. Mr. G. Livesey put the matter upon its proper basis when, at the recent meeting of the South Metropolitan Gas Company, he had to answer a question as to what would be the position of the shareholders in the event of a proposal from the County Council to buy the gas undertakings. Mr. Livesey said: "The first thing was to show that the public would be 'better served by the Company than by the Council.'" There is the whole thing in a nutshell. Again, how is the imaginary "principle" that railways "ought" to be owned by public authorities affected by the notorious fact that the British public are, on the whole, vastly better served by the "monopolist" Companies than are the inhabitants of European countries where the railways are supposed to be "administered for the public benefit?" Surely, the right solution of all such questions as the nationalization or municipalization of supply or transit undertakings must be governed by considerations of "how 'things work"—which is as much as to say that they are

questions of expediency, and not, in the true sense, of principle. But this will be enough upon the subject for the present issue of the JOURNAL.

Sir F. Mappin Replies to Colonel Makins.

THE Sheffield United Gaslight Company have held their ordinary general meeting, under the presidency of Sir Frederick T. Mappin, Bart., M.P., when the report and statement of accounts, summarized in our issue for the 1st inst., were presented and adopted. The usual maximum dividend was declared; and although to pay it involved the necessity of taking £5546 from the undivided balance, the prospects of the Company are considered to be distinctly brightening. It is no reflection upon the intrinsic importance of the Sheffield undertaking, however, which must always rank with the foremost Gas Companies of the kingdom, if we state that the most generally interesting portion of the Chairman's address will be taken, by readers of the JOURNAL, to be the passages in which Sir F. Mappin explained the reasons for his appearances at the meetings of The Gaslight and Coke Company as a critic of the Horseferry Road administration. Among other things, it appears that the condition of the trade in gas-works residuals, and especially of the sulphate of ammonia market, is a sore point with the management of the Sheffield Company, as it has long been with those who are responsible for the commercial success of other Gas Companies. Consequently, Sir F. Mappin felt impelled to address publicly to Colonel Makins, M.P., in his capacity of Governor of The Gaslight and Coke Company, the pointed inquiry, which has now become historical, as to whether the Chartered sulphate is sold through one broker who also buys for himself. To this query Colonel Makins returned a distinct, categorical negative, which, of course, Sir F. Mappin could not do otherwise than accept. The Chartered Governor also "scored" against his interlocutor by claiming that the practice of his Company compared "most favourably" with that of the Sheffield Company. Sir F. Mappin was obliged to sit patiently under all this; but he has now returned to the charge, and, as the report shows, has convicted Colonel Makins of having made statements which are not in accordance with the facts. Nobody will suspect the Governor of the Chartered Company of wilful misrepresentation; but it is clear that he must have been singularly ill-advised in making the assertions he did, and for which he will be under the painful necessity of apologizing at the next Horseferry Road meeting. Sir F. Mappin's comments on this happily uncommon incident are few and forbearing; and we shall not add to them beyond expressing our satisfaction that the Sheffield Chairman has been able to meet so fully the demand for a justification of his action at the Chartered meeting which we made in our issue for the 16th ult. The *parole* now lies with Colonel Makins, who has to explain how he came to deny, in public meeting on the 5th, those assertions which have since been so easily proved to be true. The Governor of The Gaslight and Coke Company can hardly rest content under the suspicion that his future official utterances, whenever they tend to the exculpation of the Horseferry Road administration, will require to be taken *cum grano salis*.

The Play of the Miners, and a Cry of Gas Directors.

THE great coal "boom" has spent itself. This is, to all intents and purposes, the result of last week's transactions in coal. The miners under the orders of the Federation proceeded to "play" in the orthodox way, and their leaders met in solemn conclave in London on Wednesday, ostensibly to decide whether work should be resumed after a week or a fortnight's suspension of production. It was agreed that the "play" should only last for a week; but that after the 11th prox. there should be no mining on Mondays. The huge joke of the proceedings at this conference, however, was the unanimous declaration that the object of the movement had been satisfactorily attained. Naturally, all the newspapers were asking next day for the evidences of success upon which such a statement was based. To the ordinary man who does not view everything through Trade Union spectacles, the only people who have made anything out of the job are the middlemen, and to some extent the coal-owners. The men have sacrificed a week's pay, which can never be recovered, and simultaneously with the resumption of work by the deluded "players," the inflated prices of

coal gave way everywhere; and it is certain that, so far from preventing a reduction of wages, the blunder of the Union leaders has hurried it forward. It is to be supposed, however, that the declaration of the Westminster Conference means no more than the reluctance of those who are responsible for it to confess that they have made egregious fools of themselves and of their supporters. We further notice that attempts are also being made, in quarters which uphold the modern dogma about the infallibility of Trade Unions, to blame the royalty-owners, and indeed everybody else but the men, for the disastrous results of the Federation *fiasco*. The pretence is too thin, however, and it may be taken as pretty certain that the true state of the case is sufficiently well understood by those most nearly concerned to render a repetition of the performance extremely improbable. Meanwhile, we have to notice a very extraordinary proceeding on the part of the management of the Commercial Gas Company. Mr. H. E. Jones, the Engineer and General Manager of the Company, issued to the consumers a notification stating that, in consequence of the strike of the Durham miners, coming shortly after an eight days' strike of coal porters, it would be necessary "to carefully husband the present resources of the Company." The Directors accordingly begged the consumers to dispense with "extra lights and consumption until the termination of the strike." This remarkable notice—unique in the history of the gas supply of London—concludes with what was evidently intended to be a clever bid for coke orders from users of gas-stoves, who are promised a special discount of 10 per cent. The wisdom of issuing any such confession of weakness by the Directors of a wealthy Gas Company may be a debateable matter. We do not hesitate to characterize it as a peculiarly futile and uncalled-for proceeding. Is it not a plea to the public to use anything rather than gas, and an admission that the Directors cannot deal with the ordinary risks of their own business? If the Company's "coalies" are impracticable, why does not Mr. Jones employ others? and if he cannot get coal from Durham, is there no other field open to him? and, in any case, would it not have been as well to wait until the Company had been hurt before crying out? When the issue of this cry for mercy was first bruited abroad, we could hardly believe it possible that gas directors had been brought so low. It is something to be thankful for that all gas administrators are not of their complexion. The incident is greatly to be deplored, especially as there was a prevalent impression that the management of the Commercial Company was of decidedly respectable quality. It may still be argued that the Directors and their General Manager have shown prudence in what they have done; but it can hardly be claimed that they have manifested any pluck.

Common Law versus Local Laws.

It may appear at first sight a strange topic to find mentioned in these columns; but we really cannot help drawing attention to the remarkable performance of the House of Commons recently, in deciding that a particular clause of the Improvement Act under which the town of Eastbourne is governed should be reconsidered, upon the ground that it is against the general tenor of the law of the land. It is nothing to the purpose that in this particular case a religious grievance was the medium through which honourable members saw the heinousness of the Eastbourne Improvement Act. The wonderful thing is that upon this occasion the most "advanced" politicians in Parliament were actually in the same boat with Lord Wemyss and his fellows of the Liberty and Property Defence League, whose yearly care it is to protest against the inconsistencies and irregularities of municipal statutes. It has long been notorious to all who have occasion to follow municipal legislation, that the local authorities of the United Kingdom have a strong tendency to vary the common law in all sorts of strange respects to suit their own fancy. It is not many years ago that a new Standing Committee of the House of Commons was appointed to have cognizance of the police and sanitary regulations of local statutes, in order that some system might be introduced into these enactments. But the mischief and inconvenience to the Queen's subjects traceable to the fussiness of local governing bodies, are no joke; and if the experience of the Salvation Army at Eastbourne does no more than call attention to the height already attained by grandmotherly legislation in some places, and put a

stop to fresh developments of the same objectionable growth, the serio-comic martyrdom of these indomitable tambourine-beaters will not have been altogether wasted. The subject of town regulations is not an easy one. It is impossible to legislate for all places alike, for it is obvious that proceedings which would not hurt Salford might be unbearable at Cheltenham. It may or may not be pardonable for people to treat the Medlock as they do; but nothing of the kind could be permitted in the case of the Thames. At the same time, there is reason in all things; and it cannot be proper for a respectable tradesman, by merely moving from one town into another very like it, to incur all sorts of pains and penalties for performing some acts, or for neglecting to do others, which would nowhere else bring him under the notice of the police. We are an illogical people, and do not legislate by rule. It is as much as we can flatter ourselves upon, if we have a few intelligible general principles in legislation which can be pleaded before a Committee. If we were fonder of rules in these matters, we should perhaps have a set of constitutions drafted, to which reference could be made when any municipality wanted an Improvement Act, and which would show at once what is permissible in this way for a manufacturing, for a market, for a seaport, or for a fashionable residential town, as the case might be. As it is, we go to work in the most hap-hazard style. If an energetic Town Clerk hears of a regulation from any quarter which he thinks would suit his town, he makes a note of it; and when his next "Omnibus Bill" is drafted, these scraps of administrative experience are quietly stowed away in it, to become law in due season. Sometimes, but rarely, attempts to apply these powers cause trouble, like that at Eastbourne; and somebody is moved to play Hampden to the petty local Star Chamber, until one side or the other gives in. This is very undesirable, of course; but the difficulty is to know what is to be done. If Parliament is to revise every Corporation Act which contains peculiar provisions, where is it to begin, and where stop? We shall close this paragraph, however, by repeating our expression of the amused surprise which an impartial observer may be supposed to feel on seeing Social Democrats and stern Individualists in agreement in respect of the undesirability of allowing municipalities to override, by their own statutes, the general law of the land.

Mr. T. S. Clemenshaw, Assoc. M. Inst. C. E., Engineer of the Launceston (Tasmania) Gas Company, has lately received an addition of £50 a year to his salary, as a testimony of the Directors' appreciation of his services on behalf of the undertaking. This is the second increase in the nine years Mr. Clemenshaw has filled his present position.

The Installation of Inclined Retorts at Brentford.—We learn that several of the Directors of The Gaslight and Coke Company and other influential engineers, on the 17th inst., visited the installation of 112 inclined retorts which have been erected by Mr. Frank Morris at the Brentford works of the Brentford Gas Company; and, after a close examination of their working and results, they were much impressed with the great advantages of this method of stoking.

Presentation to Mr. W. Slack.—On Friday, the 11th inst., an interesting presentation by the employees at the Bowness Gas-Works took place, on the eve of Mr. William Slack's departure from the district. It consisted of a purse of gold and a gold albert, with a gold brooch for Mrs. Slack. Mr. Slack has been an old servant of the Bowness Gas Company, having entered their service as collector in 1877; and during the past 15 years, he has won the esteem of the inhabitants of both Bowness and Windermere by his civility and kindly good nature while acting in that capacity. The Manager of the works (Mr. John Duxbury) made the presentation; and, in a few appropriate remarks, he referred to the pleasant relations which had always existed between the men and Mr. Slack, and expressed the hope that the same feeling might be shown to the new collector and himself.

Gas v. Electricity for Heating Purposes.—Early in the present year, some figures relating to the relative expense of heating by electric current and by gas were given in the *Electrician*. The Editors of that publication have since examined the simple case of boiling a pint of water, but have neglected the losses, which may be very small, since the heat may be produced exactly at the point required. To boil a pint of water, starting from 20°C., takes about 45,000 calories; and to do this in five minutes, an expenditure of 625 watts, costing 0.42d. (at 8d. per unit), will be required. It must, however, be admitted that half a cubic foot of gas, costing 0.018d. (at 3s. per 1000 cubic feet), will do the same work. The specific heat of a mutton chop is not given in the text-books; it is probably not much above 0.5. But radiant heat is necessary; and the calculation of the energy required would, our contemporary says, be rather difficult.

WATER AND SANITARY AFFAIRS.

As announced in our columns last week, the names of the members constituting the Royal Commission relative to the Metropolitan Water Supply have been made known, together with the terms of the reference; the latter being in verbal accordance with the communication addressed to Sir John Lubbock by Mr. Ritchie in January last, and published in the *JOURNAL* at the time. Lord Balfour of Burleigh, as Chairman of the Commission, appears to be a good appointment; and the others are able men, though, when we consider the relation of Mr. J. Mansergh to the Birmingham scheme, we are a little surprised to find him on the Commission. We may take it, however, that this gentleman's appointment signifies that the Commission will have nothing to do with getting a supply for London from Mid-Wales. It seems now to be understood that the inquiry by the Commission is to be kept within the limits of the Thames Valley. *The Times* expresses dissatisfaction with this restriction of the inquiry, but considers there is nothing to prevent the scope of the reference being enlarged later on. *The Daily Chronicle*, as the organ of the County Council, takes a different view, and looks at once to the Royal Commission for "an authoritative opinion on the best sources of an alternative supply," which is to have the happy effect of "bringing the Water Companies to reason." On the part of the Press generally, we observe a hasty conception that the result of the coming inquiry is "a foregone conclusion," to the effect that the present sources of water supply for London and its environs are inadequate "in quantity and quality." If the inquiry is carried on hurriedly, and without sufficient care, such a conclusion may be arrived at; but the actual facts may be otherwise. The action of the Water Companies for the present consists in the formation of a Joint Committee, composed of the Chairmen of those Companies which depend mainly on a supply from the Thames or the Lea; this Committee being authorized to procure scientific and other evidence in proof of the quality and sufficiency of the supply to be obtained in the watersheds connected with these rivers. The death of Dr. Meymott Tidy at the present crisis is a matter of special regret, in addition to the fact that this eminent analytical chemist has been cut off at a comparatively early age.

"An Explanation of the London Water Question" was lately offered to the members of the Surveyors' Institution, in a paper read before that body by Mr. J. W. Grover—an Engineer well known in connection with the Rickmansworth and Leatherhead Water Companies. Mr. Grover's theory is that, at the present rate of increase, Greater London will by the year 1901 probably contain nearly 7 million persons, and will need to have its supply of water enlarged by 45 million gallons per day. Our attention is directed to the Leatherhead and Mole district, at the base of the Box Hill chalk ranges, and the Rickmansworth or Colne district, at the base of the great chalk Chiltern range. Here, it is intimated, the auxiliary supply is to be obtained. This may be true; and we hope it is so. But there follows the extraordinary statement that "both these districts have been assigned to Water Companies under parliamentary authority; and, in view of the coming wants of London, permission has been granted to them to deal with the surplus water." Mr. Grover continues his argument by saying: "So that, practically, during the last ten years, in the three Acts of Parliament which incorporate these Companies, the supplemental supply for coming London has been legislated for." We venture to say that Parliament had not the slightest idea of placing the key of the situation in the hands of the Leatherhead and Rickmansworth Water Companies. Further on in his paper, Mr. Grover repeats his assertion that authority has been given to these Companies to "dispose of surplus water;" the effect being, as he puts it, that "no fresh legislation is required, except such as may be needed for London itself, to enable it to form the Trust and take the water." We fail to see what benefit London derives in having to take the water through the medium of two local Companies, instead of going direct to the Box Hill and Chiltern ranges. London, by a newly-created Trust, or by the existing Metropolitan Companies, would be well able to take care of itself; and these local powers simply come in to levy toll. If these two Companies

have a prior claim to all the water in the districts of the Mole and the Colne, how is it that Mr. George Webster is able to offer 20 million gallons per day from the Colne Valley for the use of London? Mr. Webster has already put up machinery wherewith he can pump 10 million gallons per day. But where are the two Companies in that case, with all their parliamentary powers and privileges? In another part of his paper, Mr. Grover says: "The site of the pumping-station of the Rickmansworth and Uxbridge Valley Water Company is very remarkable, and is worth special attention, as it is this Company's district from which the great immediate supplemental supply of London must be taken, under the powers of the Act of Parliament." The word "immediate" appears to mean that the first part of the supplemental supply is to come from the Rickmansworth district; and we may presume that this is intended to cover the operations of Mr. G. Webster. The general drift of the argument appears to be that, if the London Water Companies, or the authorities represented by some newly-formed Trust, ever come to the neighbourhood of Rickmansworth or Leatherhead in search of water, they must buy of somebody, whether it be of the two existing Water Companies or of Mr. Webster. We commend this monopoly of natural sources to the notice of Sir W. Harcourt, who must assuredly be scandalized at the idea.

It is amusing to find that while Mr. Grover stoutly defends what he conceives to be the exclusive rights of the two suburban Water Companies with which he happens to be more directly identified, he distinctly disputes the existence of such rights in the case of the Metropolitan Companies. Speaking of these bodies, he says: "The Companies have, I believe, no monopoly; they have only a permission. Anybody can dig a well and supply himself and his neighbour." Certainly, anybody can do so at his own costs and charges; but he has no power to lay mains in the streets and sell the supply. The Commissioners of Sewers know this, and restrain their operations accordingly. They are aware that they cannot even open the streets to lay mains from their artesian well in Stoney Lane to the Mansion House. Mr. Grover clearly underrates both the privileges and the powers of the London Water Companies, while he exalts those of his friends. But while we must decidedly demur to many of Mr. Grover's statements, we feel that he is doing good service in showing the extent to which water abounds in the underground strata around London. He quotes Sir Robert Rawlinson's statement, given in evidence during the Corporation inquiry, that in the Valley of the Thames "there is an abundance of water outside the open rivers." But beyond all this, there is the consideration put forth by Mr. E. H. Stevenson and Mr. E. K. Burstal, in their recent pamphlet on this subject, that the present water supply at the disposal of the Metropolitan Companies, if economized in a reasonable manner, and after the example of several large provincial towns, would suffice for a population of more than 10 millions. The only question is, as put by the two gentlemen just named, whether it may be wise, in view of a possible contingency, to obtain the control of a remote watershed, seeing that the large towns are slowly, but surely, appropriating the few remaining available areas. But at the same time it is submitted that the question is not one of urgency.

Death of Mr. J. Davies, of South Brisbane.—We regret to record the death of Mr. John Davies, the first Engineer and Manager of the South Brisbane Gas Company, Limited, and under whose superintendence the works were erected. He was formerly Engineer of the Kids Grove and Oswestry Gas Companies; and was probably known to some of our readers. He has been succeeded at South Brisbane by his son, Mr. G. A. Davies, who assisted his father during the construction of the works, and subsequently became Manager to the Townsville Gas Company.

The Coal Resources of Belgium.—As bearing on the vital question of the exhaustion of the coal resources of Belgium, it is stated, says *Engineering*, that, while the average depth of the French coal mines is 1056 feet, in Hainaut it is 1773 feet; that in the Mons basin there is a pit now being worked of 2988 feet in depth, and another unworked pit in the same district of 3801 feet; while in April last it was reported that in a Borinage pit, known as Sainte Henriette des Produits, at Flénu, a rich seam of coal had been discovered at the extraordinary depth of 4120 feet. These figures tend to show that Belgium is rapidly exhausting the "cream" of her coal resources—that is, coal found within 2000 feet of the surface.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 550.)

ALTHOUGH it cannot be said that business in the Stock Exchange developed much more activity during the past week, yet the tendency of the markets was distinctly favourable. To this the chief contributing influences were the continuing and assured cheapness of money, the brighter weather, the termination of the coal difficulty, the relief proceeding from the Murrieta business having come to a definite and intelligible position, and the hopeful tone of Mr. Lidderdale's utterance regarding the Baring imbroglio. Too much expectation should not be founded upon the last two items; but the rest are sound facts. As to money, the Bank rate may hold on till the end of the month; but it seems bound to go down at the first meeting in April. The Gas Market has been quite active—conspicuously so when compared with business of late. The Metropolitan Companies furnished the greater part of the transactions recorded. Gaslight "A" was much dealt in. It opened unchanged, but fell away later on; and business was marked at $210\frac{1}{2}$, with a drop of 1 in the quotation. The next day was similar. Then came the turn; prices mended and the quotation was restored. On Friday, it rose 1 higher; and the last mark at the close was $215\frac{1}{2}$ —the best of the week. The termination of the miners' "play" had probably something to do with this. The adjustment of that difficulty, however, still leaves the Durham strike unaffected. Gaslight debentures were freely dealt in at firm figures; and the same in a less degree can be said of the preferences. South Metropolitans were fairly active, and were firm and unchanged. A few bargains in Commercial new were marked at about the same price. Not a single transaction was recorded in Suburbans or Provincials; and all quotations were left unvaried. Continentals were rather quieter; but the tendency was good, and Imperial recovered the point it had lost the week before. Among the rest, Bombay were firm; and the fair things promised in connection with Argentine affairs put Buenos Ayres shares another $\frac{1}{2}$ up. Water stocks have been knocked down freely—a deal too freely, we should say—and quotations are almost nominal. But, as long as proprietors will keep their heads and sit tight on their stocks, no harm will be done.

The daily operations were: Business in Gas on Monday was moderate; and the bulk of it was in Gaslight "A," which fell 1. Other prices were steady. In Water, East London fell $5\frac{1}{2}$; Chelsea, 5; Southwark, $2\frac{1}{2}$; and Grand Junction, Lambeth, and West Middlesex, 2 each. Tuesday's business in Gas was about the same; and prices were unchanged, except for a rise of $\frac{1}{2}$ in Buenos Ayres. In Water, Kent fell 5; West Middlesex, $2\frac{1}{2}$; and Lambeth, 2. Gas was better on Wednesday, and all prices were very favourable; Gaslight "A" and Imperial Continental advancing 1 each. Grand Junction Water was 2 lower. Thursday was an active day in the Gas Market; and prices held very firm. The fall in Water was continued by Chelsea receding 5; Lambeth, 2; and Grand Junction, 1. Activity and firmness were still the feature of the Gas Market on Friday; and Gaslight "A" rose 1 more. Water was unchanged. Saturday was quiet, as usual; but prices marked in Gas were very good. All Gas and Water quotations remained unchanged, except that New River debentures rose 1.

CHARLES MEYMOTT TIDY.

WE record, with much regret, the death on Tuesday last, in his 50th year, of Dr. Charles Meymott Tidy, the eminent analytical chemist. He had last year an attack of influenza, which, as is usually the case, left him with impaired strength; and he never thoroughly regained his habitual capacity for work. Dr. Tidy was a son of the late William Callender Tidy, M.D., of Hackney; and for a short time he continued his father's practice. He possessed qualifications which specially fitted him for the profession of which he was so distinguished a member; and with such earnestness did he devote himself to his studies, that he was already a member of the Royal College of Surgeons when, in 1866, he took his M.B. degree, with the highest honours, at the University of Aberdeen. Coming to London, he became associated with the late Dr. Letheby, at the London Hospital. On the death of that able chemist, Dr. Tidy succeeded him as Professor of Chemistry, Medical Jurisprudence, and Public Health in the Medical School at that Institution, and also as Medical Officer of Health for the City of London. The former appointment he held till his death. He was Official Analyst to the Home Office, Medical Officer of Health for Islington, and a Licentiate of the Society of Apothecaries. His studies were not confined to medicine only, but extended into the domain of jurisprudence. The result was that a few years ago he was called to the Bar at Lincoln's Inn; and he held the office of Reader of Medical Jurisprudence to

the Inns of Court. He was a member of the Society of Arts, and delivered a course of Cantor Lectures on "The Practical Application of Optics to the Arts and Manufactures and to Medicine," in November and December, 1873; and in April 1886, he read his elaborate paper on "The Treatment of Sewage," which was discussed at three adjourned meetings. In 1889, the Swiney Prize was awarded to him for his work entitled "Legal Medicine." His principal works are his "Handbook of Modern Chemistry," published in 1878; his "Handy Book of Forensic Medicine and Toxicology," brought out in 1877 in conjunction with Mr. W. B. Woodman; and his "Legal Medicine," issued in 1883.

As an authority on chemistry and toxicology, Dr. Tidy unquestionably occupied a high position; and on water supply and sanitary matters his opinion was greatly valued. As our readers are aware, he, in conjunction with Mr. W. Crookes, F.R.S., and Dr. W. Odling, conducted daily examinations, on behalf of the London Water Companies, of the water supplied by them to the Metropolis; the monthly reports thereon to the Official Water Examiner (which we believe were prepared by him) having always been reproduced in our columns. Among the engagements he held at the time of his removal was one with the Barrow-in-Furness Corporation, who had consulted him as to the quality of certain new sources of water supply, for the acquisition of which they are now seeking parliamentary powers. He had prepared his report; and it was produced last Wednesday before the Committee of the House of Lords who are considering the Bill. The leading Counsel for the promoters (Mr. Pember, Q.C.), in handing in the document, referred to it as the work of a dead man, and testified to the ability of its author, and to the respect in which he was held by his professional colleagues. His loss will be greatly felt by the London Water Companies, in view of the inquiry about to be held on the subject of the Metropolitan Water Supply, in which his valuable assistance will be greatly missed. Dr. Tidy was a striking example of exceptional natural gifts and power of application finding a suitable sphere of work; and to this, rather than to the accident of birth or education, must be attributed his advance to the foremost place among medical jurists. He was a man of exceptionally clear and vigorous thought, and usually gave expression to his views with remarkable force.

The following reference to the late Dr. Tidy appeared in the *Chemical News* last Friday: "Upon sanitary questions, especially with reference to water supply and river pollution, the deceased chemist took a prominent position. Not only was his knowledge profound, but it was ready at command. He was unrivalled in seizing at once upon the salient points of any question, and in devising experiments to test the accuracy of the arguments and theories adduced, whether by colleagues or opponents. In addition to these qualifications, he possessed in an eminent degree the uncommon faculty known as 'common sense.' Hence, Government Departments, Parliamentary Committees, Law Courts, and Municipalities accorded to his evidence an almost unlimited weight. His papers read before the Society of Arts, and his lectures delivered to the students at Lincoln's Inn, were exceedingly valuable. Here, as on all other occasions, he was distinguished for his adroitness in tearing to pieces unfounded theories, and exposing the hollowness of sensational schemes for the water supply of the Metropolis. In conjunction with Mr. Crookes and Professor Odling, he had carried on for years a searching inquiry into the quality of the London waters, and had done much to dispel the scare which had been industriously created concerning the quantity of impurities said to be swallowed yearly by the people of London in the shape of water."

Gas-Engines for Electric Lighting Stations.—The makers of the "Otto" gas-engine in Philadelphia have completed and set up two 100-horse power gas-engines—the largest ever made in America. They have been constructed for a gas company in Connecticut, who propose to couple three engines of this kind on a single shaft in a central electric lighting station. The engines have each two cylinders, placed one above the other, operating a single crank; and they are to be worked with producer gas.

The Management of the Huddersfield Gas-Works.—At the meeting of the Huddersfield Town Council last Wednesday, the Chairman of the Gas Committee (Mr. Stocks) brought forward two propositions in reference to the management of the gas-works. The first was to the effect that, owing to the impaired health of Mr. J. Burgess, the Engineer and Manager, he should be relieved of the active supervision of the works, and assist the Committee as Consulting Engineer, at his present remuneration. The second was one appointing Mr. Walter R. Herring, the Assistant-Manager, to the position formerly occupied by Mr. Burgess. In moving the latter resolution, Mr. Stocks spoke in a very appreciative manner of Mr. Herring's capabilities as a gas manager, and stated that, so far, he had proved to be a better man than the Committee anticipated. The Vice-Chairman (Mr. Culvert), in seconding the motion, also testified to the confidence felt in Mr. Herring by the members of the Committee. The motions were agreed to.

ELECTRIC LIGHTING MEMORANDA.

The Chatham Fatality—The Problem of Electrical Distribution—The Capital Expenditure of Electric Lighting Undertakings—The Affairs of the Taunton Electric Light Company.

THE remarkable fatality at Chatham is very seriously discussed, as its gravity demands, by the *Electrical Review*, which admits that this deplorable occurrence "will once more revive the fears and apprehensions with which high-tension apparatus have been generally regarded." Our candid contemporary, in insisting upon the necessity of studying this catastrophe with a view to the avoidance of similar disasters at Chatham and elsewhere, has a pointed reference to those "gentlemen of eminence in the electrical world, whose names will readily occur to our readers, who lose no opportunity of pooh-poohing, before scientific societies and in public lectures of the popular order, the risks of high-tension transformer circuits." Of these eminent personages, the well-known Electrician to the Post Office, Mr. W. H. Preece, is notoriously the head and chief. Our contemporary remarks that these gentlemen, being anxious to see electric lighting progress by leaps and bounds, entertain the delusion that by "blinding themselves, and throwing dust in the eyes of the public, they are achieving their object; but accidents such as that at Chatham have a marvellously wholesome and sobering effect upon would-be users of the light." We could say no more than this ourselves in condemnation of the peculiar kind of advocacy referred to. The technical lesson which the *Electrical Review* draws from the Chatham affair is, that "transformers must be forbidden inside houses, and must be strictly confined to the supply companies' sub-stations, or to specially constructed apparatus outside the house, and out of the public reach." It remains to be seen what Major Cardew thinks of the matter.

The fact is that the distribution of electricity presents a very sharply-defined difficulty just now, which Mr. Preece and his like are fain to try and jump over in default of ability to remove it. Low-voltage distribution recommends itself to many companies and municipalities by its undoubted superiority in the matter of danger to life and limb. But it is subject to the heavy disadvantage of requiring something like a copper mine in the streets wherever the district of supply is extensive. Even the St. James's Company, with the most concentrated district in England, have found it necessary to put down two generating stations within a few hundred yards of each other, and connect them with a line of solid copper of 8-inch section. It is this consideration that leads many eminent authorities to shake their heads over the prospects of low-voltage systems for any but the most limited areas. No central station based upon such a system can deal with a scattered district; and hence the high-pressure transformer systems offer irresistible attractions to the technicians whose aim is to keep down the price of the unit. If customers are to be picked up here, there, and everywhere, they can be reached in the cheapest way by small, high-pressure mains; but the worst of this is that the current kills and sets fire to houses upon very slight provocation. It is easy to say that the transformer, which lets down the voltage to a safe limit, ought not to be put into houses; but where else can they be stowed away so cheaply and on the whole so conveniently? Sub-stations, and a subsidiary low-pressure net-work, mean expense, which is precisely what must be avoided. The situation is full of interest.

A modern authority upon joint-stock investments has laid down the general principle that investors should beware of open capital accounts. There is no rule without exceptions; and it is hardly necessary to remind readers of the JOURNAL that gas undertakings come under this head, their regular growth being their strength. The rule is so far good, even in regard to this kind of exceptions, that it lays upon investors the task of satisfying themselves that additions to capital account lighten rather than increase the burden of capital upon the business as a whole, whatever its nature. It is a peculiarity of central-station electric lighting undertakings that they seem to want more capital before they are able to pay for that already expended. This is the case with most, if not all of the Metropolitan electric light companies; and we notice that it is the same with the Liverpool Company. Some of the former, such as the Notting Hill venture, have had considerable difficulty in raising the additional capital called for by the management. The Kensington and Knightsbridge Company is another concern which, while just managing to scrape up funds for a 2 per cent. dividend, wants more money for extensions. This may be perfectly reasonable; for of course extensions may be productive. On the other hand, there must be circumstances wherein prudence would counsel the closing of the capital account until plant already laid down attains its full earning capacity. Has any central-station undertaking yet ascertained where this limit lies? Until it is clearly established what is the fair proportion of capital obligations to business done, it seems to us that investors in electric lighting undertakings should look closely after the justification for these extensions.

It is not at all surprising that the Directors of the Taunton Electric Lighting Company have at length been compelled to report such a deficit in the revenue account as renders it impossible to conceal any longer the desperate condition of the undertaking. These little West of England companies, which

owe their origination to the genius of Mr. Massingham, have been used hitherto to support one another; but the game is now very nearly up. The case of the Taunton Company, which is the smallest of the group, has been hopeless for a year or two, even in the eyes of its supporters; and now the Directors are formally commissioned to "do the best they can for the shareholders." It is still hoped that the Town Council may buy the plant, and so enable the proprietors to see some of their money again; but this is a forlorn hope, and in any case only the present value of the works could be obtained, which can represent but a fraction of the original outlay. The Chairman of the unfortunate Company attributes the disastrous state of their affairs "mainly to the fact that the public had not supported the Company to the extent which the Directors had been led to expect would have been the case." Moreover, the system adopted by the Company, of charging consumers so much per lamp instead of by meter, has proved a failure. One is disposed to ask why this mistake was not corrected before it had become too late; but it is easy to guess that meters are luxuries which the users of electric lamps in Taunton could not be expected to pay for. It is all very well for the clubs and wealthy shopkeepers of Piccadilly to pay by meter; but when it is a case of half a dozen lamps per consumer, what can be done? Taunton, at any rate, proves that there is no paying demand for electric lighting in small country towns. It is a nice little place in its way, and the local gas company manage to do very well; but the experiment of bringing incandescent electric lighting within the reach of the shopkeepers and residents of a market town in the South West of England, has proved the failure which we always anticipated. Promoters, like Mr. Massingham, are occasionally able, as it were by a miracle of persuasion, to get together a following in defiance of the warnings of better instructed observers; but they cannot do impossibilities in the world of industry.

The Management of the Winchester Water and Gas Works.—Owing to continued unsatisfactory health, which has confined him to his house since the commencement of the year, Mr. W. Upton Tinney, Assoc. M. Inst. C.E., has been compelled to resign his position as Manager of the works of the Winchester Water and Gas Company; and the Directors have appointed as his successor Mr. F. G. Dexter, who has been Assistant Manager for about two years. The former event severs a connection which has extended over a period of something like 34 years. In regard to both branches of their undertaking, the Winchester Water and Gas Company have lately passed through some troublous times; but it may be hoped that the step the Directors have just taken will enable them to carry on their business with more satisfaction all round. Mr. J. Cummins, late of Oakengates, and formerly of Bahia, has been appointed Foreman of the works—the position recently advertised in our columns, under No. 2070.

Artificial Fuel Gas.—We have received from the Eastern Gas Machinery Company, of Hartford, Connecticut, a specimen copy of their new catalogue of Loomis fuel gas plant; showing its applicability to most of the industrial purposes for which solid fuel is usually employed outside the natural-gas regions of the United States. The supply of natural gas is shrinking; and the Loomis system is being greatly developed in order to take the place of that gas, when it shall have fulfilled its most useful purpose of instilling into the industrial community a liking for fuel in the gaseous form. The catalogue in question is well worth the attentive consideration of gas engineers, being very much more than an advertisement of the Loomis plant. It contains a good deal of information bearing upon the crucial point of the character and cost of a successful fuel gas. Neither producer gas, with its large proportion of nitrogen, nor water gas, made at a great sacrifice of fuel, is competent to fill the requirements of a commercial fuel gas. No process involving the gasification of oil can supply a really cheap gas. It is Mr. Burdett Loomis's contention that success in this matter can only be attained by mixing the producer and water gases made from bituminous coal; and it is his business to prove that this mixture can best be made by his patent plant. The Loomis system has been much improved and extended since we first noticed it in the JOURNAL; and it is now claimed that at English prices it will make water gas for from 1d. to 2d. per 1000 cubic feet. In the new way of running, gas developing 370 heat-units per cubic foot is made, containing from 5 to 7 per cent. of light carburetted hydrogen and heavy hydrocarbons. This peculiarity gives a strong odour to the gas, which is, moreover, 20 per cent. better than gas made in the same way from coke or anthracite coal. The gas plant also generates all its own steam, which is an important consideration. The Eastern Gas Machinery Company not only make fuel-gas plant, they also teach manufacturers how to use this class of fuel to proper advantage, which has been an even more difficult task than the manufacture of the gas. Mr. Loomis claims that, by his new arrangements, the economy of fuel gas for industrial uses will be manifested to an extent never before realized; and he also contends that, having undertaken the perfecting not only of the gas making, but also of the purifying, distributing, and consuming plant, he is in a position to remove some of the hindrances that have operated to retard the progress of fuel gas towards universal acceptance on its merits.

THE CRYSTAL PALACE ELECTRICAL EXHIBITION.

CONCLUDING NOTICE.

IT is with a feeling of relief that we approach the end of our critical labours in regard to the Electrical Exhibition; and, unless our observation has led us greatly astray, it is with the same feeling that most of the exhibitors, together with the Crystal Palace Company, contemplate the near proximity of the date fixed for the closing of the show. It is true that rumours have been put in circulation pointing to the existence of a desire on the part of some exhibitors for an extension of time beyond the end of April; but there are always these reports in connection with the dying hours of every exhibition that is not a patent *fiasco*. The fact really is that the present exhibition has not proved anything like the "draw" that the last undoubtedly was. People have lost interest in electrical appliances, which are no longer a startling novelty; and the desperate attempts made by a few exhibitors to attract public attention have fallen utterly flat. The more prominent exhibits must mean a very considerable and certain present expense to the proprietors, while any return must be problematical, and belong to the more or less distant future. A fair sprinkling of visitors from different parts of the kingdom have looked in at the Palace, and asked questions of the attendants at the leading stands. But the general public are chillingly indifferent; and if the exhibition lasts too long, it will simply keep people away by occupying space that might otherwise be devoted to something more amusing. Not many exhibitors will succeed in paying their expenses, even when these are kept at a moderate figure; and with the larger firms, it is a case of paying for everything by a big contract, or of standing to lose heavily on the venture. By the end of next month, the days will have become too long to make it worth while to light up very extensively; and the decrease of the "load factor" will render the contractors for power anxious to close their accounts. Taking one consideration with another, we do not expect the exhibition, as a whole, to be prolonged beyond the allotted closing time, although some few exhibits that cost little to maintain in position, and are not in anybody's way, may remain on view through the summer.

We have now to gather up in a concluding notice all that is to be said about certain exhibits and features of the exhibition which have not yet received their meed of attention. Nothing more need be written here with regard to the lighting display, except to put upon record the remarkable fact that we stand practically alone in pointing out how artfully individual shortcomings are concealed in the glare of the *ensemble*, and how generally poor and paltry are the "new" devices of the electric lighting artist. An engineering contemporary ventures to protest feebly against the absurdity of making incandescent bulbs imitate oil-lamps and candles, because in this way one of the essential features of this method of lighting—its independence of vertical supports, and consequent shadelessness—is counteracted. Not one of the journals nominally devoted to the interests of art, however—not a single illustrated weekly or other newspaper, so far as we have been able to scan their references to the exhibition—has done even so much as this to correct the glaring errors of the electricians. It is understood that the ordinary attitude of the newspaper reporter in face of an electric light is that of gaping wonder; and in the indiscriminating praise with which the electrical fittings at the Palace have been greeted in the papers, we have another piece of evidence, if such were needed, of the vacuity with which the conductors of these media of public instruction continue to regard everything done by electricians in the name of "progress." However costly in production, false in art, trumpery in technique, and outrageous in design, the work of the electrician may be, it is sufficient excuse that his is "the light of the future," for the average newspaper writer to praise it to the skies. Though we were wholly unsupported in our opinion of the incapacity of most makers of electric light fittings to treat the incandescent lamp in an artistic—that is to say, a sensible—way, we should continue to assert this as forming one of the most striking of the lessons of the Crystal Palace display.

An electrical contemporary has complained of the prominence of overhead wires and their necessary supports, which are truly described as the reverse of ornamental. It is suggested that these unlovely adjuncts of electrical distribution might have been fixed out of sight, or at least minimized by being kept in strict subordination to the architectural features of the building. From our point of view, it is just as well that this course has not been adopted; for since wires are indispensable in connection with electrical distribution, they may be advantageously displayed for the instruction of all who are interested in this kind of enterprise.

In addition to the lighting of the model theatre by Messrs. Siemens Bros., which was described in an earlier article, one or two other "side shows" of a more or less attractive character have been on view during the last month, upon payment of a modest extra charge. The best of these, from the educational standpoint, was the illustration given by Messrs. Siemens Bros. of certain effects of a current of 50,000 volts. This exaggerated voltage was obtained by "transforming up" from a current generated by a Siemens dynamo driven by a Willans engine; and it was really a striking sight to see the stream of sparks

that emanated from a terminal of the conductor so charged, when separated from the complementary terminal by a sheet of plate glass. The discharge tore, spitting viciously, over the intercepting non-conductor in a violently agitated network of purple fire, until eventually the local heat shattered the glass, and the current passed after the manner of its desire. The demonstration was not shown for long; and it was succeeded by an exhibit of electrical heating and cooking apparatus installed under the auspices of Messrs. Crompton and Co. A room has been fitted up with the usual appurtenances of a show-kitchen—stewpans, kettles, &c.—to which are added several devices exemplifying the application of high-power electricity to domestic purposes, including the driving of pumps, knife-cleaning machines, ventilating-fans, boot-cleaners, coffee-grinders, and so forth, not even excluding cigar-lighters. The moving machinery is, of course, driven by small electro-motors; but the heating is done by causing electricity to traverse small wires offering high resistance to it, which are embedded in a layer of enamel attached to the article intended to be made hot. In the case of a flat iron, for instance, the implement has a false bottom, which is hollowed out to receive a layer of enamel packed with zig-zags of the resistance wires. The two terminals of these are connected by insulated wires to a conveniently placed wall or bench point, where contact can be made with the lighting circuit. When this is done, in the course of a minute or two the heat developed by the resistance wires spreads through the mass of enamel and the working surface of the flat iron, which is thus fitted for use in the ordinary way. The same principle is carried through the other apparatus. Thus a kettle is made to boil water by the heat developed in its false bottom, and a hot-plate for cooking is similarly prepared. The whole affair, of course, is nothing more than an arrangement of electrical toys. Nor is there anything new in the idea; for, if we are not mistaken, Mr. Lane-Fox took out a patent for apparatus of the same character ten years ago. Nobody takes Messrs. Crompton's demonstration seriously; but if this were to happen, it would become necessary to lay stress upon the fact, pointed out by an electrical contemporary, that "such electrical luxuries are only obtainable by those possessing ample means." And these are precisely the people who, as a rule, hold the kitchen as far too sacred a place to be invaded with fantastical arrangements of this kind.

One of the few novelties in the exhibition proper is the so-called "Midget" arc lamp shown by Messrs. Woodhouse and Rawson. This is a neat little lamp, stated to develop 250 candle power at 45 volts and 5 amperes, or about three lamps to 1-horse power. They are very steady, and to all appearance effective. If the pattern answers in actual service, it should be useful to shopkeepers, as being of a more manageable brilliancy than the usual arc lamps, and more economical than the incandescent form.

The critic of engine driving, of belts, lubrication, &c., will see much to interest him at the different stands in the machine-room and in the Nave. The newest electric lighting practice favours the high-speed, directly-connected engine; but it is impossible to watch these machines, with their piston-rods going like the needle of a sewing-machine in a hurry, without thinking about wear and tear, and of what would happen if the attendant failed in his regular duty. Prominent use is made of link leather belting, which certainly flaps less than solid belts, but needs to be considerably wider to carry the same power. There is no rope driving. We complained last week that the gas-engine makers have betrayed a want of enterprise in failing to show a big motor; but the same reproach lies upon the electricians and their machinist allies, for not exhibiting electrical traction, or the utilization of water power for electrical purposes. There is, it is quite true, a so-called electrical tramcar upon the Brush Company's stand; but this exhibit succeeds best in illustrating an old weakness of its kind—it is a fixture. The catalogue says that "electro-motive power appears to be the ideal form of traction for tramway work;" but unfortunately this verbal statement does not carry us very far when we desire to learn how the ideal is to become the real. One would have thought that, if there had been any business in electrical traction, some proof of the fact would have been offered in connection with the exhibition. Again, Professor Forbes has lately told the world that, in certain circumstances, water power can be made available to compensate for the difference between the maximum and actual loads, which is such a serious obstacle in the way of the commercial success of central electric lighting stations. At the Crystal Palace there are huge elevated reservoirs doing nothing at this season of the year, but used in summer for supplying the great fountains. Why were they not employed to demonstrate the possibilities of turbine driving for dynamos, with or without reference to Professor Forbes's views? Or why was there no arrangement for transmitting power from the lower lakes in the Palace Grounds to the exhibition, either by a repetition of the Frankfort-Lauffen experiment or otherwise?

These are questions very much to the point, for which no satisfactory answer can really be obtained. The exhibitors at Sydenham seem to prefer playing with search-light projectors, with the illumination of fountains, the display of inferior imitation fireworks, the cooking of cutlets, and so on, to seriously tackling any of the known problems of the electric lighting industry. Consequently, they must not complain if critical

observers of their proceedings fail to see anything new or specially noteworthy in them, and condemn those who have so obviously wasted a good opportunity. We still maintain, in defiance of much that might be urged to the contrary, that the exhibition is worth a visit; but it is so perhaps rather more for what it does not, than for what it does, contain. At any rate, if this judgment reads as being somewhat too severe, let us say that the things which, to use the hackneyed but expressive phrase, are "conspicuous by their absence" from this show, are quite as instructive by virtue of the very fact, as most of the things that can be seen.

Books Received.—Chapters on Finance—including the London Water Companies—from Burdett's "Official Intelligence" for 1892. (London: Spottiswoode and Co.) "Continental Electric Light Central Stations," by Killingworth Hedges, M. Inst. C. E., M. Inst. E. E. (London: E. and F. N. Spon.)

Society of Engineers.—At the meeting of this Society on Monday, March 7, a paper was read by Mr. Sellon on "Electrical Traction and its Financial Aspect." The author commenced by describing the best known electrical systems—viz., the accumulator, the overhead, and the open and closed conduit types. He then at great length dealt with the commercial part of the question; taking a hypothetical case of three miles of tramway, which it was proposed to furnish with an equipment sufficient for a ten-minute service by either horse, cable, or electricity. The capital cost and working expenditure of each system was closely gone into; the rate per car mile being based on a car mileage of 197,000 miles. The cost per car mile given for working by horses was 7d.; by cable, 7d.; by the overhead and conduit system, 3'9d. On adding, however, the interest on capital expenditure, the author claimed that traction by cable was less economical than that by horse traction, and that the amounts saved per annum by the overhead and conduit systems, compared with a horse tramway, gave an increased dividend on the ordinary share capital of upwards of 6 per cent. per annum in the case of the overhead system, and of 5 per cent. per annum with a conduit system.

The Electric Light and Eyesight.—A discussion has been going on in the columns of *Lighting*, as to the effect of the electric light on the eyes. It has been summed up by Mr. G. Hart-ridge, of the Royal Westminster Ophthalmic Hospital, who gives the verdict in favour of the incandescent system. He says the chief difficulty—and it is one which experience alone can overcome—is the placing of the light in such a position, and shading it in such a manner, as to prevent any of the direct rays falling upon the eyes. If proper conditions are observed, even those eyes that are unduly sensitive, or the victims of disease, may work longer, and with less risk or discomfort, under the electric light than with gas, oil, or candles. We may venture to add that it is just the neglect to observe these "proper conditions" which causes so many people to complain of injury to the sight by the use of the last-named illuminants, two of which—gas and oil—certainly run the incandescent electric light very closely indeed, if they do not supersede it, for brilliancy, steadiness, and reliability. Mr. C. Higgins, F.R.C.S., who has also been questioned on the subject, considers the electric light, when steady, to be second only to daylight; but he cannot imagine anything more "worrying and irritating to the eyes" than a light which keeps "jumping up and down," as he has noticed many incandescent lamps doing.

The Yield of Ammonia from Coal.—At a recent meeting of the North-East Coast Institution of Engineers and Shipbuilders, at Newcastle-on-Tyne, the President (Mr. J. Wigham Richardson), in the course of a personal explanation, referred to some correspondence which had taken place between him and the Chairman of the Newcastle Gas Company (Mr. W. B. Wilkinson), and also from Mr. E. A. Hedley, in reference to the yield of ammonia from coal. At a previous meeting of the Institution, Mr. Richardson alluded to the very high dividend (50 per cent.) just paid by Messrs. Brunner, Mond, and Co.; and stated that this was perhaps not very extraordinary, considering that the cost of coal to them was less than nothing. The circulation of this statement by the newspapers brought forth kindly and courteous letters from Mr. Wilkinson and Mr. Hedley, casting some doubt upon the accuracy of Mr. Richardson's figures as to the yield of sulphate of ammonia per ton of coal. Mr. Wilkinson pointed out that the recovery of ammonia by Mr. Mond cost a great deal for acid and labour, and that the price had fallen from £12 to £10 10s. per ton. This Mr. Richardson said he did not dispute. Then Mr. Wilkinson went on to say that 30 lbs. of sulphate per ton of coal was considered excellent by gas companies; and he doubted if much more could really be obtained. Upon this Mr. Richardson wrote to Mr. Mond on the matter; and this gentleman sent a reply from Italy. He said their yield of ammonia on a large scale amounts, on an average, to 32 kilos. or about 70 lbs. per ton of coal; 125 tons turning out 4 tons of sulphate. Mr. Richardson said he had quoted the two differing authorities; and this was all his knowledge enabled him to do. He felt confident, however, that if 70 lbs., instead of only 30 lbs., of sulphate could be extracted from a ton of Newcastle coal, Mr. Wilkinson and the able staff of his Company would do it. He expressed the hope that this result might be achieved.

NOTES.

The Direct Conversion of Heat into Electricity.

It is no more than might be expected, that contemporary disturbances of the coal market have revived the hitherto unrealized idea of the possibility of directly converting heat into electricity for lighting purposes. Some newspaper writers are yet hazy as to the means by which the electric light is actually produced; for comments upon the coal miners' strike, in which it is taken for granted that the electricians will profit by the possible embarrassment of gas manufacturers, have appeared in more than one widely-circulated "organ of public opinion." It is therefore as well to remark that not only are electricians fully as dependent upon coal as gas engineers, but that there is also no apparent prospect of their being differently situated. According to a calculation by Herr R. J. Gülcher, the electrical energy obtainable in a useful form from a steam-driven dynamo is only 6·4 per cent. of the potential energy of the coal burnt in the boiler; but even this poor efficiency is eighteen times greater than that of the best-known arrangement for the direct conversion of heat into electricity—the Noë and Clamond thermo-battery—where the efficiency works out to only 0·35 per cent. of the potentiality of the gas burnt. Seeing that the modern dynamo and steam-engine do not leave much scope for improvement, Herr Gülcher has turned his attention to the thermo-battery, which ought to be a very much more efficient arrangement than it is. Although he has not succeeded in revolutionizing the ordinary methods of procuring electricity, Herr Gülcher claims to have made a thermo-battery composed of tubes of nickel and an antimonial alloy which gives electricity equal in amount to the output of two Bunsen cells for a consumption of 7½ cubic feet of gas per hour. It is quite evident, however, that thermo-batteries still leave a good deal to be desired.

The Stability of Petroleum Compounds.

The remarkable stability of the petroleum compounds is noticed by Mr. H. K. Warren in the *Chemical News*. He observes that whether these exist in the solid or the fluid state, elevation of temperature simply changes them into more gaseous compounds, which retain their former properties. For instance, if petroleum, boiling at a low temperature, is passed through heated tubes, it merely becomes fractionized into compounds boiling at temperatures in accordance with the temperature to which it has been subjected, until a red heat is reached, when a true gaseous hydrocarbon is obtained, burning with the ordinary luminosity of these compounds, and capable of reducing certain metallic oxides at an elevated temperature, at the same time forming substitutional compounds with the elements bromine, chlorine, &c. The striking peculiarity of the petroleum compounds is that, although somewhat readily changed by heat, they most stubbornly resist the most powerful oxidizing agents. For instance, Mr. Warren remarks that few, if any, compounds can resist the oxidizing influence of fused nitre; yet petroleum may be passed through this substance with impunity, even when it is at a red heat, and can be afterwards collected unchanged. Boiling nitric acid, moreover, has no effect upon fluid or solid petroleum compounds. The only oxidizing agent which seems able to touch them is chlorochromic acid, which, when shaken up with petroleum and water, changes the former into a semi-wax-like substance melting at 400°, and possessing an undetermined composition.

[Painting Oils and Varnishes.

Mr. Hugo Müller, in reviewing in *Nature* Professor Church's work on the "Chemistry of Paints and Painting," remarks that there is still much to be learnt with regard to the chemical processes involved in the so-called drying of linseed oil. He seems to think that, in order to exert its best and most lasting preservative effect, a paint ground in linseed oil should not be too freely exposed to air and sunlight immediately after application. The subject requires to be further investigated. Mr. Müller points out that linseed oil under certain conditions becomes a powerful oxidizer; so much so that canvas or paper soaked with it becomes destroyed in the course of time, and it seems that this effect is specially marked when oil of turpentine has been mixed with it. Linseed oil cannot, however, be dispensed with; but it is otherwise with turpentine, for which a very much superior substitute is available in the higher members of the benzene series, which could now, Mr. Müller thinks, be obtained at a sufficiently moderate cost if a demand for them should ever arise. These hydrocarbons, while indifferent to the action of atmospheric oxygen, possess greater solvent power than any other; and on this account they are well adapted for the preparation of varnishes. For this latter purpose, however, a still more suitable vehicle is recommended, in the shape of amylic acetate, which is capable of dissolving the hardest copals after these have been powdered and kept for some time in a hot closet. The preparation of protective varnishes is, however, a secret trade; and all such commodities should be tested by laying a film upon glass, when they should dry without cracking or showing the slightest bloom on the surface or in the substance of the layer. This last appearance is due to the exudation of minute particles of solid fatty acids originally contained in the linseed oil used in the preparation of the varnish.

COMMUNICATED ARTICLE.

COAL GAS: ITS MANUFACTURE, DISTRIBUTION, AND CONSUMPTION.

A Series of Articles for Gas Students.

(Continued from p. 440.)*

RETORTS, &c.

The retort, or still, in which the coal is carbonized is well known to all gas students. It may be of cast iron or fire-clay; and either hand or machine made. The fire-clay retort now almost universally used may be of the usual type, made all in one piece, or it may be constructed in blocks or sections, while some engineers prefer to use brick retorts.

A fire-clay that is to be employed in gas-retort or furnace work should consist chiefly of silica and alumina. The more alumina there is in proportion to the silica, the more infusible will be the clay. There will also be present oxide of iron, magnesia, and other alkaline earths; but the presence of these in large proportions will render the clay less refractory—i.e., more liable to fusion—and useless for the purpose. Extremely small quantities of lime, potash, or soda may, however, improve the clay by soldering the particles firmly together.—(Percy's "Metallurgy.") The presence of oxide of iron will discolour the clay. A good fire-clay should have a uniform texture, a somewhat greasy feel, and (except as just noted) be free from any of the alkaline earths. A fire-clay with a coarse open grain will probably prove more refractory than one with a finer texture.

The chemical composition is not a safe indication of the refractory qualities of fire-clay; but a good sample will contain from 62 to 70 per cent. of silica and 24 to 30 per cent. of alumina. Analyses of Stourbridge fire-clay (much used and recommended) have given—

Silica	69.8
Alumina	26.5
Lime, &c.	1.3
Oxide of iron	2.4
	100.0

Ganister, a sandstone also from the coal measures, and much used in the lining of blast-furnace cupolas, is utilized, mixed with other clays, in the manufacture of fire-bricks, and imparts thereto a degree of refractoriness, but also friability. Hence it renders them useless for positions where they would be liable to damage by stokers' tools.

The best fire-clays are obtained from Worcestershire, Staffordshire, Yorkshire, Northumberland, and Derbyshire, as well as from a few other English, and several of the Scottish counties—principally either in the coal measures or in close proximity thereto.

Cast-iron retorts were at one time used exclusively. As far as the writer's memory serves, it was in Scotland that fire-clay retorts were first used; and they gave rise to a bitter and hardly-fought controversy relative to the respective merits of the two systems. At the present day, iron retorts are employed in only very small works, where constant letting down and re-heating is unavoidable, or in certain positions of a setting where they will not be exposed to the fiercest heat. The reason of this is that iron retorts are not capable of standing the high temperatures now in vogue without rapid oxidation and even fusion. If subjected to heats most suitable for economical carbonization, the retort would soon be burnt off. Moreover, unless made in very good metal, it is liable to uneven expansion on heating, with consequent distortions of the retorts; thus rendering satisfactory charges impossible. When iron retorts are used, they should be ribbed after the pattern introduced by Mr. A. C. Fraser.† The ribs tend to maintain the original form of the retort.

The advantages of fire-clay retorts may be briefly summarized thus: (1) Higher yield of gas per ton and per mouthpiece, with consequent reduction of cost of labour and coal. (2) More even yield of gas. Fire-clay, being an indifferent conductor of heat, takes more time in heating up, and for the same reason does not part so readily with its heat. The temperatures of fire-clay retorts are therefore more evenly maintained, with a resultant better yield of higher quality gas. (3) Much greater durability of the retort. The lifetime of a clay retort in a good setting has been given as three winter and two summer seasons. With the exercise of every care in letting down heats, and in the general working of the retorts, this period is often exceeded.

Brick retorts are very successfully used at some works. Their supposed disadvantages are chiefly: Excessive first cost as compared with the other systems, due to the larger amount of material necessarily contained in such settings, and a corresponding increase of labour in erecting; and the larger percentage of fuel requisite in maintaining the necessary heats for carbonization, owing to the excess of internal material. These objections are, however, considered by many engineers to be somewhat apocryphal. The first is met by the admitted superiority of the setting as regards lasting capabilities, by the facility

with which any needed repairs can be executed, and at a fractional cost as compared with fire-clay retorts. Such settings, now in good condition and doing well, have, to the writer's knowledge, been at work for the past seven years, only requiring during the summer months such ordinary repairs as can be carried out without interfering in any way with the setting. During the same period, a fire-clay retort setting would have been pulled down and re-erected two or three times. The second objection is to a great extent untrue. The setting will probably take more fuel to raise it to the requisite heat from the cold; but, once hot, the extra amount of material will act like the heavy fly-wheel of a steam-engine, and tend to maintain the retorts at a more even temperature, with very satisfactory carbonizing results.

There are three principal patterns of retorts in use—viz., the Δ , the oval, and the circular—and there are advocates for each shape. Their respective advantages may be summarized as follows: For the circular and oval sections, greater strength and durability is claimed; but the oval and Δ sections are certainly better adapted for carbonizing than the circular form, owing to the greater area allowed for spreading the coal in the retort, and the reduction of the thickness of the charge.

Retort-Settings.

Settings of retorts may consist of two, three, five, and up to as many as eleven in one oven; the number depending on the requirements of the establishment. In works of average size, "through" retorts—i.e., the benches built back to back, the retorts being continuous, and having a mouthpiece at each end, so as to be chargeable from either side—are now much used. The following are the principal advantages of this arrangement: In the first place, much less carbon is formed on the retorts, and this is more easily removed. Here is effected a saving in the wear and tear of the retort, through the reduction of the heavy scurfing work. (This is, however, largely obviated with the modern "singles," which are so constructed as to allow of readily opening the back ends, when required, for scurfing.) Secondly, the retorts are more evenly heated right through, and the coke is more easily extracted. Consequently, carbonization is carried on more economically and expeditiously.

Mention must be made of the scurf, or deposit of carbon, which goes on incessantly during the working of retorts. This carbon adheres to the sides and top of the retort, and, gradually increasing in quantity, tends not only to reduce the workable sectional area, but also to lower the heat of the bed. It should not be allowed to accumulate considerably, for the reasons just given, and also because the usual means adopted for its removal must more or less damage the retort. The deposition of carbon is retarded chiefly by relieving the retorts from the internal pressure of gas by means of an exhaustor, and also to a great extent by the use of the "through" retorts just mentioned, as currents of air are constantly drawn through whenever the retorts are charged, and the carbon is in part thereby oxidized and loosened.

The removal of carbon (or "scurfing," as it is called) is usually effected by chisel-shaped steel bars, applied after the retorts have been allowed to stand off for a period. A very satisfactory plan, obviating the use of the scurfing-bars, and any consequent damage to the retorts, is as follows: Take off the cap of the ascension-pipe at one end of the retort, and open the door at the other end. With single retorts, this will be done by means of the removable back end just referred to. A complete and sharp current of air throughout the retort immediately ensues. Two fire-clay blocks cut to the shape of the retort, but slightly smaller, are then placed inside—one about the centre, the other, to commence with, at the open end of the retort—and gradually moved towards the centre, as the carbon drops off. The blocks cause the heated currents of air to impinge directly on the carbon surrounding them, thus removing it, inch by inch, until the whole retort is clean; and this is done without the application of a single bar. When one-half of the retort is scurfed, the process is reversed, and the block worked back from the opposite end.

In designing a setting of retorts, the following are important considerations to be borne in mind: (1) An equal heating, as far as possible, of the whole of the retorts—tops, centres, and bottoms. This will chiefly be provided for in the arrangements of the heat passages, flues, &c. (2) The prevention of undue wear, by fusion or otherwise, of any one portion of the setting; but the attainment rather of an equal wear and tear all round. This will also largely depend upon the means employed for distributing the caloric of the bench, and suitably protecting those portions which would otherwise be subject to too intense currents of heat. (3) A system of support to the retorts, that shall provide for the maintenance throughout of the original forms of the retorts, passages, flues, &c., without the presence in the setting of any excess of brickwork. A system of flimsy supports to retorts, based on ideas of readily heating up the bench, is false economy. While an unnecessary amount of material is undesirable, it must be borne in mind that a light setting, if quickly heated up, just as readily loses its heat, and cannot therefore maintain such an equality of temperature as is consistent with good work. Moreover, the liability to collapse, through some of the light portions being burnt through, is a contingency not to be tolerated.

The sizes of retorts in ordinary gas-works (Newbigging's

* Errata.—In the first table under the head of "Coals" in the article which appeared on the 8th inst., the figures for lignite should have been given as follows: Carbon, 71.36; hydrogen, 2.71; oxygen, 25.93. In the second table, the percentage of sulphur, ash, &c., in cannel should have been 7.45.

† These retorts are described in King's "Treatise on Coal Gas," Vol. I., p. 181, and in Newbigging's "Handbook" (fifth edition), p. 72.

"Handbook") are: Oval, 21 in. by 15 in.; \square , 18 in. by 15 in.; circular, 15 in.—diameter. Length—8 ft. to 9 ft. 6 in. (single lengths).

Two principal means of heating retort-ovens can be made use of. The retort may be heated by *direct conduction* from the furnace, or by making the currents of caloric traverse various passages around the retorts and throughout the ovens, and be thus absorbed by the setting. The latter method is that chiefly adopted. The ordinary fuel used for firing the furnaces is coke; about 20 per cent. of the entire make at a well-managed works being utilized for this purpose. When used in the ordinary furnaces, it will be necessary, in order to maintain satisfactory heats throughout the setting, to fire up every two hours at the least, and periodically to shake up the furnace-bars, so as to loosen the clinker, and ensure the easy passage of atmospheric air through the burning mass. The furnace must be cleaned out every 12 hours, and thoroughly clinkered every 24 hours. If this be not done, the clinker forming on the sides and bars of the furnace will rapidly accumulate and harden, and soon prevent the possibility of complete removal. The result will, of course, be a lowering of heats, a reduction of the cubical contents of the furnace, and a very serious deterioration of the furnace walls and bars. The ash-pan should always be kept clean and full of water. This will tend to preserve the bars, aid in the combustion of the coke, prevent the undue access of cold atmospheric air through the bottom of the furnace, and keep the clinker soft.

Mr. Livesey and others have recommended the use, under certain circumstances bearing on the relative market values of the two commodities, of tar as a fuel for heating the furnace, in substitution for coke. This can easily be arranged for by bricking up the ordinary coke-firing doorway, and filling up part of the furnace with coke or breeze. Suitable spaces will be provided for the admission of atmospheric air. The tar travels into the furnace by some suitable channel, in a small stream.

An important matter, bearing on the successful working of the ordinary coke furnace, is the periodical cleaning out of all the flues accessible in the setting, where there is likely to be any accumulation of dust. This practice will be an important aid to the maintenance of good heats.

There are now in use two methods of heating retort-settings—the direct firing, with the ordinary furnaces just referred to; and the generative plan, where the retorts are heated by the combustion of gases which arise from the incomplete combustion of coke in a generator which may be, or may not be, distinct from the setting.

Coke, being principally carbon, produces on complete oxidation, carbonic acid gas, or more correctly, carbon dioxide (CO_2). If, however, the supply of air be limited, the carbon dioxide formed at the lower part of a burning mass of coke will, on passing upwards through the incandescent coke, take up another atom of carbon, forming carbonic oxide (CO). This gas, on meeting with oxygen or atmospheric air, takes up another atom of oxygen, burns with an intense heat, and is again resolved into carbon dioxide. Here we have the principles of regenerative firing as applied to the heating of gas-retorts. The carbonic oxide is the medium utilized for the production of the caloric inside the oven. The *modus operandi* is as follows: Coke is placed in bulk in a generator, which is provided at the bottom with close bars, and to which is admitted, either at the bottom or through the lower portion of the walls, a limited supply of atmospheric air. This is termed the *primary* air supply. The upper portion of the generator communicates, directly or indirectly, with the combustion chamber, which is arranged around the retorts. The volumes of carbonic oxide as they are produced in the generator are thus conveyed to the combustion chamber, and there meet with fresh supplies of heated atmospheric air—the *secondary* air supply. The carbonic oxide here burns, producing carbon dioxide, and emitting an intense heat. The secondary air supply is heated, prior to combustion, by conveyance through a series of passages constructed in the hottest positions around the generator. The advantages of the system are: Better and more even heats, and more effectual control generally in regulating the temperature of the setting; greater facilities for firing, clinkering, &c., with a resulting reduction of labour; considerable saving in the fuel account, as the furnaces can be maintained by the expenditure of from 65 to 75 per cent. of the coke required to heat the ordinary furnaces. In the regenerative furnace proper, the *primary* air, as well as the *secondary* air, is heated up before admission to the point of combustion. The arrangement is considered too costly for general adoption, as the advantages derived are not important.

Many engineers have adopted a modification of the regenerative system, which may be applied to an ordinary setting. The section of the furnace is somewhat altered; being constructed much deeper and narrower. The primary-air supply under the furnace bars is limited, and a secondary supply is provided, which is itself heated by passages usually constructed between the flues of the bottom retorts. The furnace is practically converted into a generator. The advantages of these modifications are not, of course, equal to the adoption of the system in its entirety.

(To be continued.)

TECHNICAL RECORD.

EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.

The Seventh General Meeting of this Association was held on Wednesday last, at Sleaford. About noon, the members assembled at the gas-works, where refreshments had been kindly provided; and every possible attention was paid to their visitors by the popular and genial Secretary (Mr. H. Wimhurst), his wife, and other lady friends. Several of the members took the opportunity of inspecting the works, which, though small, are admirably arranged and present a very neat appearance. Before quitting the works, the company were photographed; and immediately afterwards they proceeded to the Town Hall, where the business of the day began shortly after 1.30. At the commencement, Mr. J. CARTER (Lincoln), the retiring President, occupied the chair.

A WELCOME TO THE TOWN.

The PRESIDENT remarked that the Association were favoured with the presence of the Chairman of the Sleaford Gas Company (Mr. W. C. Allen); and he would ask him to address a few observations to the members.

Mr. ALLEN said, on behalf of the Gas Company, and, he might add, on behalf of the town, he had great pleasure in welcoming the Association that day. He congratulated the members on the numerously attended meeting, and on the fine day which they had for it. He trusted that, as on past occasions, the present meeting would result in the spread of information. These gatherings, he believed, were conducive to the interests of gas managers generally, and to gas companies in particular. He was very pleased they had seen their way clear to visit Sleaford; and he hoped it would not be the last time they would have the pleasure of welcoming the Association to the town.

The PRESIDENT observed that it was his pleasing duty to acknowledge the kind words which Mr. Allen had addressed to them. As they visited the various towns in the district represented by the Association, it was a general thing with them to enjoy hearty receptions by gentlemen occupying positions of considerable local importance. It was an experience with which they were very familiar; and it was one of the instances in which "familiarity" did not "breed contempt." They were very much obliged to Mr. Allen for the hearty welcome he had given to them to the beautiful little town of Sleaford.

MINUTES OF LAST MEETING.

The HON. SECRETARY (Mr. H. Wimhurst) then read the minutes of the meeting held at Cambridge in September last; and on the motion of Mr. W. DUESBURY (Cambridge), seconded by Mr. W. BARRATT (Grantham), they were confirmed.

NEW MEMBERS.

On the proposition of the PRESIDENT-ELECT (Mr. C. E. Jones, of Chesterfield), seconded by Mr. W. WELLS (Stamford), the following gentlemen were elected members of the Association: Mr. C. F. Cutting, of Downham Market; Mr. J. A. Fielding, of Waterbeach; Mr. F. Kent, of Worksop; Mr. H. Clark, of Maldon; and Mr. J. E. L. Hughes, of Uppingham.

ANNUAL REPORT AND ACCOUNTS.

The following report and the statement of accounts were then taken as read:—

Your Committee have pleasure in presenting their third annual report to the members of the Association, and express satisfaction at the progress made during the year. Two half-yearly general meetings have been held—the spring meeting at Lincoln, and the autumn meeting at Cambridge.

The number of members on the 1st of January, 1891, was 44. Eleven new members were elected during the year, and one member has resigned—leaving the number 54 as members on Jan. 1, 1892, which number the Committee hope will be largely increased during the current year.

The accounts show that the year began with £16 4s. 7d. in hand; and subscriptions amounting to £29 18s. were received—a total of £46 2s. 7d. The expenditure has been £38 12s. 7d., including the honorarium voted to the Hon. Secretary and Treasurer of £10 10s., leaving a balance in hand at the end of the year of £7 10s., and only two subscriptions outstanding.

At the spring meeting, the President (Mr. John Carter) delivered his Inaugural Address, which was of the greatest interest to the profession; and Mr. W. Barratt contributed a paper, "Some Thoughts on Gas-Meters," which was ably read by the author, and gave rise to a most interesting discussion. The members then adjourned, some visiting the Lincoln Cathedral, others Messrs. Robey and Co.'s, Limited, engineering works; all dining together in the evening at the Great Northern Hotel, Lincoln—amongst the visitors being the Mayor of Lincoln, Councillor W. T. Page, jun., Chairman of the Gas Committee, and J. Hepworth, Esq.

The autumn meeting of the Association was held in the Council Chamber, Cambridge, when papers were read by Mr. Fred Weller on "The Economical Working of a Small Gas-Works," and on "The Rating of Gas-Works" by Mr. F. A. Ward; also a discussion was inaugurated by Mr. C. E. Jones, on "Coal Storage, viewed with regard to the Combination of the Mining Interests to the Detriment of the Gas Industry"—the whole being very ably discussed by the members generally.

The officers for the year 1892 were elected at this meeting as follows: President, Mr. C. E. Jones; Vice-President, Mr. W. Duesbury; Hon. Secretary and Treasurer, Mr. H. Wimhurst; Auditors, Mr. F. Weller and Mr. A. J. Yorston; Committee, Mr. W. J. Carpenter and Mr. J. H. Troughton. Upon the conclusion of the business portion of the meeting, the members visited many of the Cambridge Colleges, the FitzWilliam Museum, and the Gas-Works, and dined together in the evening at Y^e Old^e Castel Hotel; the

Mr. J. Lee, of Crossgates, Leeds, has been appointed, out of 100 applicants, Manager of the Warkworth Gas Company,

visitors including the Mayor of Cambridge, Alderman C. Balls, J.P., Chairman of the Cambridge Gas Company, and W. A. Valon, Esq.

The thanks of the Committee are due to those members who have contributed papers during the year; and the Committee hope that each member will undertake a similar task in the near future, and that each member will use his influence on behalf of the Association by inducing other gentlemen to join in the good work of the Association by becoming members.

THE RETIRING PRESIDENT.

Mr. BARRATT said this finished Mr. Carter's term of office as President; and he had great pleasure in proposing a vote of thanks to him for the able way in which he had discharged the duties of the chair. Mr. Carter was younger than some of the members; but he had acted in an honourable and straightforward way, and the Association had lost nothing during the past year by having him at their head.

Mr. J. G. HAWKINS (Spalding) seconded the motion, which was unanimously agreed to.

Mr. CARTER said he could scarcely find words—certainly not adequate words—by which to express his sense of the too flattering terms in which Mr. Barratt had referred to him and to the work which it had been his duty and (he might say now that he was getting through the wood) his pleasure to perform during the past year. Their membership had increased; the meetings had been well supported; and they had been, he thought he was justified in saying, highly successful. Their thanks were due in the first place to those gentlemen who had contributed papers; and, secondly, to their Honorary Secretary for the able manner in which he had attended to the duties of his office. Mr. Wilmhurst had had remarks similar to these made before with regard to his services; but when they remembered the warm, personal interest he took in his work, any recognition that they might make, either publicly or privately, would not at any rate be beyond the demands of the case. There was nothing left for him to do, but to vacate the chair, and allow the honours to fall into the more capable hands of his successor; and he trusted that, when Mr. Jones reached the end of his term of office, he would have the pleasure of looking back upon a year which had been as pleasant and successful as the one which had just closed.

Mr. JONES having taken the chair,

The SECRETARY read letters from the President of The Gas Institute (Mr. W. A. Valon, of Ramsgate), Mr. G. Garnett, of Ryde, and the Chairman of the Sleaford Local Board, expressing their regret at not being able to be present at the meeting.

PRESIDENT'S ADDRESS.

The PRESIDENT said he appeared before the members that day under circumstances of considerable difficulty. Owing to the pressure of important professional engagements, he had not had time to write the whole of his address; so that a large part of it would be given extemporaneously. In the early portion of his remarks, the President observed that, although the efforts of gas managers in the main degree were, as might be supposed, chiefly directed towards devising methods for obtaining the largest yield of illuminating gas from a given quantity of raw material, and the most suitable and approved means of ensuring the proper application of the manufactured article, the production of secondary products on a large scale had given an impetus during the last half century to the science of chemistry of considerable importance, besides calling into existence new industries unknown before. Manufacturing chemistry had taken a new lease of usefulness since the introduction of coal gas. There was probably no other branch of manufacture which produced at one operation such a host of compounds as that of coal gas; and no source of chemical investigation had been so useful, and, let them hope, profitable, both to the manufacturing chemist and the general community. Gas-works were now recognized as the principal source of the ammoniacal salts of commerce; and it was difficult to conceive the inconvenience that would be caused by a diminution or cessation of their productive operations. Some of the most brilliant discoveries in chemical science in modern times were intimately associated with the gas industry; and the arts of war, as well as those of peace, had benefited by having substances at command so applicable to their various requirements. Medical and sanitary science also scrupled not to employ new sweetening and curative compounds or remedies; while the decorations of the home, and the bright and gaudy colours of wearing apparel, were indebted not to Tyre, but to coal tar, as the source of colouring material, and liquor furnished the agriculturist with a cheap and powerful fertilizer. Surely, it was a noble work to bring about these beneficial changes and boundless advantages for the good of mankind, and an honour to belong to such a profession as that which the gas industry had created.

In speaking next of the growth and popularity of the gas industry, the President referred to the statistical information which was furnished in detail to the Board of Trade. In 1882—the year of the Electric Lighting Act—there were, he pointed out, 458 authorized gas-works in the United Kingdom; and now the number was 594, or an increase of 136. The confidence of the public was shown by the capital invested in the undertakings. Of the £77,519,068 authorized, £61,344,357 had been expended, as against £60,577,736 authorized and £44,626,205 expended in 1882. During the same period, the number of

tons of coal carbonized had advanced from 6,365,336 to 10,242,427; and the gas manufactured from 63,345,300,497 to 103,011,038,299 cubic feet, with distributory mains sufficient to “put a girdle round the earth.” Comparing the production per ton of coal, in 1882 it was 9951·60 cubic feet; while last year it was 10,057·28 feet. This increase was important, since it would have required, to have made the total gas for 1891, 108,742 tons of coal more—the value being (say, at 10s. per ton) £54,371; or, roughly, £1000 per week had been saved by improved carbonizing. He confessed these figures, at first sight, appeared disappointing. With the many improved settings of retorts, gaseous firing, and more economical furnaces, it was not unreasonable to expect a better result; and the question arose, Have we reached the limit of the production per ton?

In considering this point, however, it should not be forgotten, remarked the President, that the average standard of illuminating power had been increased in this country; and it was no less a fact that, owing to the greater care exercised by the miner, a larger proportion of comparatively inferior coal was sold than formerly. To this it might be argued that cannel was used as an enricher of poor gas. This was true; but the use of cannel for the purpose named diminished as a knowledge of purification extended. They had only to reflect for a moment on the rôle played by carbonic acid gas, or the volatilization of the benzols or lighter oils by judicious condensing, to be assured of this. It was not by any means improbable that oil would, if necessary, usurp the place of the richer materials in gas making; and the growing scarcity of rich cannels must of necessity accelerate this result.

Reverting to the Board of Trade returns, the President said they were incomplete, and did not exhibit the full importance of the gas industry—either as regarded the number of gas-works, or the quantity of coal used therein. Thus in his own neighbourhood, there were more than twelve works not included in the returns at all; and no doubt this would be found to be the general experience. Again, the coal carbonized only was given; whereas there were large quantities of manufacturing fuel to be added to the total, in order to obtain an accurate idea of the gas coal trade. It was obvious that considerably more than 10,250,000 tons of coal per annum were absorbed in gas-works; and he was disposed to put it at 12,000,000 tons, which was something like one-fifteenth of the entire output of the United Kingdom. Of this enormous quantity of material, gas companies used two-thirds, and local authorities one-third; and it was interesting to note that, while the conversion of coal into gas went on augmenting, the price per 1000 cubic feet, as well as the net profit, exhibited a diminution. The President quoted a number of figures from some tables which he had prepared, and which partly illustrated this last statement. They exhibited a slight superiority for the undertakings not belonging to local authorities. The companies' returns for 1882 showed that 10,014 cubic feet of gas were made per ton of coal carbonized; and 9228 cubic feet were sold. The figures for the local authorities were respectively 9873 and 8983 cubic feet. In 1890, the companies' returns showed that 10,155 cubic feet of gas were produced per ton, and 9306 feet were sold; and in the case of the local authorities, 9877 cubic feet were made, and 9021 feet sold. In 1887, the net profit of the companies for every ton of coal carbonized was 9s. 11d., and on every 1000 cubic feet of gas sold 14·02d.; the figures for 1890 being 8s. 3d. and 10·67d. The corresponding figures in the case of the local authorities were: For 1882, 4s. 4½d. and 5·79d.; for 1887, 2s. 11½d. and 3·84d.; and for 1890, 2s. 6½d. and 3·35d.

There was another point, said the President, on which he wished to address the members. As they would have seen, the Board of Trade were again considering the question of the testing of gas; and it would have been observed that they were assisted by men in the gas profession. In all his life he had never seen such abject folly as had been displayed this year by the people in London. It was a mistake to rush after a standard which they could not possibly obtain, on account of the fact that it was impossible to measure accurately any light in the world. If they were going to get a standard of light, they could only do so in one way. He had been a worker in this particular direction; and he had endeavoured to determine the illuminating power of gas by its explosive properties. Mr. Thomas Newbigging had asked him to allow him to mention this matter; but he had refused, as he desired to thresh it out. This he had done; and he was prepared to say that there was not a single system in the world that could measure the illuminating power of gas like its explosive properties.

In concluding his address, Mr. Jones referred to the coal question. He said that of all the most wicked things he had ever heard of, and which had occurred in his own recollection, it was the present strike of the colliers. The gas industry purchased something like 12 million tons of coal a year for the purpose of producing gas. In the Act of Parliament of 1876, there was a clause which said that any man, or any set of men, who wished to put a town or district in darkness was liable to prosecution; and he asked whether the members did not think the colliers were now trying to put the whole country in darkness. If he had had time to have prepared his address, he should have said something very severe in reference to this action of the miners. The men had never been threatened with a strike; and, in his district at any rate, they had not been

asked to take less wages; but nevertheless they must "play." This matter was of the highest importance to the gas industry; but he had not said half as much upon it as he had intended to do.

Mr. BARRATT, in proposing a vote of thanks to the President for his address, observed that it was only the previous week that he visited him, and found him under the doctor's care, suffering from influenza. He did not expect to see him present at the meeting that day; and he was sure the members would sympathize with him in not having been able to deliver himself as he usually did.

Mr. A. DRAGE (East Dereham) seconded the proposition, which was unanimously agreed to.

Mr. J. H. TROUGHTON (Newmarket) then read the following paper, entitled

CONSUMERS' FITTINGS.

The subject I have chosen to bring before you is one which has not been discussed before by this Association; but it is constantly coming before us in our respective localities. Consequently it is nothing new; but I think it is of sufficient importance to give rise to a profitable and interesting discussion.

At one time it was considered by the majority of gas managers that, when a good supply of gas had been laid on to a customer's premises, and a meter of sufficient capacity for his requirements fixed, we had done all that was necessary so far as we were concerned; and the remaining and most important part of the work was left to the tender mercies of someone else, who might continue the good work we had begun, and give satisfaction, or who might continue the work and give general dissatisfaction, by putting in pipes utterly inadequate to convey sufficient gas to the various points of combustion—thus at once crabbing and crippling the supply we fondly hoped our customer would obtain.

Our efforts to satisfy our customers must always be more or less handicapped, while we labour under the disadvantages of having the internal fittings done by irresponsible tradesmen and unqualified fitters. We are too much in the hands of gas-fitters who are not up to their work, and who know little or nothing as to what are the sizes of pipes necessary to properly fit up a house. The fitter may be a moderate workman, but he lacks the idea; and it is astonishing what a volume of gas some of these fellows expect a $\frac{1}{2}$ -inch or $\frac{3}{4}$ -inch pipe to convey. I have actually known a so-called "fitter" lead off from the outlet of a 50-light meter with a $\frac{1}{2}$ -inch pipe, intending it to supply sufficient gas for between 50 and 60 burners.

But it is not always the gas-fitter who causes us trouble, and our customers inconvenience. It sometimes occurs that architects are the cause of these reprehensible blunders; for they do not always specify pipes large enough for the number of burners required. I have had to condemn fittings for this reason, and to refuse to fix the meter until the defect was remedied. A fruitful source of mischief arises from contract work; for there are few things easier to be scamped than internal pipes. Then we have the "jerry-builder," who scamps everything, and the gas-fittings in particular; putting in the cheapest trash he can get, without the slightest consideration of quality or capacity—the work being abominably done. Next to his tenants, I think the gas manager is most to be pitied; for the result of the builder's short-sighted economy leads to dissatisfied customers, who are continually sending urgent requests for a fitter to stop some dangerous leak, or annoying us with complaints of insufficient light, and of "bad gas," which is generally produced by their own defective and shoddy fittings. These are a few of the many drawbacks we have to contend against; and to give in detail the many glaring and inexcusable blunders which undoubtedly exist to-day in almost every town supplied with gas, would be a waste of time, as we are all more or less acquainted with the causes I have mentioned. Fortunately, something has been done of late to remedy and guard against this unsatisfactory state of things; but there is a great deal more to be done before we can hope to dispose of the evils arising from defective and inadequate gas-fittings.

It has been said that the subject of internal fittings is beyond the province of the gas manager, and that we have quite enough responsibility without increasing it. With this I quite agree. But whether or not we are willing to accept this extra work, we shall have to submit, because it is being slowly but surely forced upon us; and I think the sooner we grapple with it, the more likely we are to come to some practical conclusion as to what is the best way to deal effectually with this important problem.

When we come to consider ways and means of surmounting and overcoming the many defects caused by leaving this work for others to do, we encounter obstacles at all points; for what would be a success at one place would not be practicable at another. Some companies undertake to fit up houses complete, supplying everything and charging cost price for the work done. Others have adopted the plan of doing the work complete on a three-years' system. The scheme introduced by Mr. Valon, at Ramsgate, seems to be a very successful one, and worthy of imitation. He told us at our Cambridge meeting, that, by fitting up houses of a rateable value of £30 and under free of charge, he had tapped a class of customer which only a similar plan would be likely to obtain. In return for free fittings, Mr. Valon charges 7d. per 1000 cubic feet over the rate

charged to ordinary customers. This, it is estimated, will pay for the fittings in five years. They have at Ramsgate above 500 of these customers, who consume, on the average, about 10,000 cubic feet of gas per annum; and, being supplied on the prepayment system, no bad debts are incurred.

These schemes are very commendable, and steps in the right direction. But I fear they would be too difficult to carry out by many small companies in the Eastern Counties; for in the first place we should have the local gas-fitters to deal with, and this is no congenial task to set ourselves, because they already look with envy on gas companies, and the first move we make towards interfering with what they call their private business, would be looked upon as an encroachment, and in all probability strongly resented. Then small companies are not always so fortunately situated with regard to capital as larger companies and corporations may be. An extra skilled fitter would be required, whose wages would necessarily be high; and an additional workshop, and perhaps a show-room in the town, with an attendant, would be necessary; so that only large or medium-sized concerns can adopt these schemes with advantage. But we can all do something towards limiting, if we cannot overcome, the many defects which from time to time come before our notice; and especially should we be alert at the present time, when we have so much competition to contend with in so many various forms. The electric light has not done us any harm in the Eastern Counties; and we need not look upon it as a very serious rival at present. But we have a far greater competitor in oil, which is extensively used not only as an illuminant, but for heating and other purposes. We have therefore every reason to be jealous of its presence among us; and nothing should be left undone until we can compete successfully with any rival which may cross our path, by adopting such plans as will tend to bring gas within the reach of all.

Something might be done at the outlet of the meter. It is here that the most important part of distribution commences; and I think it is here that we require some power or authority to fix upon, and adopt, a standard size of pipes suitable for dwellings and other buildings, so that, whether or not we undertake internal fitting work, we can at least see that our customers will have a system of pipes put into their premises which will ensure them obtaining a supply of gas at whatever point it may be required. The sanitary arrangements of new buildings are carefully looked after by inspectors; and unless pipes of suitable size and quality are laid, with a proper fall, and trapped to their entire satisfaction, they have power to condemn the whole system according to the law. Water companies, too, have similar powers; and I cannot see why gas companies should not have some additional facilities, to enable us to prevent the abuse of the light we manufacture and convey to our customers' dwellings, if not for their health, at least for their happiness and comfort. Personally, I should like to see our Association take up this matter, and adopt a standard of sizes, for (say) the skeleton part of the internal fittings of a house. I am confident much good would be the result, if only a united and persistent effort were made to carry it out when adopted; and I think we should be doing something which would help those of our members who, from no fault of their own, are unable to undertake the responsibility of doing the whole of this work, at the same time performing a duty we owe to our customers as well as to ourselves, which would tend very materially to popularize the use of gas, and diminish to some extent those annoying and irritating complaints which cause us so much trouble. If this were done, managers would be consulted more by present and intending customers, and be in a position to insist upon internal pipes of a proper capacity being put into their premises.

Some time ago the North British Association appointed a Special Committee to fix upon a standard size of pipes for internal fittings; and the result was that they recommended the following:—

Internal Diameter of Pipe. (Inches.)	Greatest Length of Pipe allowed. (Feet.)	Greatest Number of Burners for Size and Length of Pipe.
$\frac{3}{8}$	20	3
$\frac{1}{2}$	30	6
$\frac{5}{8}$	40	12
$\frac{3}{4}$	50	20
1	70	35
$1\frac{1}{4}$	100	60
$1\frac{1}{2}$	150	100
2	200	200

No. $\frac{1}{4}$ -inch pipe to be used.

I may say that at Newmarket I adopted these recommendations, with beneficial results. I had the scale printed, with other rules and information, in circular form, and distributed them among our customers; and whenever I see any buildings or alterations going on, I send a copy to the architect, builder, and owner, and have generally found that the information given has been acted upon. I can with confidence recommend the above scale to those who cannot do more than advise their customers on this subject. Where gas-stoves are used, or intended to be used, the internal diameter of the pipes should be at least $\frac{1}{2}$ inch larger; and in any case it is advisable to allow for them, for I have often lost the chance of placing both cooking and heating stoves, on account of the trouble which would be caused by enlarging the pipes, even when the work would have been done free. We let gas-cookers on hire at New-

market, and fix them free to customers who are willing to keep them a year, or we sell them and heating-stoves at a little above cost price. I cannot state the number of stoves we have in use; but during the summer months our day consumption of gas is as near as possible equal to the night consumption. With regard to tubing for internal fittings, that only of the best quality should be used. I prefer iron to lead or composition, as it is not liable to bend or to be nailed through.

There is also plenty of scope to improve upon the old-fashioned chandeliers and wall brackets which are still to be seen in our towns; and in fitting up new buildings, care should be taken to have these of good quality, and not altogether devoid of ornamentation, for they can be substantial as well as artistic, and are obtainable at very reasonable prices. With such a great variety of gas globes to select from, it is a difficult task to say which is best; but only those with large openings at the bottom should be recommended. Globes with narrow openings cause the light to flicker; and it would be well if these objectionable things were abolished. It is a mistake to have deeply tinted or painted globes, which often obstruct from 10 to 50 per cent. of the light. I prefer those which are nearly clear, though it is somewhat fashionable now-a-days, where the maximum of light is not the chief object in view, to have them deeply tinted. Of burners there are all sorts and conditions. Those of a corrodible material should never be used; yet it is strange that the "burner man," who still pays periodical visits to many of our towns, can find a ready sale for these antiquities, at very remunerative prices. I have known people pay 6d. to these men for the commonest burner imaginable; and, on account of the cost, prefer to use it in preference to a good governor burner given to them gratis. I strongly recommend the governor type, and always recommend burners of the best quality. I have found it a good policy to give samples away to any customer applying for them, as well as small boiling-stoves, and to send a fitter to fix them, and to attend to any little defect, free of charge. These little services tend to create a spirit of contentment amongst consumers, and cannot fail to do good.

There can be no doubt that the time has come for gas companies to take a greater interest in the distribution of gas beyond the meter, and those who do so will doubtless benefit both themselves and their consumers; and, with this object in view, at Newmarket we have decided to undertake the whole of the distribution from the meter to the point of consumption.

In conclusion, it is needless for me to say that I have not touched upon many of the details and little defects which are inseparably connected with this broad subject. But I do say that it deserves more attention than it usually gets; that we should exercise more supervision over consumers' fittings; and that we should no longer hesitate about tackling, in a systematic manner, what has been termed the greatest "bugbear" we have to contend against in the way of selling gas.

Discussion.

Mr. W. DUESBURY said he was very pleased indeed with the paper; and there was a great deal of truth in most of the remarks made by the author. There was no doubt that it was a part of the duty of many gas companies to look after the internal fittings; but the one which he represented had rather neglected this matter in the past. They had, however, been going into it during the last year or two; but they had not fixed the sizes of the pipes to be used. He knew of one company that had defined a system of the kind mentioned in the paper; and it had worked very well, both for the consumers and the company. They had a certain size of pipe for a given number of lights; and they had authorized fitters. They compelled the fitters, before they authorized them, to say that they would keep to the rules, and anyone found disobeying them was not allowed to do fitting afterwards. He thought they might do more than had hitherto been done. They found that fitters and plumbers would sometimes interfere with the meters—would disconnect them, and so on; and this was a thing that no company should permit. Companies and corporations supplying gas should have the control of the pipes up to the meter; and to a certain extent up to the point of combustion.

Mr. BARRATT said he was apprenticed to this particular business; and he had had considerable experience in it. He was very pleased that a member of the Association had taken up the subject; but there were a good many more things to be said in connection with it. In the first place, with regard to the specification drawn up by their Scotch brethren, he should like to ask what was the initial pressure given, because if they took a $\frac{3}{4}$ -inch pipe up to a meter where they had a 2-inch pressure, the pipe was bound to deliver more gas than it would do if they had only 1, $1\frac{1}{4}$, or $1\frac{1}{2}$ inch pressure. It followed, therefore, that they must themselves decide what ought to be done in each individual case; and to do this, they must know the pressure given both day and night. At Accrington, where he was before he went to Grantham, they possessed certain power in this matter; but they had infinite trouble before they could enforce it. A scale was drawn out in conjunction with one or two of the leading plumbers and gas-fitters of the place; and this was perhaps the best thing for a company to do. They not only gave the pressure in certain localities, but he fixed the sizes of the pipes that were to be used for a certain number of lights, and their weights per yard or foot as the case might be (they had there the supply

of both gas and water). He also specified the kind of "back-knee" that was to be used. In the next place, he positively refused to allow a joint to be made with a copper-bit; and he maintained that, if they wished their gas-fitting done properly, all the joints should be made with a blowpipe. If they had no power in the matter of fittings, it was not much use having a scale, because the jerry builders would simply laugh at it. In Lancashire, where he was, a number of gas-fitters and plumbers were constantly kept going; and they had frequently large mills to supply with 1000 lights. They wrote out specifications for the mills and houses; and consequently everyone of them knew what he was going to tender for. The result was that more gas was consumed; and very few complaints were received at the office. In Grantham, he had a whole street in which the houses were supplied with three or four lights; and they had only $\frac{1}{4}$ -inch pipes fitted. In consequence of this, they had more complaints from that street—by, he should think, five times over—than from any other. He told the landlords it was an utter impossibility for the tenants to have a proper supply of gas; and he had since put in $\frac{1}{2}$ and $\frac{3}{4}$ inch pipes and three or four light meters, with very beneficial results.

Mr. WIMHURST said this question of fittings was one that he had taken a deep interest in for a long time past. In Sleaford his Company did the greater part of the fitting—at any rate, he might venture to say that they did 90 per cent. of it. In order to give the members an idea of what they had accomplished, he had culled a few figures from their accounts. The Company took up fitting work some 19 years ago; previously it had been done by local fitters. During the period mentioned, they had received for fitting no less a sum (for a small town of 5000 inhabitants) than £3346 5s. 3d.; and the expenditure had amounted to £2845 19s. 7d.—giving them a net profit of £500 5s. 8d., or an average of £26 6s. 7d. per annum. He believed the members would all agree with him that this was not an excessive profit, when it was remembered that they had to keep a stock of fittings of the value of £200. He had no doubt that the way in which they had done the work had to a large extent been the means of increasing the consumption of gas from 8 to 15 million cubic feet; and in the same period, the price of gas had been reduced from 6s. 5d. to 3s. 4½d. During the past eleven years, they had let out fittings; and there were now between 60 and 70 cooking-stoves on hire, but not many heating-stoves. The total rental received for these stoves had been £170 14s. 6d.; or an average of £15 10s. 5d. per annum. Besides, the stoves had largely increased the summer consumption of gas; and many consumers not only used them in the summer months, but during the winter as well. Regarding the kind of pipes to be used, he quite agreed with Mr. Troughton that iron pipes should be fixed where practicable. There were cases in which they were bound to put in composition piping; but if the sizes that Mr. Troughton had quoted were adopted by the consumers, it would be very advantageous both to them and to gas companies. He might say that in his own case he generally recommended the fixing of these sizes of pipes as near as possible. There was one thing he should like to suggest with regard to a remark made by Mr. Barratt as to the pressure. He (Mr. Wimhurst) took it that, when the North British Association framed their rules, they had the idea of decreasing the pressure, and thus save leakage. As to burners, he quite agreed that no burner should be employed except a governor; and respecting globes, he had a great preference for the opal "Comet" globe. These globes gave general satisfaction in Sleaford; and they had a large number in use.

Mr. J. CARTER remarked that a few years ago, gas managers would have felt so secure in their position that, so long as they attended in a more or less perfunctory manner to putting in services and meters, they would have had little care afterwards as to what became of the consumer, so long as he paid his accounts regularly and did not make complaints. He took it that the additional interest which was now being shown in the consumers was an indication of the good that had been done by the actual and threatened competition of the last few years. One of the good results which the increasing use of oil and the threatened rivalry of the electric light had produced had been to create in gas managers an interest in the question of gas lighting, and perhaps a keener desire to see the gas more satisfactorily supplied, not only to the meter but to the point of combustion. He congratulated Mr. Troughton upon having what he presumed was the exceptional legal authority of refusing to fix a meter where the outlets did not meet with his approval; and he questioned whether many of the members were in that favourable position. The suggestion that gas managers should attend to the internal fittings was not made, if he understood rightly, so much for the profit that would be derived from the work, as to avoid subsequent complaints (which were often very numerous) arising from insufficient and inadequate fittings. If it could be done, this was the only way to avoid or minimize the complaints. The author's recommendations were such that they were applicable to some localities; while for others, they were not at all suitable. In a number of towns, the architects and plumbers were quite willing to carry out their work in harmony and in accordance with the wishes of the local gas manager. Where a feeling like this existed, it seemed to him that it would be altogether beyond the proper duties of a gas company to interfere with the internal fittings; and, in such a case, the first reason given by Mr. Troughton would not apply. Then

he suggested the prepayment system as a means of increasing the number of consumers. In some towns that would also apply; while in others it would not. In Lincoln, for instance, it would not. If he were to adopt Mr. Valon's method, he did not believe it would increase the number of consumers by 25 in the course of twelve months, as it was a custom with them not to build an artisan's or a factoryman's house without putting in fittings. Mr. Wilmhurst agreed with Mr. Troughton that only iron pipes should be used for internal fittings. One of the advantages of a paper of this kind was that it brought out differences of opinion. Now, if it was left to his (Mr. Carter's) decision, he would say that not a single foot of iron pipe ought to be put in a house; and if he was fitting a house for himself, he should take care that a foot was not used.

Mr. W. J. BEST (St. Ives) on the whole endorsed what Mr. Troughton had stated in his paper. There was no doubt, he said, that in many towns there were good gas-fitters; and at St. Ives they had one who, when he had to put in new pipes, invariably arranged the sizes with him. In many cases, when small cottage houses were being erected, the builder required the fitting done as cheaply as possible; and the result was that it was let out to tinmen or ironmongers. These people competed one against the other; and the result was they would do the work at a low price, and put in material of inferior quality. In many towns that he knew of, where the companies had taken up the fitting, it had been followed by very satisfactory results. Now that regenerative lamps had been introduced, he thought a little more attention should be paid to the question of pressure; and lamps of this class which were used for domestic lighting should be regulated by governors. In the case of the Bower, the Wenham, the Deimel, and other similar lamps, if the illuminating power of the gas was increased a little, they would at once begin to smoke; but this would be to a great extent prevented if they were properly governed.

Mr. TROUGHTON, in replying on the discussion, said he was much obliged to the members for the manner in which they had dealt with the paper. Mr. Duesbury had referred to fitters being authorized; but this, he thought, was hardly practicable in towns where there were only one or two. Then Mr. Barratt had said something about the relation of the pressure to the sizes of pipes he had given. He could not say what pressure Scotch gas managers gave; but he could say that the scale of sizes applied very well at Newmarket, where they gave a pressure of about 15-10ths in the day time, and 25-10ths at night. His works were situated on a hill; so that they had to force the gas down to the town. He thought they were all practically unanimous that something should be done with regard to the sizes of the fittings from the meters. He purposely left out the question of chandeliers, brackets, and burners, as on these they all had their own individual opinions. Mr. Carter had said something in regard to the legality of refusing to fix a meter when the pipes did not meet with approval; but he evidently misunderstood him, as they had no legal powers of that kind at Newmarket.

The PRESIDENT observed that they had had a very interesting discussion, and a somewhat valuable paper; and he proposed that the thanks of the meeting be accorded to Mr. Troughton.

This was cordially agreed to; and Mr. TROUGHTON briefly acknowledged the compliment.

PLACE OF NEXT MEETING.

The next business was to fix the place at which to hold the autumnal meeting.

The SECRETARY announced that they had received an invitation to Lowestoft from their friend, Mr. J. Ayris, who stated that he would do his best to make the meeting a success. He had therefore much pleasure in moving that the next meeting be held in that town.

Mr. A. J. YORSTON (Ely) seconded the motion, which was unanimously carried.

This concluded the general business; and later in the afternoon, the members and several friends dined together at the Bristol Arms Hotel.

Increase in the Price of Gas at Derby.—The Derby Gas Company give notice of an increase in the price of gas of 3d. per 1000 cubic feet.

Australasian Gas Association, Limited.—The Directors of this Association have declared an interim dividend of 7 per cent. per annum, free of income-tax, for the half year ending Dec. 31 last.

Sales of Shares.—At the Auction Mart, Tokenhouse Yard, last Wednesday, Messrs. Fox and Bousfield sold by auction a portion of a King's share and twelve new fully-paid £100 shares in the *New River Company*. The former was divided into nine lots, each consisting of the 120th part of an entire share; and of these three lots sold at £700 each, four at £690, and two at £670. The new shares were disposed of at £332 each.—On Monday evening last week, Mr. T. Bray sold at Pudsey, £70 of 10 per cent. stock of the *Drighlington and Gildersome Gas Company* for £126; £25 of similar stock, for £43 11s. 6d.; two 7 per cent. shares (£9 paid), for £13 4s. each, and one for £13 3s.—At a sale by auction at Camborne last Wednesday, five fully-paid shares in the *Camborne Gas Company* realized £5 5s. each, and five others produced £5 6s.—Mr. C. E. Taylor offered for sale at Shipley last Thursday £5000 of new ordinary 7 per cent. stock in the *Shipley Gas Company*. There was a large attendance, and the bidding was spirited. The shares were offered in £100 lots, and found ready purchasers at prices varying from £154 to £157.

THE FOURNESS PROCESS OF GAS MAKING.

Reference has already been made in the JOURNAL to the system of gas manufacture devised by Mr. H. Fourness, of Manchester; and in the number for Jan. 26 last (p. 159), we gave an illustrated description of the plant, abridged from the specification of the patent. The process has been reported upon by Mr. D. Fulton, Assoc. M. Inst. C. E.; and a few extracts from his report may be of interest, now that the question of establishing auxiliary water-gas appliances in gas-works is occupying the attention of managers.

The apparatus consists of a water-gas producer, with an oil vessel and syphon at the top for carburetting the water gas; the top of the producer being connected by tubing to three retorts, heated partly by the producer gas, but chiefly by a furnace at the foot of the brick setting containing the retorts. A small oil-supply pipe passes through the front of each retort; the oil flowing through a syphon leg from a supply-tank, and being carried by an extension of the pipe for a short distance along the interior of the retort. In making gas with this apparatus, the producer is filled with coke or other suitable broken material, and the furnace then lit and blown up until the coke becomes incandescent; the producer gas evolved helping to heat the retorts. The air-blast is then stopped; and steam from a suitable generator is sent into the lower part of the coke, in rising through which it becomes decomposed into water gas. Crude petroleum or other heavy and cheap oil is fed into the upper part of the producer, and is vaporized by the hot coke so as to mingle with the ascending gas. The mixture of water gas and heavy oil gas then passes from the top of the producer to the heated retorts; and at the same time a secondary supply of lighter oil enters at the front, and, becoming vaporized, further enriches the mixture from the producer. The enriched gas becomes fixed in the heated retorts, and then passes to the holder either directly or through purifiers, if these should be thought necessary. A special feature of the apparatus is the facilities afforded for preventing explosions in the producer and adjacent parts, which are not infrequent in carburetting appliances worked by heat. They usually occur when, the coke having become too cold to further decompose the steam, it is necessary to blow it again into a state of incandescence. The consequence of the sudden admission of air to the producer is to form an explosive mixture, which is quickly fired by the coke, and explodes, sometimes with disastrous effects. In the Fourness apparatus, when the coke is becoming too cold, the admission of the heavy oil at the top of the producer is first cut off. The admission of steam and the evolution of water gas, however, still go on, with the result that the water gas, in passing to the retorts, carries away from the producer all remaining traces of the heavy oil, or at least so reduces the quantity present that the dangerous or explosive elements are entirely removed from the producer. This passage of pure water gas into the retorts and holder would seriously impair the illuminating power of the gas, were it not that, in flowing through the retorts, the water gas picks up from the lighter oil, which is admitted to the front of the retort, sufficient oil vapour to maintain its illuminating power. But for the auxiliary oil-feed, this cleansing of the explosive vapours from the producer would hardly be practicable without considerable waste. With regard to the apparatus itself, Mr. Fulton says that, in its main features, there is nothing *per se* novel, except in matters of detail. What he considers to be novel—and what Mr. Fourness claims—consists broadly in the particular combination of parts he uses, and especially in the secondary oil-feeding tubes at the front of the retorts. Mr. Fulton inspected patent records extending over the last twenty years, and failed to find a specification which directly anticipates Mr. Fourness. He could not discover any patent in which an attempt was made to further enrich carburetted water gas by the additional vaporizing of finer oils in a heated retort, as in the Fourness apparatus.

Dr. C. A. Burghardt has lately inspected the plant on two occasions, and has expressed himself pleased with its simplicity and efficiency. On the second visit, he carried out a thorough test of it, as also of the illuminating power of the gas made thereby, and of the quality of the residual products. He says that he found the gas to be perfectly permanent, and of 21.5-candle power. The liquor resulting from the process consisted of very little tar, containing about 1½ per cent. of benzol. He is confident that no difficulty will be found in making with the apparatus gas of at least 22-candle power with 3½ gallons of oil per 1000 cubic feet; and this quantity of gas could, he believes, be produced at the cost of about 1s. Of course, the gas manufactured by the Fourness process has to be purified like ordinary coal gas.

The Fatal Gas Explosion at Blackburn.—At the Manchester Assizes, last Wednesday, the Grand Jury threw out the bill in the case of Mark Robinson and Francis Robinson, indicted for the manslaughter of Eleanor Buckley, at Blackburn, on Nov. 30 last. It will be remembered that, by removing a large gas-meter in the cellar of the Crown Hotel in Blackburn, the accused caused a serious escape of gas; and by the explosion which followed, the house was wrecked, and Mrs. Buckley and other persons were killed and several were injured.

REGISTER OF PATENTS.

In future the prices of the specifications will be omitted, as a uniform charge of 8d. each has been adopted by the Patent Office. Copies of specifications will be supplied from the Sale Branch, 38, Cursitor Street, Chancery Lane; or through the post by means of a form of application purchasable for the above amount at the principal Post Offices in the United Kingdom.

Governing Gas-Engines.—Griffin, S., of Bath. No. 4535; March 13, 1891.

This invention relates to means for governing the supply of working charges to the motor cylinder of gas-engines, as also the discharge of the exhaust gases from the cylinder; and it has special reference to the arrangement described in patent No. 19,962 of 1890.

The inlet and exhaust valves (advantageously of the mitre type) are arranged either in one casing or separately; being connected with the motor cylinder and actuated by suitable cams and levers or other devices in any convenient manner. The valves are held down on their seatings by springs of sufficient strength to resist any partial vacuum that may be formed by the action of the piston in the motor cylinder; and they are simultaneously thrown into and out of gear with the cams and levers, or other device which actuates them, by means of suitable mechanism actuated by the governors. The admission of combustible gas for forming the working charge is advantageously controlled by the inlet-valve, for which purpose, according to one arrangement, any number of small holes are made on the seating of the inlet-valve, and in communication with the gas supply. The supply of both air and gas are thus simultaneously controlled by the valve.

The operation is as follows: When the engine is running at or below its normal speed, the mechanism in connection with the governor holds the inlet or exhaust valves in gear with the cams and levers or other device, so that the necessary motion for controlling the inlet of the charge of gas and air, as well as the exhaust, is given them. When the normal speed of the engine is exceeded, the governor will interrupt the action of the valves, which will now remain stationary on their seatings, and so prevent ingress or egress of gas or air until the normal velocity of the engine is again reached. It will thus be obvious that, during the light running of the engine, the negative work of continuously charging and exhausting the motor cylinder with air (as is usual) is entirely avoided; considerable gain in economy and power being the result, and also saving in wear and tear.

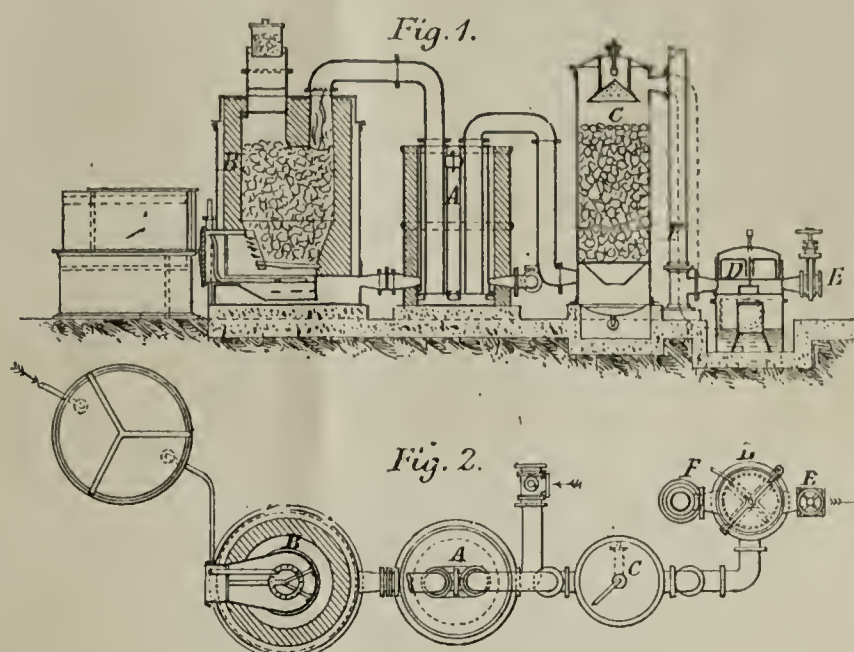
Ignition Apparatus for Gas-Engines.—Cooper, E. W., of Coventry. No. 4771; March 17, 1891.

According to this invention, instead of the ordinary ignition-tube, a "nozzle" is provided of any suitable material and shape, having a passage running from its base upwards, or to the part to be heated, and then turning back again, or being conducted away from the deleterious action of the gas-jet, and terminating in, or forming, a suitable chamber of sufficient capacity to hold the incombustible gas or gases. Such a chamber may form part of the nozzle, or may be made separately, and attached to it by any suitable means. This arrangement of igniter, it is claimed, will ensure the reduction to a minimum of the part affected by the gas-jet, and at the same time facilitate the disposal of the "dead" gases. Greater duration of the life of the igniter, and more certain ignition—in other words, economy and efficiency—are also claimed for it.

Gas-Generators for Motor Engines.—Boult, A. J.; communicated from the Compagnie des Fonderies et Forges de l'Horme and A. Lencauchez, of Paris. No. 4798; March 17, 1891.

Gas motors, it is remarked in the specification of this invention, have at the present time attained a very high degree of perfection; deriving, as they do, a much greater amount of motive power from a unit of heat than the best steam-engines. Hitherto, however, gas-engines have more frequently been operated by gas obtained by the distillation of "gas coal," than by other combustible gases, capable, when mixed with atmospheric air, of forming the required explosive. Such ordinary lighting gas, while it is convenient enough in cities, where it can readily be procured, becomes very expensive where a sufficient supply is required for powerful engines, and is to be paid for at the usual rates, while outside a certain radius no gas is obtainable at all. "It is therefore of the greatest importance that both excessive costliness and scarcity of ordinary gas should be provided against by the discovery of a suitable substitute for the same." It has long been a well-known fact that the gas yielded by existing works, becomes capable of feeding motor engines the moment its calorific power exceeds 1200 units of heat per cubic metre; and as, in practice, it is possible, by means of good apparatus, to produce 1300 and even 1350 units of heat with the worst fuel, and as many as 1500 units with choice fuel, it is desirable that gas generators should be so constructed as to supply as rich gas as possible. For this purpose, the patentees have devised certain novel devices and combinations, the most important of which are described by them with the aid of the accompanying diagram—a vertical section and a plan of the proposed plant.

Air, after passing through a small regulating valve or dome, is caused to enter a superheater A. This is a tubular apparatus, in which the hot-air tubes may or may not be provided with wings, according to the importance of the generator B. It receives the heat from the gas (which issues from the generator at a temperature of about 600° to 800° C.) before such gas passes into the lixiviating or purifying apparatus C. In passing through the superheater, the gas therefore yields part of its available heat to the air-blast, thereby warming it to a temperature of about 200° to 300° C. From the superheater, the air (after being thus heated) enters the hollow base of a special arrangement presently to be described, upon which is erected the generator. This base is filled with hot water supplied from the cylinder of the engine. By coming into contact with this water, the air becomes saturated with it and superheated, whereupon it flows through the generator B, and is converted into rich gas. The gas thus produced passes on into the superheater A, and then into the purifier C. This latter apparatus consists of a column of coke moistened by a continuous



shower of cooled water. The coke it contains should be finer the nearer it is to its top. This purifying apparatus is provided with a perforated conical distributor, arranged to spread water evenly all over the filtering surface. Similarly to what takes place in an ordinary apparatus of this kind, the water and gas move respectively in opposite directions, whereby thorough lixiviation and a gradual and methodical cooling are ensured. From this purifier the gas escapes into a distributor D, provided with a valve or trap, which enables the required amount of gas to be supplied to a gasholder through a sluice-valve E, or discharged into a chimney F during the short periods of lighting and cleaning. This gas feeder may be replaced, if desired, by valves or any apparatus adapted to reverse the course of the gas.

The characteristic features of a gas plant for motor engines such as is here sketched out are as follows: (1) The means employed for saturating the air under pressure with steam and superheating it. (2) The means employed for supplying the generator with gas under pressure, so as to store up gas for the renewal of the operation after the period of rest, or when the grate loses somewhat its brightness, as it is apt to do from time to time in consequence of the cooling which results from the decomposition of the steam or through any other cause. (3) The means employed for controlling the air-blast.

In regard to the first of these three features, it will be seen that the gas generator proper B is erected upon a hollow base containing the ash-pit. This base forms around the ash-pan an annular basin or jacket, the water-level in which is kept constant by a suitable overflow cock or valve. The water, being discharged from the cylinder of the engine (and the temperature of which is about 65° C.), is first conducted by a pipe to the upper part of the grate within which is a head-piece forming a distributing reservoir, from which it subsequently flows in the condition of spray into the ash-pan, after having cooled the metallic portions of the grate. The hot water falling into the ash-pan passes through openings in the latter into the annular jacket. In this jacket the air under pressure, having already been heated by contact with the heater A, is introduced into a conduit; and as it flows in contact with the surface of the heated water contained in the jacket, the air becomes saturated with the water and superheated. The mixture of hot air and superheated steam which passes through the generator in so doing, is converted into combustible gas rich in hydrogen.

Turning to the second feature above mentioned, it sometimes happens that, in consequence of the units of heat necessary for the decomposition of the mixture of steam and air being consumed, the grate is found to lose its brightness to a certain extent. To enable it to recover this brightness, and to make the fuel in this part of the furnace red-hot throughout, a gas coil or ring-burner is arranged so as to receive gas under a pressure higher than that of the gasholder or that of the blast underneath the grate. This ring is then lighted and instantly develops heat capable of rendering the grate and fuel incandescent in a few minutes, without stopping either the supply of air or the operation of the engine. In order to feed the ring or coil with gas, there is arranged at G a small storage holder similar to one used in laboratories, which is besides surmounted by a vessel which may be filled with any desired quantity of water and evacuated wholly or partly by means of suitable cocks. When this vessel is emptied, gas from the gasholder is introduced into it, which, upon raising the dome, fills the apparatus. When it is filled with combustible gas, the gas-inlet cock, is turned off and the water-inlet cock is opened. Water will then fill the vessel, and the dome be charged to a higher degree of pressure than that existing in the main holder. The dome or auxiliary holder being thus charged, the cock of the ring or coil is turned on, and the gas lighted underneath the grate, so as to keep up the red heat, and accelerate the production of operative gas in the generator B. When the operation has been stopped for a certain time, the filling of the secondary gasholder G may be repeated, if necessary, two or three times, in order to supply the gas for brightening up the grate of the generator.

Referring to the third point, the means used for controlling the supply of air under pressure consist of a dome provided with window-like apertures, and adjustable by means of a rod in a tube or sleeve, which forms a branch of the main-pipe. By raising this dome, one or more of the apertures are exposed, thereby enabling the air-blast to pass through; its pressure by these means being regulated to any desired extent.

Manufacturing Illuminating Gas.—Munns, W. H.; communicated from E. De Beauharnais, of New Bedford (Mass.), U.S.A. No. 5212; March 24, 1891.

The claim for this invention is for a process of manufacturing illuminating gas, which consists in treating petroleum by passing it through wood-ashes and ground corn-cobs, highly heating the oil so

treated, together with water, steam, and air, in a retort, and passing the resulting gases through a filtrant saturated with refined petroleum.

In the words of the patentee: In the practice of my invention, I first take a quantity of crude petroleum, and treat it with a vegetable compound consisting of ground corn-cobs mixed with a small quantity of ashes made from the wood and bark of the white-ash tree. Thus, for example, take one bushel of ground corn-cobs, and place it in a hollow perforated copper cylinder or receptacle made of wire or of thin copper sheets finely perforated. This retaining cylinder is set in a second cylinder or receptacle made of wood. To each bushel of prepared cobs, I add not more than one pint of the ashes, spreading it on the top of the cobs. A concave perforated cover is placed on the top of the retaining cylinder; and into the cover the crude petroleum is thrown and allowed to drip down through the perforations on to the compound below. About one bushel of cobs is sufficient to treat one barrel of petroleum. To get good results, the oil should be left in contact with the compound about 24 hours. Just what the chemical effect of this treatment is, I have not been able to determine; but I do know that the result of the treatment is a very superior illuminating gas. The crude petroleum having been treated as aforesaid and mixed with rain water, the operation of mixing the gas is as follows: After the fire has been laid, and the retort brought up to the required temperature—say, 1500° Fahr.—heated air is admitted through a tube, and the prepared petroleum and rain water are passed in by means of other tubes; and the steam generated outside of the retort is introduced through another tube. These ingredients are converted into gas in the retort, whence it is led into the reservoir. In one limb of the retort, is a return-tube; and the gas is therein superheated before it escapes to the reservoir. The water and petroleum are converted into steam and hydrocarbon vapour in the one limb of the retort, and there combined; and the steam generated outside of the retort is introduced into the opposite end of the other limb, and projected towards the outlet; so that while at the same time the gas is generated, mingled, and combined, it is accelerated in its passage from the retort by the current. In this connection I desire to state that, by repeated tests, I have ascertained that, by introducing water and steam into the retort along with the petroleum, as above described, instead of introducing steam alone, a large quantity of fixed gas of superior quality is produced. In this operation, a part of the waste heat is utilized in converting water into steam. A portion of this steam is forced into the retort through a tube; and part is utilized in working the piston supplying power to the blower, which is employed in forcing heated air through one of the tubes, and for increasing the draught of the furnace, if that be desired, in any ordinary way. After the gas has been thus generated and collected into the reservoir, it is passed through a tank containing the refined petroleum and sponges, by which it is greatly enriched; and all foreign particles are removed from it before it passes into the burners and by which the clogging and choking of the burners is avoided. When the gas is to be employed for any ordinary illuminating or heating purposes, it is not desirable to highly charge it with hydrocarbon, as above explained; and in that case the sponge-box already described is employed merely to free the gas of foreign particles floating in it—the sponges in that case not being saturated with oil, in which case the clogging or choking of the burners is prevented, and a gas is produced which will not emit sparks in burning. In the manufacture of illuminating gas from the ingredients, and in the manner above described, an illuminating gas is produced that, for all practical purposes in the use of such gas, I have found to be non-explosive, non-asphyxiating, sanitary, and not even injurious to the life of delicate house-plants.

Gas-Engine Bags and their Valves.—Lanchester, F. W., of Bedford Row, London. No. 5226; March 24, 1891.

This invention—relating to improvements in the valve arrangements and other details of gas-bags for gas-engines—is intended to perfect the action of such bags so as "to obviate more completely than hitherto the fluctuations of pressure in the gas-pipes supplying gas-engines."

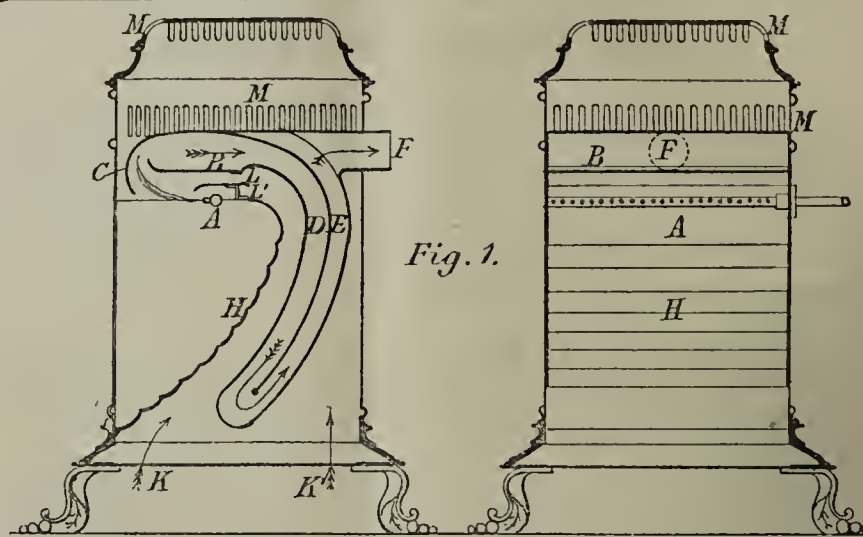
In one mode of carrying the invention into effect, a metal ring or cylinder (of considerable diameter compared with its length) is arranged with both sides closed with rubber or other diaphragms attached to the metal cylinder, which also carries the gas inlet and outlet pipes and has the two rubber sides forming the gas-bag. To the upper interior part of the metal ring or cylinder, stirrups or staples are attached, and from them are suspended strips of leather or other flexible material in such manner as to form a loop (double or treble) hanging towards or below the centre of the cylindrical bag. It is attached to the rubber sides, at or near the centre of the circle, by plates and rivets above the lower end of the suspended loop. In the opening leading into the gas-bag, a loose conical plug or valve is placed, constructed of light sheet metal or preferably of wood; and this is supported by a light rod resting in the end of the suspended loop, the end being attached by an eyelet, cord, or wire. The length of the rod is so proportioned that, when the flexible sides of the bag are flat, because of the absence of excess pressure of gas, the loop hangs in such a position that the valve allows very free access from the supply-pipe. If the suction from the engine causes the sides to bulge inwards, or become concave, the loop is in its most extended position, and the valve is full open. When the gas pressure distends the flexible sides, the loop is pulled up, and acts like a toggle linkage on the rod controlling the gas-inlet valve, and so closes it or diminishes the inlet area to a greater or less extent. The valve thus opens more or less as the bag requires more or less gas to supply it, as determined by the requirements of the engine.

Regenerative Gas-Stoves.—Siemens, F., of Queen Anne's Gate, Westminster. No. 5907; April 6, 1891.

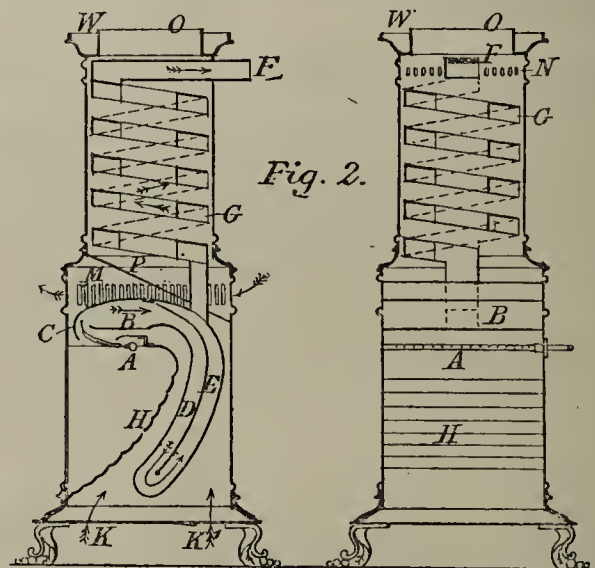
This invention relates to a regenerative gas-stove in which light and heat radiated from open gas-flames are reflected, and air is heated by contact with the surfaces of the reflector and passages for the products of combustion, part of this air going to supply the flames.

Fig. 1 shows vertical sections, at right angles to each other, of one form of the stove; fig. 2, similar sections of a stove with extended air-heating flue surface.

A is a horizontal gas-pipe, which may extend across the whole width



of the stove, and has projecting from it a number of small tubes forming a flame or a row of flames directed horizontally under a plate B. The products of combustion pass up in front of the edge of this plate, and behind a downwardly projecting flange C, which may either conceal the flames and prevent them being seen in front of the stove, or may be arranged with glass, ceramic material, or mica, to transmit more or less of the light. The products of combustion pass over the plate B, then descend a passage D, and ascend E, as indicated by the arrows, and proceed to a flue F, either directly as in fig. 1, or after passing through a helical flue G as shown in fig. 2. In front of the passages D E is fixed a concave reflector H, preferably of corrugated copper polished, so that light and heat radiated from the flames above are reflected by it into the apartment. Fresh air, entering by apertures K at the bottom, ascends within the stove, and becomes heated by contact with the external surfaces of the flue D, and the internal surface of the reflector H. The air thus heated passes through openings L L¹ to supply the flame on its upper side; the lower side of the flame receiving a supply of air more or less heated by ascending in front of the reflector. Fresh air also enters by apertures K¹ at the bottom, and, rising within the stove, becomes heated by contact with the flue E, and issues into the chamber through apertures M in the upper part of the stove.



In the form of stove shown in fig. 2, besides the air heated in the lower part, additional air, entering the upper part by some of the perforations M above a partition P, is heated by passing along the surface of the helical flue G; and it then issues, by apertures N or by an opening O, at the top of the stove. W is a trough for water to supply vapour for moistening the heated air; and a similar trough may be arranged in connection with the stove shown in fig. 1.

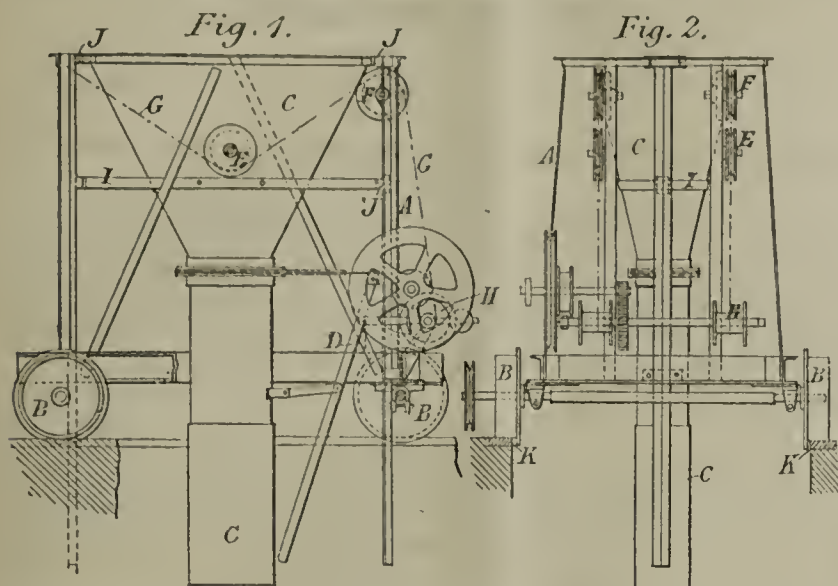
Retort-Charging Devices.—Hardman, J., and Peake, J., of Tunstall. No. 6159; April 10, 1891.

In carrying out this invention—which relates to a hopper adapted to travel on rails above the retorts, and capable of being raised or lowered according to the varying heights of the different retorts—the patentees construct a travelling framework, provided with flanged wheels to suit the rails; and in this framework the hopper is adapted to be raised or lowered, and is preferably carried between vertical V-shaped or other guides, which guide it in its up and down movement. Upon a suitable portion of the hopper are pulleys; and upon the framework, are preferably two chains, each secured at one end to the framework, and adapted to pass round pulleys to a winch apparatus upon the framework, so that by winding up or unwinding the chains, the hopper will be raised or lowered.

The engraving shows a side and end elevation of the arrangement in question.

A is a rigid frame, the lower portion of which is formed of channel-irons at its sides and angle-irons at its ends. It is mounted on wheels or rollers B; and the upper part is also formed of angle-iron, and secured to the lower part by angle-iron standards, the tie-bars (one at each side of the frame) also serving to stiffen the structure.

There are vertical angle-iron guides secured to the upper and lower frames by blocks or shoes; and these extend down below the frame. C is the hopper, the lower part of which may be circular or (as shown) with parallel sides and semi-circular ends; and the upper conical part at its mouth is surrounded by an angle-iron frame. A slide or valve is provided at the junction of the upper and lower parts of the hopper, operated by a lever D, pivoted to a bracket secured to the lower part of the hopper. E are two pulleys mounted one on each side of the upper part of the hopper; and F are two similar pulleys on brackets secured to frame A. G are two chains, each fastened at one end to one of the standards, and each of which passes under one of the pulleys E, and over one of the pulleys F, and thence to one of the drums H of the



winch apparatus, both drums being secured on the same shaft. A wheel is provided, round which passes an endless rope or chain for operating the winch apparatus; and a similar wheel receives the rope or chain by which the whole apparatus may be moved from place to place by causing the rotation of the wheels or rollers B. I is a band secured to the taper part of the hopper C; and at its ends, it is provided with blocks J, which work in the angle-iron guides; similar blocks J being fitted to the ring at the upper part of the hopper C. There is a brake-lever on the winch apparatus, by which the descent of the hopper may be checked at any desired part.

Gas-Burners.—Röher, R., of Tena, Germany. No. 9442; June 3, 1891.

This invention relates to improvements in gas-burners whereby, whenever the inflow of gas is increased or reduced, a corresponding increase or reduction is effected in the inflow of air; while in the case of burners having several jets, the number of jets which are required to burn can be determined by merely turning the base of the device. The invention is described as applied to a Bunsen burner; but it is likewise applicable to any sort of burner.

The base of the burner is provided with a plug furnished with four openings, serving to supply the various jets with gas and air. Upon the plug is mounted a casing, divided by a partition into three gas chambers below, and an equal number of air chambers above. Three tubes or inner burners are screwed in the top casing, and communicate with the gas and air chambers. Each air chamber has two air-inlets, which can be more or less opened and closed by a circular valve, furnished with corresponding openings, and with three teeth upon its outer periphery, gearing with a toothed segment arranged at the upper part of the gas-inlet tube. These three teeth act as stops to prevent the plug in the inlet tube from being turned on too far. Thus, at the same time as the inflow of gas is regulated, the opening of the air-inlet is also correspondingly regulated; and owing to each flame having its own air chamber, the introduction of air from the unused or closed burner is prevented. The air chambers are closed at the top by a suitable cover.

Non-Regenerative Gas-Lamps.—Harrison, T. B., and Hudson, G. W. S., of Armley, near Leeds. No. 14,961; Sept. 4, 1891.

The patentees, in their specification, point out that in non-regenerative gas-lamps the burners are usually arranged around a bulb or chamber, from which they derive the gas at about 45° from the vertical; the heat from the burners ascending and striking upon the under edge or surface of a superposed basin-shaped dome or deflector. According to their "improvements," above the burners is a dome or deflector with a cover or canopy above, separated from it sufficiently to allow a passage for the escape of the products of combustion to a ventilating or exhaust shaft; a fan being arranged at the top of the ventilating opening for exhaust purposes. The deflector is of mushroom shape; having a turned-up rim or flange, and perforated for ventilating purposes, and likewise in order to prevent the formation of any carbon deposits thereon.

Another part of the "invention" consists in a special construction of joint for suspending such lamps in workshops, &c. The pipe union at its top end is provided with a swivelling joint, similar to a ball-and-socket joint, which allows considerable freedom of motion; the union at the lower end being provided with a pivot, which fits into a recess upon a bracket secured to woodwork, while other brackets are employed for holding the union at the required parts.

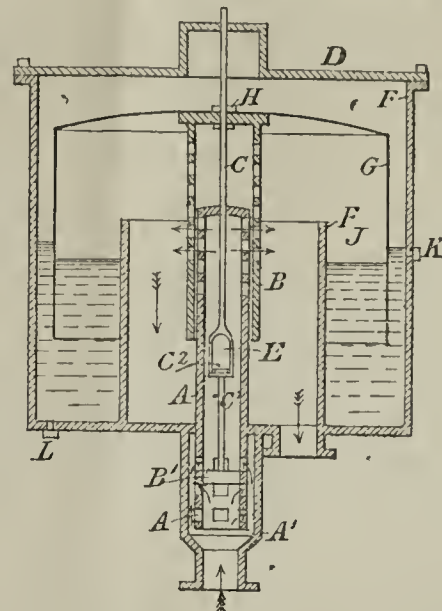
Gas-Pressure Regulator.—Fleischer, J., of Frankfort-on-the-Main, Germany. No. 16,326; Sept. 25, 1891.

The object of this invention is to construct a gas-regulator, in which the disadvantages accruing from the accidental sinking of the fluid level in the regulator, are obviated. These disadvantages, according to the patentee, are as follows: (1) Gas can escape into the room in which the regulator is standing; (2) the gas-flames are entirely or partially extinguished; (3) in the case of gas-motors, stoppage is often caused owing to the gas-feed being cut off; (4) the regulator fluid is often sucked out into the service.

In the engraving, F is the exterior casing of the regulator, into which the fluid is placed, and which is provided with the interior cylindrical part I and cover D. G is the regulator bell, having attached to it the perforated tube B, sliding on the interior perforated tube A, which is preferably cast in one piece with the outer regulator casing. The interior tube is provided at its lower end with perforations, while the lower end of the tube B is full. The two tubes A and B also vertically guide the regulator-bell. Inside A, a piston-valve B¹ is arranged to slide vertically by means of its rod C¹, jointed to the upper rod C, which is attached to the bell G. The two rods C C¹ are so joined as to allow a certain amount of play; C¹ being provided with a button C² embraced by the fork or stirrup E of the rod C, which

latter extends through the cover D. The bell may be weighted by means of weights H.

The apparatus works in the following manner: Gas enters at the inlet A¹, and passes in the direction of the arrows through the lower perforations of the tube A, rising therein, and passing out through the perforations of A and B into the interior of the bell G, and thence to the outlet. If now the pressure in G increases, the bell will be raised; and as the lower part of the tube B is not perforated, the gas-inlet will be gradually closed. The gas in the bell can be used up, however, to a certain small extent, without varying the inlet, owing to the play of the button C² in the stirrup E. This arrangement has the additional



advantage that sudden variations in the pressure in the service, and consequent jumping and bobbing of the gas-flames, are avoided. As soon, however, as the consumption of gas increases for any length of time, the bell sinks, and so increases the gas-inlets through the tubes A and B, owing to the depression of the piston B¹ opening up more of the lower perforations of A. This arrangement of the perforated tubes A and B and piston B¹ allows for a very sensitive regulation of the gas pressure.

Gas-Burners.—Bayley, H., of Walsall. No. 21,252; Dec. 5, 1891.

This invention relates to gas-burners for use alternatively for intermittent heating purposes and for lighting, such as are described in Lavender's patent, No. 2198 of 1890; and it has for its object an improved description of valve mechanism for use with such burners, and improved means for use in opening and keeping open the passage-way for gas when the burners are to be used for lighting. This arrangement consists of a weighted arm capable of being moved to opposite sides of its pivoted centre, with an arm fixed to turn therewith, and formed so that, when the weighted arm is turned over in one direction, the other arm operates to open the valve, and allow a full supply of gas to pass, and when turned back again the other arm allows the valve to close sufficiently to cut off the main flow of gas.

Valve Gear for Engines.—Miller, J. J., of Hammersmith. No. 21,529 Dec. 9, 1891.

This invention has reference to means for operating the exhaust-valves of gas and other engines having a multiple-stroke cycle. In one arrangement, suitable for an engine having a four-stroke cycle, the exhaust-valve is operated by a cam fixed on the crank-shaft of the engine, and formed with a cylindrical extension, around which and the cam proper extends an endless groove, into which takes a pin or one end of a rod or lever connected to, or arranged to work in conjunction with, the exhaust-valve. The arrangement is such that, during three successive half revolutions of the crank-shaft, the exhaust-valve will remain at rest; but during the fourth half revolution, or the greater part thereof, it will be held open by the action of the cam upon the pin, rod, or lever.

Manufacture of Gas.—Fairweather, W.; communicated from the Acme Liquid Fuel Company, of New York. No. 21,881; Dec. 15, 1891.

The object of this invention is to produce a fixed gas, for heating or illuminating purposes, from hydrocarbons, from hydrocarbons and water or steam, or from hydrocarbons and hydrogen, by apparatus which may be adapted to furnaces of ordinary construction, with but little, if any, modification, or which may be used in connection with the special form of furnace designed for the purpose.

Many attempts have been made, say the inventors, to produce a fixed gas from hydrocarbons, or from hydrocarbons and water or steam, by various processes and forms of apparatus; but, so far as is known, with only partial success. This want of success has resulted principally from defects in the apparatus employed and in the methods pursued. Under the Acme process, the gas may be formed from hydrocarbons alone, after which atmospheric air may be mingled therewith, if desired, in any known manner and in any desired quantity; or after the hydrocarbons have been converted into a fixed gas, and while superheated to a high degree, gas formed from highly-superheated steam may be mingled with such superheated hydrocarbon gas, thereby producing a gas possessing the necessary qualities for heating or illuminating, as may be desired. Or hydrogen, or a gas consisting largely of hydrogen, may be mingled with the vapour of the hydrocarbons, and be superheated therewith.

The purposes for which the gas is intended will govern to some extent the amount of steam employed in the process, or the quantity of hydrogen or atmospheric air used. When the gas is intended for heating, the bulk of steam product, of hydrogen, or of air, is increased or decreased as may be desired, as the greater the steam product or the hydrogen, the greater the heat produced; and the heat and light giving

qualities of the gas may be regulated in this manner by simply increasing or diminishing the proportion of steam, hydrogen, or air employed in its manufacture.

The process and apparatus for producing gas from hydrocarbons alone is first described in a lengthy specification, accompanied by four sheets of drawings; then the modification of the process and apparatus by which the gas is produced from hydrocarbons and water or steam; and then the modification of the process and apparatus by which hydrogen is mingled with the vapour of the hydrocarbons, and superheated therewith. There are no less than fifty "claims" for the invention.

APPLICATIONS FOR LETTERS PATENT.

- 3935.—LEWIS, J., "Regenerative gas-lamps." Feb. 29.
 3958.—JOHNSON, J., "Gas-burners." A communication from Hugh Kennedy. March 1.
 3964.—HEYDON, J., "Regulating the supply of gas to gas-engines." March 1.
 3973.—WHITE, D. D., "Automatically controlled gas-light extinguisher." March 1.
 3981.—ADDIE, J., and CUNINGHAM, J., "Treating blast-furnace, illuminating, and other gases, and spent lime and gas liquors, for the recovery of cyanides therefrom." March 1.
 3995.—BOULT, A. J., "Manufacture of fuel gas." A communication from the Chicago Heat Storage Company. March 1.
 4032.—OSBOURN, T. R., "Quenching coke." March 1.
 4041.—M'DOUGALL, J. S. and J. T., "Treating mineral oils or spirits to facilitate the manufacture of gas therefrom." March 1.
 4183.—DARWIN, H., "Gas heating-stoves." March 3.
 4189.—HAMILTON, J. H., "Gas motor engines." March 3.
 4206.—HOLLOWAY, J. E., "Regenerative gas-lamp or gas-burner." March 3.
 4210.—LANCHESTER, F. W., "Gas-engine details." March 3.
 4241.—FERRIE, P. D., and THIROUX, H. J. B., "Enriching ordinary gas by means of naphthalene." March 3.
 4369.—RUDD, J., "Combination economic gas-light." March 5.
 4374.—LANCHESTER, F. W., "Gas and petroleum engines." March 5.
 4465.—GRIFFITHS, W. B., and WOODLEY, J., "Pumping air, gas, and other fluids." March 7.
 4610.—PINKHAM, G. F., "Electric gas-lighting burners." March 8.
 4679.—SMITH, W. E., and M'MURTRIE, J. M'L., "Burning petroleum and other liquid hydrocarbons for heating and lighting purposes." March 9.
 4728.—MOELLER, J., "Making gas from oils, fatty substances, and other material." March 10.
 4736.—DOUGILL, J., "Gas motor engines." March 10.
 4855.—CLINCH-JONES, F. J., "Gas-engines." March 11.
 4907.—LEE, J., and LANCASTER, S., "Producing an atmospheric or Bunsen smokeless flame from liquid hydrocarbons as fuel." March 12.
 4922.—LEE, J., and LANCASTER, S., "Continuous manufacture of oil gas for domestic and general illuminating and heating purposes or for motive power." March 12.

The Eccup Reservoir of the Leeds Corporation.—The Water Committee of the Leeds Corporation last Tuesday paid a special visit to the works now in progress at the Eccup reservoir. The Engineer (Mr. T. Hewson) explained to the party that the trench had now been excavated to a depth of 164 feet for a distance of 426 feet; and he was of opinion that the Committee should inspect the bottom and works generally before commencing to replace the puddle. In pointing out the difficulties that had been met with, he stated that, from a depth of 100 feet to 120 feet, a huge wall of cement had been found running along the centre of, and in several places across, the puddle wall. The presence of this cement wall clearly indicated that the puddle-wall had been completely ruptured, and left with immense fissures in it, which had been filled with cement flowing into them from the bore-holes put down in a previous attempt made to cure the leak; and that, at a depth of 130 feet, there was found a hole some 2 feet square running right through the puddle-wall, which is 14 feet thick. The Committee then went down the trench, and minutely inspected the bottom from end to end, in addition to the trial-holes that had been sunk. On the inspection being completed, Mr. Hewson advised the Committee to strengthen their hands by taking the opinion of the most eminent Engineer available as to the propriety or otherwise of now replacing the puddle-wall; and they decided to consult Mr. G. H. Hill, M. Inst. C. E.

Stoppage of Water Supply through the Miners' Strike.—Owing to the withdrawal of all the men employed at the Durham Mines on the 12th inst., the day fixed for the commencement of the "play" time, the pumping-engines were stopped, and those towns which were dependent upon the mine water for domestic or manufacturing purposes were consequently brought within the prospect of a water famine. At Houghton-le-Spring, which is served from a feeder in the Houghton Colliery, and derives about 90,000 gallons of water a day from this source, the inhabitants found themselves suddenly deprived of it, and had to draw upon their reservoirs, the contents of which it was expected would not last beyond Thursday or Friday. Other sources had consequently to be resorted to. At Newbattle, Herrington, and Washington, the inhabitants were similarly inconvenienced. A wish was expressed by the agent of Lord Durham (Mr. Stobart), that the people around the Lambton Collieries should not be without water. An offer was made to the miners that they could, if they pleased, send their own enginemmen to keep the water supply going; but it was refused. A similar offer was made at Mr. Stobart's own colliery at Washington, with the same result. The Houghton-le-Spring Urban Sanitary Authority on the first day of the stoppage, to avoid the inconvenience that was likely to arise, wired to the Federation Board at Durham, asking that an engineman and fireman might be supplied to pump the water from the Houghton Colliery; but the reply simply was that it could not be allowed. The policy of withdrawing the enginemmen is unaccountable, and altogether unjustifiable, especially in view of the fact that diphtheria was prevalent in one of the places deprived of water.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

Regulating the Seal in, and Drawing the Tar from, Hydraulic Mains.

SIR,—In reply to the letter upon the above subject, signed "J. H.," in your issue of the 15th inst., I beg to submit that the illustration of the above, as given in your issue of the 8th inst., and that to which he refers as having appeared in the JOURNAL of Dec. 16, 1879, possess no features of similarity, excepting that in both the connecting-pipe is attached to the bottom of the "main," which is by no means new.

Paisley, March 19, 1892.

GEO. R. HISLOP.

SIR,—In your issue of the 8th inst. is a description of an invention by Mr. G. R. Hislop, of Paisley, for "regulating the seal in, and drawing off tar and liquor from, hydraulic mains." I now write simply to say we have several regulators exactly similar, even to some small details, now in use at these works, manufactured to my design, and fitted up by Messrs. Dempster some years ago.

Bath, March 19, 1892.

C. STAFFORD ELLERY.

The Standard of Light.

SIR,—The ideal standard of light, as a basis of photometric measurement, is one that should not have an uncontrollable variation of character. Consequently, any form of luminous effect, depending for its origin upon such variable agents as are the combustible or oxidizable elements (whether solid, gaseous, or liquid) and an oxidizing element such as air, that changes in volume, in temperature, and chemical constitution every minute, can never be an ideal standard of light.

The only form of luminous energy that can be considered to fulfil the ideal requirements, as a basis of photometric measurement, would be a standard electro-resistance filament *in vacuo*, such a filament to be raised to a condition of highly luminous incandescence by the passage of an electric current of a specific voltage, determined by comparison with the luminous energy of a sperm candle of a known weight, and consumed under as perfect a condition as the imperfect control of the variable elements will permit. A careful observation of the voltmeter during the photometric test would comprise the principal attention required to obtain a perfect standard of light. Where dynamo-electric energy is not available, a set of primary and secondary batteries of regular output may be employed.

Manchester, March 19, 1892.

B. H. THWAITE.

The Inclination of Foul Mains.

SIR,—I fail to see any point in the reply of Mr. Armitage to my letter on this subject. In the first place, he is not in a position to refute any argument or statement I may have advanced—not having seen the book mentioned, and having merely "referred" to the paper. Had he taken the trouble to read the latter, he would have found a distinct reference to improved illuminating power, and also a statement to the effect that I did not care to claim any originality. As a matter of fact, the whole thing, including the use of steam, or otherwise, is simply a carrying out of the suggestions published by Bowditch in 1867, which have formed the basis for a large number of hot condensers of various kinds. The fact that Mr. Armitage's arrangement was erected in 1882, has no bearing upon the forestalling of his published description; nor do I find that he has advanced anything in disproof of my remark as to the agreement between my views and his own.

Salisbury, March 17, 1892.

N. H. HUMPHRYS.

Coal Gas: Its Manufacture, Distribution, and Consumption.—A Correction.

SIR,—I was very pleased to notice, in your issue of the 8th inst., the commencement of a series of articles on the above subject. Being written specially for the use of gas students, in view of the approaching Examinations in Gas Manufacture, accuracy is the first essential. Therefore the writer will perhaps pardon me for drawing his attention to what will most likely prove to be a printer's error. In his table of the approximate proportions of carbon, &c., in combustible minerals, he gives the percentage composition of lignite as follows: Carbon, 39.601; hydrogen, 15; oxygen, 25.93. Assuming the chemical composition of lignite to be $C_{33}H_{15}O_9$, and taking the atomic weights of carbon, hydrogen, and oxygen to be equal to 12, 1, and 16 respectively, the quantities by weight of each element should be: Carbon, 71.35; hydrogen, 2.70; oxygen, 25.95. This agrees very fairly with the following analysis by Vaux of dry Bovey Tracey lignite: Carbon, 66.314; hydrogen, 5.627; oxygen, 22.861; nitrogen, 0.565; sulphur, 2.364; ash, 2.269. Another authority (whom I regret I cannot verify) gives the composition of lignite as carbon, 65.7; hydrogen, 5.3; oxygen, 29—comparing very favourably with the previous analysis.

March 15, 1892.

C. J. M. A.

[As will be seen by the note appended to the second instalment of the article, which appears elsewhere in the JOURNAL to-day, the errors pointed out by our correspondent had already been detected; and they would have been corrected last week had not the continuation of the article been unavoidably held over.—ED. J. G. L.]

East London Water Company.—At the forthcoming half-yearly general meeting of this Company the Directors will recommend a dividend at the rate of 8 per cent. per annum; leaving a balance of £12,566 to be carried forward.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress was made with Bills last week :—

Opposition withdrawn :

Ashton-under-Lyne, Stalybridge, and Dukinfield (District) Water Bill.

Liverpool United Gas Bill.

Southborough Local Board (Gas) Bill.

Bill committed : Llanbradach District and Aber Valley Water Bill.

Bills reported, with amendments : Bristol Gas Bill ; Kilmarnock Corporation Water Bill.

Petitions against the Llanbradach District and Aber Valley Water Bill were presented from Promoters of the Rhymney Valley Gas and Water Bill, the Pontypridd Water-Works Company, the Merthyr Tydfil Rural Sanitary Authority, and others.

HOUSE OF COMMONS.

Monday, March 14.

THE METROPOLITAN WATER COMMISSION.

Mr. RITCHIE said that perhaps the House would like to know the names of the Commissioners appointed on the Royal Commission to consider the question of the Metropolitan Water Supply. They were : Lord Balfour of Burleigh (Chairman), Sir George Barclay Bruce, C.E., Professor James Dewar, F.R.S., Sir Archibald Geikie, Mr. George Henry Hill, M. Inst. C. E., Mr. James Mansergh, M. Inst. C. E., and Dr. William Ogle, F.R.C.P. The terms of the reference were as follows : " Whether, taking into consideration the growth of the population of the Metropolis, and the districts within the limits of the Metropolitan Water Companies, and also the needs of the localities not supplied by any Metropolitan Company, but within the watersheds of the Thames and the Lea, the present sources of supply of these Companies are adequate in quantity and quality ; and, if inadequate, whether such supply as may be required can be obtained within the watersheds referred to, having due regard to the claims of the districts outside the Metropolis, but within those watersheds, or will have to be obtained outside the watersheds of the Thames and the Lea."

The following progress was made with Bills last week :—

Further Standing Orders complied with : Barry and Cadoxton Gas and Water Bill ; Mold Water Bill ; Stamford and St. Martin's Stamford Baron Gas Bill.

Bills read a second time and committed : Brynmawr and Abertillery Gas and Water Bill ; Southend Gas Bill.

Bills referred to a Select Committee consisting of Mr. Gurdon (Chairman), Mr. F. H. Evans, Mr. J. W. Sidebotham, and Mr. Hingley ; to meet on Thursday, March 24 : Barry and Cadoxton Gas and Water Bill, Brynmawr and Abertillery Gas and Water Bill, Exmouth and District Water Bill, Mold Water Bill, Pontypool Gas and Water Bill, Rhyl District Water Bill, Rhyl Improvement Commissioners Bill, Stamford and St. Martin's Stamford Baron Gas Bill.

Bills reported : Airdrie and Coatbridge Water Bill ; East Grinstead Gas and Water Bill.

Bill withdrawn : Pontypool Gas and Water Bill.

Petitions against the following Bills were withdrawn :—

Airdrie and Coatbridge Water Bill, from the Upper Ward District Committee of the County Council of Lanarkshire, and from Owners of lands and mills on Hilly Gill Burn and Culter Water.

Blackburn Corporation Bill, from the Lancashire County Council. Stamford and St. Martin's Stamford Baron Gas Bill, from the Guardians of the Stamford Union.

LEGAL INTELLIGENCE.

COUNTY OF LONDON ASSESSMENT SESSIONS.

Sessions House, Clerkenwell, E.C.—Saturday, March 12.

(Before Sir P. H. EDLIN, Q.C., Chairman, and a Bench of Magistrates.)

The Gaslight and Coke Company's Assessment Appeals.

To-day the parties interested in the above appeals were again in attendance at the Court, with the object of submitting the allocations of the respective rateable values among the various parishes, as arranged on the previous occasion (see *ante*, p. 398), and considering the question of costs.

The CHAIRMAN having inquired if any agreement had been come to,

The SOLICITOR-GENERAL said that the representatives of the appellants had supplied the respondents with a tabular statement [see next page] which showed the result of the judgment ; and though there were some small differences between them as regarded the figures worked out, they were so small that he was prepared to accept the valuations as made by the advisers of the Company.

Mr. LITTLER said that the Company had prepared a supplementary statement, showing each parish in the City of London Union ; and he asked his Lordship to correct each parish *seriatim*.

The SOLICITOR-GENERAL said he had appeared throughout the proceedings as Counsel for the City of London Union ; and the case all through had been treated as one.

The CHAIRMAN asked if a subdivision of the amount allocated to the City of London Union generally was necessary for the purpose of the present question, having regard to the fact that one rate of 4s. 11d. in the pound had been agreed upon throughout the Union.

The SOLICITOR-GENERAL replied that, in his opinion, it was not at all necessary.

Mr. LITTLER contended that the parishes should be separated. Supposing, he said, there were parishes which were 100 per cent. too high, in those instances it would have been absolutely necessary for the Company to appeal, and to have incurred the costs of coming before the Court.

The CHAIRMAN said he had worked out the figures, and found that the Assessment Committee of the Union had assessed the Company at £4879 less than the judgment of the Court had awarded. The appellants admitted this ; but they said that, when it came to be subdivided, it would be found that some parishes had put them up too much. He thought it must be taken on the balance.

Mr. LITTLER pointed out that in the City of London Union a reference to the notices of appeal would show that they had succeeded in 53, and had lost in 51 cases. It would have been absolutely impossible to have tried all of them one by one ; and the next quinquennial period would have arrived before the whole of them could have been considered. It was to save all the expense they could and to expedite the appeals, that they were willing that all the matters should be heard practically together.

The CHAIRMAN said the Company had succeeded in reducing the assessments in 15 out of 23 parishes or unions to the amount of £47,909 ; but they had failed in respect of certain parishes, in which it was shown that the Assessment Commissioners had under-assessed them to the amount of £7539. If they deducted the £7539 from the £47,909, they might say the Company were still £40,370 to the good. If the rates were taken at an average of 5s. in the pound, the result would be that the Company would have gained £10,000 a year during the quinquennial period. On the other side, the Company had failed, as regards the figures given in their cases, to the extent of £209,862.

Mr. LITTLER said that, if there was to be a comparison, it should be made by means of Court figures against Court figures, or paper figures against paper figures. If the Company's appeal cases had set the figures too low, he suspected the difference on the other side would be almost as startling as his Lordship's figures ; because they had put their figures in almost every instance higher than they had proved in Court.

In the course of further discussion,

The CHAIRMAN asked whether it was the intention of the Company to abide loyally by the decision of the Court after the long time that it had engaged their attention. He could not but think that the Company had been most considerably dealt with.

Mr. LITTLER said that at the present moment they had not arrived at that degree of gratification. It was a matter of such large amount and such grave importance, that he hesitated, without further reflection, in advising his clients on the matter, unless he could assure them that he was absolutely clear, in point of law, that it was not liable to be upset. There were other parishes outside—of some importance—which had not appealed, which were in a difficulty in dealing with that matter. The question was, would they be put up or down ; and would they also have to deal with them by their coming with a supplemental list ?

A discussion arose as to whether it might not be possible, by consent, to raise the figures in the parishes where it was shown that the Assessment Committee had under-estimated the value of the property ; but it was felt that it would involve difficulties which it was not desirable to encounter.

Mr. LITTLER then addressed himself to the general question of costs. He suggested that the course for the Court to adopt was to say the appellants had substantially succeeded ; that they would not have achieved that success had they not come to the Court ; and that therefore it was only reasonable that they should have their costs. They had sought relief where, in order to get it, they had incurred costs which the Legislature said they were entitled to have. They went to the Assessment Committee, and obtained no relief ; but they came to the Court to succeed, as his Lordship had said, to the extent of something like £10,000 a year.

The CHAIRMAN : But then we cannot overlook this, that when you went before the Assessment Committee you went with figures which were not accepted ; and supposing we could find they were absolutely unacceptable—that they opened no door to consideration or negotiation, and afforded no hope of an ultimate amicable settlement—why then your figures would not be adopted. With regard to Mr. Field's figures, I abstain from expressing my opinion about them. Possibly before the end of this case, I may be asked to do it ; and I really think it may be my duty to do so if I am asked.

Mr. LITTLER reminded his Lordship that it had been laid down in the High Court that appellants were not bound to show a figure to the Assessment Committee, but that they had done their duty if they simply told them the figures were too high. However exaggerated their figures might be, or however minimized, the matter for the Assessment Committee was the figures they had to determine. Counsel then pointed out the cases in which the Assessment Committee had increased the Overseers' figures, whereas the Court had held that they should be reduced. He submitted that, having regard to the whole matter, the course to be adopted should be that the Company should be entitled, in all cases where they had succeeded, to receive their costs—paying where they had not obtained relief ; or, taking a broad view of the thing, that his Lordship should say that, this being an important matter, it was one which both sides were justified in bringing before the Court, and there should be no costs on either side. There had been relief on both sides, and there had been mistakes made on both sides ; and, under the circumstances, it would be reasonable to make a fair field between the parties. Otherwise he should press upon his Lordship the hardship of compelling the Company to pay costs, or even not to receive costs where they had obtained substantial relief.

The SOLICITOR-GENERAL said he would endeavour, on the question of costs, to assist the Court with suggestions which appeared to him to be sound and reasonable, looking at the whole course of the litigation. He appeared in eight different cases ; and the observations that he might make would not, of course, equally suit each of his clients, having regard to the different results that had been obtained. The suggestion of Mr. Littler that there should be a sort of general set-off, and that no costs should be given to either side, he submitted was the only course that would work absolute injustice to everybody. If,

Apportionment of the Rateable Value among the various Parishes where the Assessment has been appealed against (all the Figures given being net).

PARISH.	JUDGMENT.				ASSESSMENT COMMITTEE.			GAS COMPANY.		
	Direct Mains.	Indirect Mains.	Works.	Total according to Judgment.	Mains.	Works.	Total from Valuation Lists.	Mains.	Works.	Total from Company's Cases.
City of London Union	£55,858	£838	..	£56,696	£51,817	..	£51,817	£17,566	..	£17,566
Bethnal Green*	6,686	287	£5,500	12,473	6,600	£6,400	13,000	2,405	£7,001	9,406
Bloomsbury	8,516	258	..	8,774	8,498	..	8,498	2,958	..	2,958
Chelsea†	8,819	366	..	9,185	9,154	..	9,154	3,996	..	3,996
St. Clement's Danes	3,602	57	..	3,659	4,065	..	4,065	1,333	..	1,333
St. George, Hanover Square .	22,233	276	5,014	27,523	29,750		29,750	7,338	6,527	13,865
St. John, Hackney	17,152	1,512	..	18,664	22,000	..	22,000	6,676	..	6,676
Hampstead	11,121	..	..	11,121	10,655	..	10,655	3,409	..	3,409
Islington	28,148	725	..	28,873	54,490	..	54,490	9,106	..	9,106
Kensington	27,242	59	10,000	37,301	28,350	10,000	38,350	8,995	10,000	18,995
St. Martin-in-the-Fields . .	9,828	472	..	10,300	11,525	..	11,525	3,462	..	3,462
St. Marylebone	24,383	..	..	24,383	29,000	..	29,000	7,623	..	7,623
St. Mary-le-Strand	1,222	33	..	1,255	1,553	..	1,553	444	..	444
Paddington	16,932	..	..	16,932	17,284	..	17,284	5,138	..	5,138
St. Pancras	24,395	101	16,000	40,496	45,332		45,332	7,878	15,212	23,090
St. Paul, Covent Garden . .	2,188	..	..	2,188	2,353	..	2,353	669	..	669
Liberty of the Rolls	422	..	..	422	440	..	440	129	..	129
Precincts of the Savoy . . .	453	21	..	453	320	..	320	137	..	137
Shoreditch	12,298	220	14,724	27,242	15,541	14,724	30,265	4,107	14,724	18,831
St. George, Southwark . . .	1,222	..	..	1,222	897	..	897	391	..	391
Stoke Newington	3,283	..	..	3,283	3,700	..	3,700	1,005	..	1,005
St. James, Westminster . .	13,994	..	..	13,994	13,335	..	13,335	4,139	..	4,139
St. Margaret, Westminster .	11,670	748	9,240	21,658	20,909		20,909	5,431	10,457	15,888
Totals . . . . .	..	..	..	£378,097	..	..	£418,692	..	..	£168,256

* The Works in the Parish are agreed at £6400—the figure £7001 for Works which appears in the Company's Supplemental Case for Bethnal Green having been inserted in error.
† The portion of the Dock in Chelsea agreed at £195 must be allowed in addition. It is included in Mr. Ryde's figure of £5998.

having regard to the circumstances of the case, the Company could be held to have properly initiated that expensive litigation, and to have fairly carried it through and succeeded, then Mr. Littler had a strong case for applying for costs. It might be that, although he was entitled to ask for them in that way, taking it as a whole, the Court would say he was not to have his costs, because of certain matters connected with the getting up of his case or the presentation of it to the Court. Still, although refusing to allow him costs on this ground, which might be a reasonable course, it would be most unreasonable to follow this up by saying that, where it had been absolutely and completely defeated by the parish or the union which had been at the cost of maintaining, and had successfully maintained, its own valuation, the ratepayers should be burdened with the expense. Dealing with the cases *seriatim*, he pointed out that in the City of London Union, treating it as one case, the rateable value was double what it was in any other of the litigating parishes, with the exception of St. Pancras; and it was £16,000 more than it was in St. Pancras. That property was assessed at £51,817, which sum the appellants contended should be reduced to £17,566. The result of his Lordship's judgment showed that the Assessment Committee had put it at £5000 too little; and therefore it was clear the respondents ought to have their costs. The public authority, and the Assessment Committee who represented them, had done nothing wrong, except so far as they had been too lenient to the Company.

The CHAIRMAN pointed out that in their valuation the Company were too low by £39,130.

The SOLICITOR-GENERAL said the effect of putting so small a figure was to make it impossible for the parties to negotiate upon any basis of settlement. His Lordship knew how very reluctant parochial authorities and assessment committees were to enter upon a litigation such as that in which they had been engaged; and undoubtedly if there had been any proffer of figures so near their own as these, it might be quite reasonable that the respondents should enter into negotiations; and that, not having done so, the question of costs should be dealt with as if both parties were in some respects to blame. But the putting forward of what, in the face of the decision of the Court, he might now call ridiculously inadequate figures, was at once a bar to any possibility of discussing or arranging the matter. He submitted that the City of London Union ought to have the whole of their general costs; but in the cases of those parishes where the Company had succeeded, there should be a disallowance of the costs in respect to the special expenses which related to the different parishes. Passing to the case of Bethnal Green, where the reduction had been £527—from £13,000 to £12,473—it was agreed that the assessment should stand at £13,000. In that case the appellants had wholly failed; and the respondents were therefore entitled to costs.

The CHAIRMAN: There is a point arising there which is deserving of attention, and which has been a source of embarrassment on more than one occasion in considering this case. That is that, although their valuation of the mains and pipes (I speak of the direct mains) was very much less than that which has been presented on behalf of the Assessment Committee, yet, strange to say, the Company, for some reason or other, put a far larger value upon their works than that. It might be apparent what their object was with regard to this; but you observe that, in respect to this parish, it is very remarkable, because they valued the mains at £2405 only, and, according to the judgment of the Court, they are of the value of £6686. Do you see that?

The SOLICITOR-GENERAL: Yes, my Lord, I do.

The CHAIRMAN: I can surmise—I can conjecture what their motive was, and what their reason was, for putting so much higher value upon their stations, and upon the indirect mains in some instances, than the parishes themselves, while they were attributing so much less value to the direct portions of the works; and I wish Mr. Littler to understand that I cannot help thinking that this has very much increased the labour and cost of this matter, for which we have to thank the appellants. It was most embarrassing, and very difficult to fathom and correct.

Mr. LITTLER: It simply arose from the difference of principle, my Lord—of the size, that is all.

The SOLICITOR-GENERAL said he would pass away from the case of

Bethnal Green, with the remark that it was one in which the appellants had absolutely failed. He then proceeded to refer to the case of Islington, which, he said, stood apart from the others in the magnitude of the reduction that had been made—from £54,490 to £28,873.

The CHAIRMAN said he could not understand how that parish went so far astray.

The SOLICITOR-GENERAL said that some excuse might be found in this: The assessment had previously been agreed at £45,000, and had not been challenged; but undoubtedly the Assessment Committee did think it right to substantially raise it. He asked the Court to look at the figure which the Company put forward—viz., £9106—which was entirely unreasonable; and the Assessment Committee surely could not be blamed if, in the absence of any definite and trustworthy information, they considered there was an accretion of value in the quinquennial period. In the case of St. John's, Hackney, the Assessment Committee reduced the Overseers' figures of £29,167 to £22,000; and these had now been brought down to £18,664. But the figure the Company desired was £6676, or one-third of what the Court had decided to be proper. As between, on the one side, an appellant who had every means of knowledge, and, on the other, gentlemen constituting the Assessment Committee, who could not possibly employ expensive agencies and give much time to the consideration of these cases, he asked the Court to say that this was a success for the Assessment Committee, and that they ought to have the general costs of the litigation. The same observation applied to Stoke Newington, where the Court had reduced the assessment by £417—a sum which was £2278 more than the figure at which the Company put it. He submitted that where the Assessment Committee were in error to the extent of one-eighth, and the Company to the extent of seven-eighths, the respondents ought to have the sixth-eighths, or three-fourths of their costs. This was supposing they were on an equal footing; but what he asked the Court to remember was that the greatest error was on the side of the litigant who had the least excuse for being in error at all.

The CHAIRMAN: There is another point which strikes me, and which you would wish, perhaps, not to overlook, Mr. Solicitor. It is this—that when we look at the differences between the values as presented by the Assessment Committee, compared with the judgment of the Court in respect of these several unions and parishes, we cannot relegate them to any general principle that appears to have actuated the Company with regard to all of them; the differences are so widely disproportionate. If, with the information in their power, we found that the differences were pretty well the same in proportion to the amount actually awarded in each of the parishes, we might come to the conclusion that, rightly or wrongly, they sent in their estimates and founded their appeals upon certain principles; but the differences are so disproportionate, that one is forced to the conclusion that they were really guided by no principle at all. I do not know whether I make myself intelligible.

The SOLICITOR-GENERAL said he did, perfectly; and it was curious that the next parish he (the learned Counsel) was going to mention was one which exactly indicated the point his Lordship had mentioned. In Shoreditch, the assessment was £30,265; the judgment of the Court fixed it at £27,242; and the amount put forward by the Company was £18,831. In that case, again, the divergence of the figures was too great to allow of a compromise. In Kensington, too, there had been an infinitesimal reduction—being £1000 off £38,000; but the figures put forward by the Company were £18,995.

The CHAIRMAN: Including the works and the indirect mains, as to which there was little, if any, difference.

The SOLICITOR-GENERAL said therefore the comparison was between £27,000, excluding the works, and £8995, which was again an irreconcilable and undiscussable figure. In Shoreditch, excluding the works, the Company's figure was £4107 against £12,290, or about one-third. The learned Counsel then proceeded to refer to the question of costs as applicable to the proceedings being adjourned till the figures relating to the year 1890 could be prepared to be taken into consideration—contending that these costs should be visited upon the Company; and also to the arrangements as to the cost of the shorthand

notes which had been printed for the use of the Court and the several parties.

Mr. POLAND also addressed the Court with reference to the cases in which he was concerned apart from the Solicitor-General—viz., Bloomsbury; St. Clement's Danes; St. George's, Hanover Square; St. Margaret's, Westminster; Hampstead, St. Marylebone, Paddington, and St. Pancras—claiming that, on the results of the figures, the respondents ought to be allowed their costs. With regard to St. Pancras, however, he considered this was a case in which the Assessment Committee and the Company were both wrong; but he thought the appellants should not have their costs.

Mr. ROBINS, for Paddington, also contended that they ought to have costs in that case, on the ground that the Company had only succeeded in striking off 1-48th of the whole assessment.

The Court then adjourned till the following Monday.

Monday, March 14.

Mr. POLAND to-day resumed his address on the question of costs; dealing with six parishes in the Strand Union—viz., St. Martin's-in-the-Fields, St. Clement's Danes, St. Mary-le-Strand; St. Paul's, Covent Garden, the Liberty of the Rolls, and the Precincts of the Savoy.

Mr. FULLARTON, on behalf of St. Saviour's Union, Southwark, also applied for costs; and Mr. W. RYDE followed, for St. Luke's, Chelsea—the assessment having, in both these cases, been below the amounts awarded by the Court.

A discussion then arose as to the treatment of the City of London Union as a whole or in separate parishes.

Mr. LITTLER said it was an inevitable result that in each of those cases there must be a judgment; and there must be 68 judgments that the Company had been right, and 41 that they had been wrong. In the 41 cases in which they were wrong, he, of course, did not contend that they ought not to have to bear the expense; but in those in which they had been right, it was clear that the Company ought not to pay the costs. It was true the Company had been exceedingly wrong where they were wrong; but this was so with the parishes also.

The CHAIRMAN: You ask us, then, to consider these parishes as if they were separate individuals. That is all very well. But how can we overlook the fact that the appellants are the same persons in all? and why should we overlook the fact that there is a Union whose Solicitor and Counsel are instructed on the part of every parish included therein, and that you have acquiesced in our putting a value on the whole property in that Union, and have presented this value to us in your own tabular statement?

Mr. LITTLER said the respondents were the Assessment Committee, but that Committee had presented two sets of cases, in 68 of which they were totally wrong, and in 41 of which they were absolutely right. Under these circumstances, he asked how the Assessment Committee could have any costs at all.

The CHAIRMAN said it was in his mind that they ought not to allow, as to the parishes which had made an over-assessment, any of the costs of their case—that was of stating their case. But he could not help looking at the enormous differences between the sum awarded and that for which the Company stood out. They were fighting for impossible amounts. He did not say that they did not do so in good faith. But their demands were excessive in every one of those matters; and he could not but think that it shut the door to negotiations which might otherwise have been possible.

Mr. LITTLER said that, so far from shutting the door, the figures that were before the Assessment Committee in every case were proposals amounting to from 10 to 10½ per cent., which was the identical figure at which the South Metropolitan Gas Company's case had been settled.

The CHAIRMAN: Was the South Metropolitan Company's case tried before us, or did they come to terms?

Mr. LITTLER: When they came here, they came to an understanding on these very terms—from 10 to 10½ per cent.

Mr. POLAND: I was against the Solicitor-General in that case. We were both so reasonable that we came to terms.

The CHAIRMAN said he could not think that the respondents would have found Mr. Littler unreasonable. He wished the Company had taken such advice from Counsel as Mr. Littler's would be, especially when they found they were obliged to dispense with the evidence of their own experienced valuers.

Mr. LITTLER said the proposals that were made to the parishes were infinitely higher than the figures in the cases, and were made with the view to enable the Assessment Committee to arrive at something reasonable. They were figures much larger than those that the Company were advised to fight upon; and in no instance were they presented to the Court as being the right ones, but those which were submitted to the Assessment Committee. The City of London Union absolutely declined to hear them. He inquired if it was to be laid down—if so, it would be for the first time—that, if they asked for more than they obtained, and then succeeded in getting a substantial reduction, thereupon they were to be punished.

The CHAIRMAN said the Court would be very careful not to express such an opinion. As to making a rule of that kind, it was out of the question. They had again and again proceeded on the right an appellant had to receive his costs, although the demand of the reduction exceeded the actual allowance made by the Court. But this was not an ordinary case. This was a case which had to be judged, to a great extent, by its general results, and with a due regard to the magnitude of it, and to the complexity of the calculation.

Mr. LITTLER pointed out one consideration which seemed to destroy absolutely the force of the smallness of the figures in the Company's cases. A single addition of 2d. per 1000 cubic feet in the price of gas would have brought them within £4000 of the figures fixed by the Court. Every one of the valuers on the other side argued on the advanced price; and one of them got up as far as £187,000 by reason of that increase. The learned Counsel proceeded to quote from the figures given by the valuers on the other side; urging that the Court had received but little assistance from them, and that, as they had put outrageous figures before the Court, the appellants ought not to pay the costs of those witnesses. There was nothing extraordinary in an appellant putting his case too low; and in any ordinary case, the moment

the respondents failed to establish their figures, they failed to get their costs. Under no circumstances, he submitted, in the 14 or 15 parishes in which they had succeeded, according to ordinary principles, could the Company be called upon to pay any of the costs. The discretion under the Metropolitan Act was a judicial one, and must be guided by judicial practice and knowledge; and the judicial common knowledge was that a person who had failed could not get his costs. Under the Judicature Acts, the Court had not only deprived persons of costs, but had ordered them to pay their opponents' costs, although they had won. But this was done only on the ground of attempted fraud, and an endeavour to deceive the Court. He would be insulting the intelligence of the Court, and insulting himself, if he assumed that those whom he represented had attempted to deceive or to cheat the Court. They had been conducting a *bonâ fide* case; but the Court had held that they were wrong in principle. Therefore the whole current of judicial decision and judicial discretion, and his Lordship's judicial discretion, must be limited within judicial lines; and those judicial lines were that under no circumstances, short of absolutely discreditable behaviour, could a person who had succeeded to ever so slight an extent be subjected to costs. He had already pointed out that, had they made a correction of 2d. per 1000 cubic feet for the increased price of gas, it would have come to a little more than the Court had awarded. Of course, he could not tell what might have been the moving influences in the minds of the Court; but he assumed that they had properly thought fit to look a little forward, and that all sorts of things had been taken into consideration; indeed, it was stated in the judgment that the Court did think fit to take into consideration the power to increase the price.

The CHAIRMAN said this was so. He thought it right to state in the judgment certain reasons which actuated them, and to draw attention to certain powers which the Company possessed, and which they had not overlooked. At the same time, they drew attention to the difficulties which at certain crises the Company would have in carrying on their undertaking. He trusted that nothing had escaped them.

Mr. LITTLER went on to say that, if they had corrected their calculation to the extent of that 2d., the Company's figures would have been a little above those fixed by the Court. Not having, on principle, taken this into account, how could it be argued against the Company that they had been ridiculously wrong in the figures presented to the Court, when they told the Court that it should have been taken into account? They were wrong to a large amount because the amount involved was large, that was all. Their failures were worth comparing with what they had won, in which cases he ventured to say they ought to have their costs. In Bloomsbury, there had been a gain of £276; in Chelsea, £31; in Hampstead, £466; in the Savoy, £133. There were several such cases; but there was not one that was more than £750. On the other hand, in St. Clement's Danes, they had gained £406 on £4065, or exactly 10 per cent. Surely this was a case for costs. In St. George's, Hanover Square, they gained £2227 on £29,750, or 8 per cent.; in St. John's, Hackney, they gained £3336 on £22,000, or close upon 15 per cent.; and in Islington, nearly 50 per cent. The Solicitor-General said triumphantly, regarding Islington, "Oh, but you assented to £45,000." Then, of all people, Islington ought to pay the Company's costs, because they had been getting too much out of the Company for the last five years. There never could be a stronger case for costs than that of Islington.

The CHAIRMAN said the reply to the Solicitor-General was obvious. He could not help smiling when he heard the argument that they should be excused from paying costs on the present occasion because they had been for the last five years receiving a higher amount than that to which they were entitled. They were far more wrong than the Company were. The Court could not overlook this fact.

Mr. LITTLER said that throughout the Company were wrong on one ground only. If they had tied themselves to 1889, as possibly, in strict law, they might have done, not a word would have been said about the increased price. This arose from the laudable desire on the part of the Company that, in the next quinquennial period, there should not be further litigation between the parties. If his Lordship had tied himself to 1889, he could not have informed himself, as he had since, that there was a possibility of a rise in price. Every gas company had the power to raise their price. But this was proved by an event which took place in 1890; and if it had not been put before the Court then, on the 1889 figures, his Lordship could not have taken into consideration the possibility of a rise in 1890, and then the Company would have been absolutely right in their valuation.

The CHAIRMAN said he thought the Court would have taken into consideration the existence of that power. He ventured to say more than once that, if they had to consider what a tenant would give for the works, and what they would let for, surely a tenant, looking at the Act of Parliament, and observing therefrom that he would have a power of raising the price of gas, would let this be an element in determining the price he would give.

Mr. LITTLER, proceeding with his comparison, remarked that in Kensington and Paddington the gain to the Company was between 2 and 2½ per cent.; in Marylebone, upwards of 15 per cent.; in St. Maryle-Strand, over 18 per cent.; in St. Pancras more than 10 per cent.; in St. Paul's, Covent Garden, over 6 per cent.; in the Liberty of the Rolls, nearly 4 per cent.; in Shoreditch, 10 per cent.; and in Stoke Newington, upwards of 11 per cent. These were substantial wins; and even in the lowest cases of Paddington and Kensington, the 2 per cent., multiplied by the five years of the quinquennial period, represented 10 per cent. or more. Wherever they had won £1000, it must be remembered that, taking it over the five years, it came to £5000; and a rate of 5s. in the pound on this was a considerable sum. In all those cases, he submitted the appellants should be allowed their costs. The learned Counsel then went on to discuss the manner in which the costs of the preliminary proceedings, prior to the figures of 1890 being taken into account, should be dealt with, and said that those costs should not be visited upon the Company, as what was done was for the purpose of assisting the Court, and avoiding further litigation. With regard to the costs of the shorthand notes, he suggested that the arrangements by which the parties had been supplied with copies by the Company should be adhered to. In dealing with the costs, the other side were trying to get the very last sixpence in the shape of "skinning the hare"—the hare which was

paying one-sixtieth of the whole rates of the Metropolis, after having a hard fight; and they were calculating it on the contention that the Company were losing from their reserve funds, though they were compelled to charge a higher price for gas, and were paying more for labour, which did not seem to have weighed with the Court.

The CHAIRMAN said Mr. Littler was not justified in saying this. The points were fairly submitted to the Court; and Counsel must presume that the Court fairly considered them, and gave due weight to them.

Mr. LITTLER said it was a very different "weight" from that for which the appellants contended; and he could not but think that some of them had had very little weight, when weighed with an impartial mind. The Company, who were paying one-sixtieth of the rates of the Metropolis, were dealt with as if they were in a County Court.

The CHAIRMAN: There is not a parish in the Metropolis in which you have not valuable property, leaving out those parishes which are under the South Metropolitan Gas Company.

Mr. LITTLER: Under proper conditions, instead of paying a sixtieth of the rates we should not perhaps pay a six-hundredth.

The Court then retired to consider their judgment. On returning,

The CHAIRMAN expressed his regret that the Court found it impossible to give judgment that day. Their hesitation arose principally in regard to the valuations in the City of London Union, and to what had been presented to them in respect of the relative proportions of increase or decrease in the present 112 valuation lists. They found, upon further investigation of the tabular statement, that the effect might be very different, when the results come to be made, from what had been contemplated on either side. It would obviously not amount to giving the appellants the advantage of the difference between the highest assessment in the Union, regarding the parishes constituting the Union as a whole, and the total assessments appearing at present in the valuation lists. It might be that, instead of the appellants profiting to the extent of (say) £5000 during the quinquennial period, when the alterations came to be made the result might possibly be still more to their benefit. The Court would take time to consider the questions arising out of the 112 assessments, although they had not overlooked the force of the argument in support of the appellants' contention, that, in respect of such of them as were shown to have been too highly assessed, they should be entitled to costs.

Mr. DANCKWERTS, in reply to a question by the Chairman as to how the general result would affect the total liability for rates in the Union, said that the assessments would be reduced by something more than £10,000.

The CHAIRMAN said, if Mr. Danckwerts's figure was correct, then the Company would gain some £6000 more than the difference between the assessments as found by the Court and the total of the assessments in the Union. That was not a subject for congratulation, except for those who rejoiced that justice could not be done in these cases because the Court had not the power of increasing the assessments where their judgment showed they ought to be increased. Therefore the appellants would be undeservedly the gainers; and this appeared to him to be a matter well worth notice in regard to the argument of Mr. Littler that, in each of the 68 cases in which they had won, the appellants should have their costs.

Mr. LITTLER said that he hoped his Lordship would not entertain any such question as that. The issue was what had happened in the individual cases, not what had happened to someone else. There was no power to raise the assessment; and that it was not raised in certain cases was the fault of the Assessment Committee, not that of the Company. The Committee thought fit to raise some things by 100 per cent., and to leave others alone. Surely the Company should not be punished for that.

The CHAIRMAN said the Company had the full advantage of those under-assessments; and the Court could not deprive them of it. But they had yet to consider whether they would be wrong in taking those under-assessments into consideration when the appellants asked to be awarded costs against the Union in respect of certain other cases.

Mr. LITTLER protested against this view of the matter being taken.

The Court then adjourned; no date being fixed for judgment on the questions raised.

Ottoman Gas Company, Limited.—The accounts of this Company for the half year ending Dec. 31 last show that the gas-rental amounted to £8574, and the net profit to £3463. The sum standing to the credit of the profit and loss account is £4000, which the Directors recommend should be dealt with as follows: To be carried to the reserve fund £1000; and to the payment of a dividend at the rate of 7 per cent. per annum on both classes of shares. The dividend will absorb £2625; and leave a balance to go forward of £375.

An Extraordinary Artesian Spring.—A boring for water Sleaford, in Lincolnshire, for the supply of some large new maltings for Messrs. Bass and Co., of Burton-on-Trent, is being attended with remarkable results. At a depth of 156 feet in the limestone beds of the lower oolite formation, Messrs. Le Grand and Sutcliff, of London, have just struck a very powerful artesian spring, which rises to 12 ft. 6 in. above the ground, and rushes out of the bore-pipe 3 feet above the surface at the rate of upwards of 12,000 gallons per hour, or nearly a ton of water per minute. The spring increases in strength daily as the boring goes deeper.

The Improvements at the Heywood Corporation Gas-Works.—The minutes of the Gas Committee submitted at the last meeting of the Heywood Town Council, recommended that tenders be obtained for a Livesey washer and tar extractor, for a set of four purifiers, and for Ruscoe's patent stoking machinery; and that Messrs. Jonas Drake and Sons' tender for the erection of generator furnaces be accepted. Mr. Lawton, in moving the adoption of the minutes, referred to a recent visit of the members of the Council to see the new plant already completed at the gas-works, and to the general expressions of satisfaction at what the Committee had accomplished. He felt sure, if they had not commenced the additions at the time they did, they would have been in a dilemma before now. He also called attention to the recommendation that further improvements should be carried out, and said that the whole of the alterations would cost from £4000 to £5000. The report was adopted.

MISCELLANEOUS NEWS.

SHEFFIELD UNITED GASLIGHT COMPANY.

The Half-Yearly General Meeting of this Company was held on Monday last week—Sir F. T. MAPPIN, Bart., in the chair.

The GENERAL MANAGER (Mr. Hanbury Thomas) having read the notice convening the meeting, the report of the Directors, with the accounts for the half year ending Dec. 31 last, the principal features of which were dealt with in the JOURNAL for the 1st inst., were presented.

The CHAIRMAN said he assumed the proprietors would, as usual, take the report as read. It showed that the expenditure on capital account had been very limited—amounting to only £5752. But, as most of them were no doubt aware, the Company were just establishing new works at Grimesthorpe; and this would cause the expenditure to be considerable for a few years to come. That day the Directors had made contracts amounting to £32,000 in connection with these works. The total expenditure of the Company on capital account had been £666,051. At the end of the past year, they had power to call up £92,510; but it had not yet been exercised. The loan capital, which amounted to a sum of £76,073, had not been made use of. The revenue account had not realized such a profit as would enable the Directors to pay the usual 10 per cent. dividend without falling back on the balance brought forward from previous half years; and from this they had taken £5546 3s. 11d. After paying the dividend, there would remain a sum of £1209 12s. 4d. in hand. When the proprietors considered the increase in wages, the shorter hours of work, and the higher prices the Company paid for coals, he thought it would be admitted that the Directors had acted wisely in using some of their surplus funds. The reserve fund, as they knew, was at its maximum—£78,618 17s. Repairs of the works had been continued on the same extensive scale as had been done for some years past. They found the necessity and advantage of this. The purifiers at Neepsend had been renewed to the extent of £5322 during the past half year, and at Effingham Street to the amount of £1533; and they had spent £2753 in replacing boilers and in altering the boiler-house. The shareholders would see by this that the Board had not stinted the expenditure out of revenue to keep the works in first-rate condition. Repairs and renewals of mains and services had cost £1609 more than in the corresponding half of 1890. The income from coke had been £2616 less; and they had realized £694 less for sulphate of ammonia. They had, however, received an additional £1385 for gas. This was not so large an increase as they had been in the habit of having; but the proprietors must bear in mind that this came upon a very large augmentation at the same period last year. The quality of the gas had been fully maintained, and was highly satisfactory. In his opinion, it was better than they had ever supplied during any of the years in which he had been associated with the Company. There were 939 tests made last half year; and the average was 16.06 candles, or equal to 17.56 candles by the London standard burner. Taking the entire year 1891, they made 1815 tests; and the average by that burner was 17.52 candles. Therefore, he thought they were justified in saying that they had supplied the quality, and more than maintained the standard, set up by the Act of Parliament. Upon the leakage, or the loss of gas, he had nothing to remark; this item being satisfactory. Their stoking machinery had been in operation about six months; and although no doubt some little difficulty had been occasioned at times by the newness of the system, they were thoroughly well satisfied with the results they had obtained, both in profits, and also in the facilities with which they could increase the make of gas by using the machinery. The last two years, as the proprietors had been told before, had been against gas companies in regard to expenditure upon coals and labour. As a rule, gas companies all over the country had been compelled to put up their prices—in most cases something like 3d. per 1000 cubic feet. At Liverpool they had advanced the price 4d.; at Leeds, 4d. at Bristol, 5d.; and The Gaslight and Coke Company had raised theirs 7d. The Sheffield Company had maintained their old prices of 1s. 10d., 2s., and 2s. 2d.; and he trusted they would be able to keep to these figures. At all events, the Directors had so far not found it necessary to consider the subject. No doubt the proprietors had realized the fact that the value of their property had been reduced in the last six months by something like £10 for every £100 stock. Why this was so, he could not understand, as there had been no change in the management. He thought the Company had been as successful as in the past. The Directors had been obliged to enlarge the works to meet the ever-increasing consumption. He thought they might all ask themselves why the decline in the value of their stock had taken place. But they must bear in mind that the largest Gas Company in the world had found their stock decline during the last twelve months from 251 to 221 per cent. The Sheffield Gas Company must not, therefore, expect to maintain for their stock exactly the price at which it had hitherto stood. There were timid people who were influenced by changes in the value of their stocks. But those who understood the matter must feel satisfied with companies who could maintain their dividends. To act in the way some shareholders had done showed, in his opinion, some want of judgment. Twelve months ago he attended for the first time a meeting of The Gaslight and Coke Company, and criticized the policy of the management. On receiving the report and accounts from that Company for the six months ending Dec. 31 last, he felt it to be necessary that someone who knew something about gas companies and how they were managed should go to the meeting, and express his opinion upon a subject that was of much importance to a very large body of shareholders. He therefore attended, and pointed out that, whereas in the year 1888 the Company had a reserve fund and balance amounting to £807,000, they had, after paying their last dividend, only £115,000 left. In three years the £807,000 had been reduced to £115,000. He also told them that they were only earning 7½ per cent. on their stock, although they were paying 12 per cent. dividend. In the observations he made, he ventured to ask the question if it was true, as it was rumoured, "that the Chartered Company's make of sulphate was sold through one broker, who also bought on his own account." Colonel Makins, the Chairman, in his reply, stated

"that the Company did not sell sulphate of ammonia through any broker, but only through the agent of the Company, who never bought an ounce or a ton for himself." That was a very distinct and a very positive reply to his inquiry; and he did not feel himself able to do more than accept it. But Colonel Makins went further; and, in reply to his (Sir F. Mappin's) inquiry, thought fit to attack the Sheffield Gas Company by stating that the results of "the Chartered Company's practice in this respect"—referring to the sulphate of ammonia—"would compare favourably with those of any other gas company, and most favourably with those of the Sheffield Company." He was not prepared at the time to deal with that assertion. But he had since looked at the published accounts of the two Companies; and he found that the statement of Colonel Makins was not quite up to the mark. If The Gaslight and Coke Company had obtained for their sulphate of ammonia the same price that had been paid to the Sheffield Gas Company for theirs, they would have received in 1884 £18,433 more than they did; in 1885, £10,520 more; in 1886, £19,500 more; in 1887, £24,566 more; in 1888, £45,177 more; in 1889, £46,101 less; and in 1890, £23,941 more. The total they should have received more was £79,367; but deducting from this the £46,101, there was left £74,757, which the London Company should have received had they obtained the same prices as the Sheffield Company. These figures would show, he thought, that Colonel Makins's statement was not quite satisfactory. The JOURNAL OF GAS LIGHTING had asked him to reply to the statement of Colonel Makins, as, after it had appeared in the papers, there was much comment upon it. There was a trial in the Queen's Bench Division in April, 1890, of a case in which the plaintiff was manager in London for a merchant in tar and other products, and who sued his employer for commission due and damages for wrongful dismissal. The circumstances of that case were as follows: In the month of November, 1888, the defendant was buying pitch, through his manager (the plaintiff); and on the 5th of that month, the plaintiff bought for himself, in a rising market, 1000 tons from Mr. W. G. Blagden, the agent for The Gaslight and Coke Company, who had the larger proportion of the pitch for sale on the London market. He resold the stuff to Mr. Blagden on the 13th of that month at a profit of £56 5s; and on the same day bought it again for the defendant at a further advance in price of 1½d. a ton. A letter was addressed to Mr. Hanbury Thomas, dated Feb. 26 last, by Mr. Blagden, who wrote: "I shall feel obliged if you will wire me on the enclosed telegram form, first thing to-morrow, your lowest price for 50 tons of sulphate ammonia, and whether you could despatch 20 tons to Goole to-morrow night." He (the Chairman) thought the statement of Colonel Makins had not been borne out, and that the information which had been published justified him (Sir Frederick) in asking the question he did. It was often found that the price of sulphate of ammonia had gone down suddenly. He did not say who had been the cause; but he thought it right to put the inquiry to Colonel Makins. The Chairman went on to refer to a report which had appeared in the papers to the effect that two trains loaded with coal from Scotland, and intended for the Sheffield Gas Company, had passed through Barnsley. He said the report was true; but it should be explained that it was cannel coal, which they were compelled to have. It was their usual stock, and was obtained without any consideration whatever as to there being a strike imminent. The price they paid for it was very high; but they used it in order to maintain the quality of the gas. He concluded by moving the adoption of the report.

Mr. H. HUTCHINSON seconded the motion.

Mr. J. WILSON pointed out that the reserve fund account was stated to be £78,618; but the reserve fund investments were only put down at £42,470. He wanted to know where the remaining £36,000 was—whether it was invested in the works or in some other way.

The CHAIRMAN replied that they employed the money in their business rather than invest it at a low rate of interest; and the Directors thought it was wise policy so to use it at the present time. If they called up capital, they would have to pay 10 per cent. upon it.

The motion was unanimously carried.

On the proposition of the CHAIRMAN, the usual resolution with regard to dividends was passed.

The meeting was then made special, for the purpose of obtaining the consent of the shareholders to the conversion or consolidation of the 11,462 class "E" shares of £8 10s. each (in respect of which the whole of the money subscribed has been paid up) into capital stock, to be called "C" stock.

The CHAIRMAN, in proposing a resolution sanctioning this conversion, said the alteration would simplify the stock of the Company, and be an advantage in all respects; and he thought none of the shareholders would object to it.

Mr. E. HALL seconded the resolution; and it was carried.

On the motion of Mr. J. WILSON, seconded by Mr. A. J. HOBSON, a vote of thanks was passed to Sir F. Mappin for his services in the chair.

The CHAIRMAN, in acknowledging the compliment, said he presumed the proprietors included in the vote, the officers of the Company, who had used every effort to attain the successful results achieved. He trusted the Company would always have officials as good, as efficient, and having the interests of the undertaking so much at heart, as their present staff.

The meeting then terminated.

THE GAS UNDERTAKING OF THE STOKE-UPON-TRENT CORPORATION.

Report by Messrs. Alfred Lass, Wood, and Co.

Our readers may possibly remember that, in consequence of certain remarks made a short time ago by the Chairman of the Gas Committee of the Stoke-upon-Trent Corporation, on the comparative cost of gas and the electric light at the consumer's meter, a discussion was raised by a member of the Council, who contested the Chairman's figures. The outcome of the proceedings was that the services of Messrs. Alfred Lass, Wood, and Co. were called in to investigate the question at issue; and their report was presented at the meeting of the Council last Thursday. It dealt with the accounts for the year

ending March 31, 1891; and it was accompanied by a reconstructed balance-sheet and a working statement for the year.

The report stated that the cost of gas at the consumer's meter was 19'90d. per 1000 cubic feet, or 19'02d. after deducting the cost of lighting, cleaning, &c., the public lamps. The average price received for the supply of gas for the private lighting of Stoke, Trentham, Hanford, and Trentham Hall was 36'19d. per 1000 cubic feet, leaving a profit of 17'17d. The average price received for gas for public lighting was 31'25d. per 1000 cubic feet, which, after deducting the cost of lighting, cleaning, &c., left a profit of 11'35d. With regard to the supply of gas to the North Staffordshire Railway Company (central station), the average price received was 27d. per 1000 cubic feet, with a profit of 7'98d. per 1000 feet on 7,977,000 cubic feet, or a sum of £265. This, however, did not represent the entire value of the supply, because: (a) The gas was supplied in bulk, and passed through a meter fixed close to one of the leading mains of the Corporation; and as the Railway Company distributed it through their own system of mains, any leakage that occurred was entirely borne by the Company. This mode of supplying gas was very different from that which operated in connection with the supply of gas for public lighting, where the leakage was borne by the Corporation. (b) Supposing the Company erected gas-works and supplied themselves with gas, the sale of about 8 million cubic feet would not only be taken away, but the Company would in all probability supply 1,999,800 cubic feet to the North Stafford Hotel, the Etruria Railway Station, and other places now supplied by the Corporation, for which a price of 3s. per 1000 cubic feet was paid, and upon which the profit amounted to about £140. (c) Supposing the Company supplied themselves with gas, they would not require to purchase of the Corporation such a large quantity of coke, which might adversely affect the profits. (d) Supposing the Corporation ceased supplying the Company, the remaining quantity of gas sold would cost proportionately more per 1000 cubic feet, and the leakage per cent. would be proportionately greater.

Upon the question of a sinking fund, the report stated that the Corporation were empowered to borrow £85,000; and Article I., sub-section 1 of the Stoke Provisional Order, 1888, provided that of the £62,700 borrowed prior to March 31, 1888, £41,900 should be repaid within 48 years from November, 1880, and £20,800 within 48 years from November, 1885. Any moneys subsequently borrowed were to be repaid within 50 years from the dates of borrowing. By sub-section 4, it was provided that the first payment of the sinking fund in respect of the £41,900, should be deemed to have been due on or before Oct. 31, 1881; in respect of the £20,800, on or before Oct. 31, 1886; and in respect of subsequent loans, within twelve months after the respective dates of borrowing. The Corporation have raised five loans—viz., £28,000, £15,000, £14,300, and two of £5000 each. The first-named loan is repayable within 30 years, and there has been paid off on account of such loan £4217 13s. 6d.; but nothing has been paid off the other loans. Messrs. Lass and Co. say that, instead of pursuing this course, the Corporation should have established a sinking fund to provide for the payment of £41,900, at 3½ per cent., in 48 years from November, 1880; £20,800, at 3½ per cent., in 48 years from November, 1885; and £4600, at 3½ per cent., in 50 years from December, 1888. The question arose whether the sum of £4217 13s. 6d., which had been paid off the loan of £28,000, was sufficient to provide for a sinking fund for paying off £67,300 within the prescribed periods. The annual instalments amounted to £556; and if they had been invested year by year, and allowed to accumulate at compound interest, they would, on March 31, 1891, have amounted to £5080, as against £4217 loans actually repaid. In fact, there would have been standing to the credit of the sinking fund £863; whereas there was really nothing to the credit of that fund. This £863 should now be taken out of the profit and loss net revenue account, transferred to the sinking fund, and allowed to accumulate at interest as from April 1, 1891.

With regard to the question of a reserve fund, Messrs. Lass and Co. pointed out that amongst the purposes to which the Corporation were required to apply the moneys received from the gas undertaking were the provision of a reserve fund, not exceeding £5000, to be invested in any securities in which by law trust moneys ought to be invested; and finally any balance might be carried to the credit of the district fund. Before any further moneys were taken out of profits and carried to the district fund account, the reserve fund, which only amounted to £2775 11s. 10d., out of £5000, should be filled up. Of this £2775, only £2000 was invested; and there was a question whether this investment was in accordance with the law.

As to the capital expenditure on fixed plant, the report stated that the total amount laid out to March 31, 1891, was £68,338; and the question arose whether any, and if any, what amounts had been placed to the capital account which should have been charged to revenue. This question could not be answered definitely; but the general inference drawn was that, upon the whole, the capital account had not been very unfairly dealt with. During the last five years, there had been an annual average increase in the sale of gas of 4'50 per cent. compound; and if the business continued to increase at the same rate, it would double itself in 15½ years. With regard to repair and maintenance of works, the report stated that works and plant should be kept well up to modern requirements.

In conclusion, Messrs. Lass and Co. stated that the accounts ought to have been kept in accordance with the form contained in Schedule B of the Gas-Works Clauses Amendment Act, 1871; and that the books of the Gas Department (in which all the accounts ought to appear in proper form and order) required remodelling.

Mr. BENNETT proposed that the report should be considered at a special meeting.

Mr. MARKS seconded the motion, on the ground that, having gone to great expense in having it prepared, it ought not to be rushed through without discussion.

Mr. GEEN (at whose instance the services of Messrs. Lass and Co. were called in) also considered the matter to be far too important to be hurriedly dealt with.

After some further remarks, in the course of which the Mayor (Alderman Kirkham) and the Chairman of the Gas Committee (Alderman Leason) urged that the matter should be proceeded with, it was decided to consider the report at a special meeting next Thursday.

THE GAS SUPPLY OF MANCHESTER.

The Deputy-Chairman of the Manchester Corporation Gas Committee (Mr. Gibson) delivered a lecture, last Wednesday, at Hulme, on the Manchester Corporation Gas Supply. At the outset, he recalled the condition of the city, especially as regarded its lighting, prior to the introduction of gas as an illuminant, and declared that the history of gas had been one of continuous scientific and industrial triumph, in which Manchester had played a most important part. That history he traced in detail, so far as it related to Manchester, from the year 1792 down to the present time. In 1818 the price of gas in Manchester was 14s. 6d. per 1000 cubic feet; and there were seven miles of gas-mains in the streets—the income from the undertaking being £163. People who were now asking for gas at cost price would be interested to learn that an exactly similar agitation was going on in 1824. There were grumblers then as there were grumblers to-day, largely recruited, of course, from the ranks of those who knew least about the subject. He admitted that in recent years the Gas Committee had not kept pace with the times. They ought to have provided more producing power and storage accommodation five years since. But a few years ago, it seemed very probable that the electric light would become a formidable competitor with gas; and his hearers would doubtless agree with him that the Committee exercised commendable caution in pursuing a waiting policy under those circumstances. The Committee were now taking steps to produce 5 million feet more of gas a day; and they had let contracts for enlarging the holders for an increased storage, the greater part of which they hoped to have in working order by next winter. In his opinion, the gas consumers of Manchester had very little cause for complaint in the price of gas. Out of 1703 gas companies in Great Britain, only six sold gas of the same illuminating power at a lower price than Manchester. Nevertheless, he believed something would soon be done in the way of reduction, although what it would be he was not at present at liberty to say. The value of the land occupied by the gas-works was £228,000, and of the plant £853,984. There were now 682½ miles of gas-mains and 625 miles of service-pipes, valued at £410,203; 14,511 street-lamps, valued at £9085; and 790,231 meters on hire, valued at £75,676—the whole standing on the books at £1,576,948. The original cost in round figures was 2½ millions; so that besides lighting the streets for nothing, and paying over to the rates large sums of money, the excess of assets of the gas-works over their liability was exactly £841,654. The gross producing power was 21 million cubic feet per day; and the gross storage, 16 million cubic feet. They had never had storage room for a day's make of gas; and he for one had strongly protested against this state of things during the whole of the time he had been a member of the Gas Committee. Under the arrangements that were about to be carried out, however, the storage capacity would be brought up to 25 million cubic feet per day. At present the Committee had 80,000 customers within a 10-mile area; and their turnover amounted to half a million every year. A vote of thanks was accorded to Mr. Gibson for his address.

LEEDS CORPORATION GAS SUPPLY.

A Description of the Works, and Some Statistics as to their Progress.

On the invitation of the Chairman (Alderman Gilston) and members of the Gas Committee of the Leeds County Council, about fifty members of the Corporation visited the borough gas-works last Thursday. The party first went to the New Wortley works, where the Manager (Mr. Smith) explained the different manufacturing operations. A visit was then paid to the meter-stores in Dewsbury Road; and the site adjoining the Meadow Lane works, recently acquired by the Corporation, was next inspected. It is proposed to erect thereon a gasholder of 5 million cubic feet capacity. The party were then conducted through the Meadow Lane works, being accompanied by the Manager (Mr. Tooley), and subsequently through the York Street works, being attended by the Manager (Mr. Townsley). Afterwards the company were entertained to tea by Alderman Gilston.

In view of the above visit, the Chairman of the Gas Committee (Alderman Gilston) and Mr. James Lupton (the Secretary and General Superintendent of the Gas Department) issued, in the form of a neatly got-up volume of about 40 pages, a sketch of the works from the period of their acquisition by the Corporation to the present date. The several works are dealt with separately, those in Meadow Lane being first. It is stated that they cover an area of 5 acres; and since they were transferred from the Leeds New Gas Company to the Corporation, they have been almost entirely reconstructed. Now they are capable of producing about 4,500,000 cubic feet of gas per day. There are 770 retorts, every one of which was in use during the past winter. When all are at work the consumption of coal is at the rate of 430 tons per day. During the past few years, some improved furnaces have been used, with the result that every ton of coal has produced 10,034 feet of gas; whereas in 1886 it only yielded 9664 feet. The total quantity of gas made at these works in 1891 was 918,933,000 feet. The gasholders at the works are of very limited capacity; the two only containing 427,000 feet. In 1878 another holder in connection with the Meadow Lane works was erected in Dewsbury Road, capable of storing 530,000 feet. This was the first of the gasholders constructed with three lifts, of which the Corporation now possess eight. The Council have recently purchased a large plot of land called the Leeds Forge Estate, abutting on Holmes Street, and adjoining the present gas-works, for the purpose of extension when this is necessary. A description of the York Street station is next given. Here there are 380 retorts, which last winter produced an average of 2,121,000 cubic feet of gas per day. Ten years ago the quantity they made was only 1,441,000 feet—an increase of 47 per cent. With regard to the New Wortley works, the largest in the borough, it is stated that they were purchased in 1857 from the Leeds Gaslight Company. The land occupied by the works and holders is 11½ acres in extent. In the lower works there are 363 retorts, equal to the production of 2,250,000 cubic feet of gas per day; whilst in what are known as No. 2 works, which were started in 1881, there are 892 retorts, which can make 5,500,000 cubic feet. In 1882 the quantity of gas made at these works was 524,007,400 cubic feet; and in 1890 it was more than double, or 1,071,123,900 feet.

Mr. W. Suddaby, the Superintendent of the street-mains, gives a report of the department under his control, in which he states that the maximum 24 hours' consumption in 1879 was 7,500,300 feet. The maximum 24 hours' consumption in January, 1891, was 14,139,500 feet. As there is only a total storage capacity of 10,500,000 cubic feet, or a 16-hours' supply, he is of opinion that to place the distributing apparatus in a state of efficiency, there should be at least a storage capacity for 24-hours' production during the depth of winter. This would necessitate an increase of gasholder capacity of about 4,500,000 cubic feet. There are in the borough 700 miles of mains, varying in size from 30 inches to 1½ inches. The area to be lighted is about thirteen square miles. The pamphlet also gives the following interesting particulars: The illuminating power of the gas has been considerably improved since the time of purchase. It is now, and has been since 1888, when the 24-hole burner was adopted for testing purposes, upwards of 19 candles. The sulphur impurity has been reduced from 40 grains per 100 cubic feet in 1880 to an average of 16.36 grains during the year ending June 30 last. The number of meters in use has been increased from 58,700 in 1871 and 67,400 in 1881 to 82,500 in 1891. There are upwards of 1000 gas-engines in use in Leeds varying from ½-horse power to 16-horse power. In June last there were no less than 1105 gas cooking-stoves in operation. A series of tables is given at the end of the book, which show at a glance the great strides which the department has made since it was taken over by the Corporation. In one, as to the cost of coal and labour, it is shown that in the year ending June 30, 1871, 98,878 tons of coal, costing £45,006 (or 9s. 1½d. per ton), were used, while the wages of the hands employed amounted to £13,483. Since then these figures, except those showing the price of coal, have steadily increased. In the year 1890-91, no less than 240,587 tons of coal were consumed. This cost £144,217; the price being 12s. per ton. During the same period £46,260 was paid in wages. The price of coal has varied from 7s. 7d. in 1881 to 17s. 8½d. in 1874. Another table shows that the income from residuals per ton of coal carbonized has varied from 3s. 7d. in 1871 to 7s. 7½d. in 1883. Last year it was 5s. 9½d. From the capital account, it appears that the amount expended at the time of the purchase was £763,224. To this sum £367,212 has since been added. In 1871 the cost of capital per ton of coal carbonized was £7 16s. 8d.; and in 1891 it was £4 14s.

LEICESTER CORPORATION GAS AND WATER SUPPLY.

The Half-Yearly Accounts.

At a Special Meeting of the Council of the County Borough of Leicester last Tuesday—the DEPUTY-MAYOR (Alderman Kempson) presiding—the accounts of the gas and water undertakings for the half year ended Dec. 31 last were presented.

The Gas Committee reported that their accounts for the half year ended Dec. 31 last showed that the net profit was £11,778. Out of this sum had been paid £2762, the half-year's amount of sinking fund; leaving a balance of £9016, which, added to the balance of net profit (£12,174) for the half year ending June 30, would make a total of £21,190 to be applied to the district fund at the close of the current financial year (the 25th inst.); or from which the Council might, if they were so minded, increase the present reserve fund of £5000, or appropriate or set aside a sum to be applicable for the renewal of works. The net amount realized by the residual products manufacture was £7167. With regard to the gas-fitting business, the half-year's working showed a net profit of £401. The Committee recommended that a sum of £3000 be placed to the gas-works renewal fund, and that the remainder of the net balance, £18,190, be applied to the district fund. During the half year 53,447 tons of coal had been carbonized. The quantity of gas made was 563,214,000 cubic feet, as against 543,017,000 feet in the corresponding half of the previous year; being an increase of 20,197,000 feet, or 3.71 per cent. No. 2 section of the Aylestone Road works had been working at its maximum throughout the winter in a most satisfactory manner; and every portion of the plant had in its working fully realized the expectations of the Committee.

Mr. BILLINGS, in the unavoidable absence, through illness, of the Chairman of the Committee (Mr. Lennard), moved the adoption of the report. He drew attention to the fact that last year the Council allowed the Committee to put £5000 towards the renewal fund. The Committee had thought of asking for £3000 for a similar purpose on the present occasion; but, like all other departments of the Corporation, they were anxious to keep the rates as low as possible, and had accordingly agreed to ask for only £2000. The balance-sheet showed that the work for the past half year had been most satisfactory. The profits showed a decrease of £2015, as compared with the corresponding period last year. It would probably interest the Council and the public to know how much of this decrease was owing to the reduction of the meter-rents and the price of gas in the extended districts. The reduction in the meter-rents was responsible for £634, and the lower price of gas for £459; making a total of £1093. He also reminded the Council that the Committee had not, like many other committees and gas companies throughout the country, increased the price of gas, in consequence of advances in the price of coal and workmen's wages.

The motion having been seconded,

Alderman INSKIP asked for some information with regard to the cause of the strike which recently took place at the Aylestone Road works, and urged the advisability of steps being taken in the near future to reduce the price of gas by at least 2d. per 1000 cubic feet, with the view to more directly benefiting the consumers. He contended that, under the existing system, property owners, and those who compounded for rates, alone received direct benefit.

Mr. HINCKS hoped that, in replying to the discussion, Mr. Billings would be able to give the Council and the town some information as to their present intention with regard to the introduction of the electric light.

Alderman WOOD, in supporting the adoption of the report, emphasized what Mr. Billings had said as to the great increase of expenditure with which the Committee had had to contend, in consequence of the rise in the price of coal and the advances which had been made in the

matter of labour, and gave it as his opinion that, under all the circumstances, the report was a very favourable one, and one upon which the Committee might be fairly congratulated. If they reduced the price of gas, as suggested by Alderman Inskip, they would add to the difficulties of the manufacturers; and he hoped it would be a long time before they saw the price of gas lowered materially, unless they had a corresponding decrease in the cost of coal, on account of the great relief which the present system gave to ratepayers generally in the town.

Mr. EDWARDS thought the arguments which the last speaker had used were most unfortunate. He believed a reduction of 2d. in the price of gas would be a great advantage to manufacturers instead of a disadvantage.

Alderman WOOD: What I mean is that the manufacturers generally are the largest ratepayers in the town; and they would suffer in that direction.

Mr. WAKERLEY fully agreed with the principle laid down by Alderman Inskip; but he asked him whether he knew of any trading concern with an invested capital of three-quarters of a million, the proprietors of which were content with a net profit equal to that which satisfied those who had the sole responsibility of the gas-works upon their shoulders. It must not be forgotten that, whereas now the Gas Committee were making a profit, next year they might make a loss; and he took it that, in such event, the loss would fall not on the consumers but on the ratepayers.

Mr. BILLINGS, replying to Alderman Inskip's question concerning the recent strike, said the men in question were receiving wages quite equal to those paid by other corporations, or private firms, for a similar class of labour; and that the prompt action which the Engineer (Mr. A. Colson) took to fill their places, was fully endorsed by the Chairman (Mr. Lennard) and the Committee generally. As to the electric light, it had proved so unsatisfactory to public bodies who had attempted to adopt it, that the Committee considered that waiting was the safest plan. Every month that they delayed the matter tended to strengthen their position. They would have to adopt it, but they were anxious to defer its adoption until they could satisfy themselves as to the most approved methods.

The motion was then agreed to.

The Water Committee reported that the accounts of the undertaking for the half year ending Dec. 31 last showed a net profit of £8188. Out of this had been paid the sum of £2024, the half-year's amount of sinking fund, leaving a balance of £6164, which, added, to the balance of net profit (£5283) for the half year ended June 30 last, would make a total of £11,448 to be dealt with by the Council at the close of the current financial year. The taxed costs of obtaining the Act of 1890 were £2309, of which £104 had already been paid out of revenue; leaving £2205 to be provided for. A period of not exceeding ten years was allowed by the Act for repayment of these expenses; and the Committee recommended that the amount be paid out of profits during the next five years by equal instalments. The payment for the present year would be £441; and the Committee recommended that the remainder of the above net balance—£11,007—be applied for the benefit of the district fund. The Committee also recommended that the salary of Mr. Griffith, the Resident Engineer and Manager of the undertaking, be increased from £500 to £600 per annum. The quantity of water delivered during the past year within the limits of supply had been 1,207,785,890 gallons; and the average consumption of water per day per head of the population supplied had been 17.64 gallons. This also included the quantity supplied for trade purposes. The number of houses on the books at the end of December was 38,193; giving an estimated population of 190,965.

Alderman WOOD, in moving the adoption of the report, gave some statistics showing that while the water population had nearly doubled since the Corporation acquired the works, the consumption per head of the population had, owing to careful supervision, very materially decreased, and that the financial results had correspondingly improved. As to the proposed increase in Mr. Griffith's salary, the Committee were unanimous in making the recommendation, believing that they were only thereby doing justice to a most efficient officer.

Mr. COLEMAN seconded the motion, which, after a short discussion, was agreed to.

The Hadlow Gas Undertaking.—After having been carried on for upwards of 30 years by the Hadlow Gas, Coal, and Coke Company, Limited, the undertaking has been purchased by a new Company, to be known as the Hadlow Gas Company. Mr. W. A. Williams, late of the Hastings and St. Leonards Gas Company, is Secretary of the new Company, the offices of which are in High Street, Tonbridge.

Southend Gas Company.—At the annual general meeting of this Company next Thursday, the Directors will report a balance of £1159 available for division, out of which they will recommend the declaration of the statutory dividends, which will leave £159 to be carried forward. The receipts for the year were £8151; the expenses, £6441—leaving £1710 to go to the profit and loss account.

Exmouth Gas Company.—The annual general meeting of this Company will be held next Saturday, when the Directors will report a sum of £1213 available for division, and will recommend the declaration of dividends at the rates of 10 per cent. per annum on the "A" stock, and of 7 per cent. per annum on the "B" and "C" stocks, free of income-tax. This will absorb £640; and there will consequently be left a balance of £573 to be carried forward. The total receipts amounted to £4186, and the expenditure to £3223; leaving £963 to go to the profit and loss account. On the whole, the year's working was satisfactory—a result attained mainly by the increased consumption of gas, and the realization of a better price for coke, coupled with the exercise of economy in every department of expenditure. Owing to a falling off in the sales of ammoniacal liquor, and the necessity for disposing of it at a loss, the Directors have decided to erect plant to convert it into sulphate. Other extensions and alterations are about to be carried out in the current year; and for this purpose additional capital has been raised. The Company have been troubled over the re-assessment of their works; the amount having been increased from £436 to £796. The Directors appealed, but without any good result.

THE GAS-WORKS PURCHASE QUESTION AT BIDEFORD.

At a Meeting of the Bideford Town Council last week—the Mayor (Mr. M. Dymond) presiding—the Sub-Committee appointed to consider the gas question presented a further report. It will be remembered that the Council agreed either to name a price, allow the Gas Company to state a price, or leave the matter entirely to arbitration. The reply sent by the Directors was to the effect that a meeting of shareholders considered that the Council had totally ignored the terms of the Directors set forth in their resolution of the 29th ult., as a basis of settlement, and that the Council had therefore closed the negotiations; and that the Directors were instructed by the shareholders to proceed with their application for a Provisional Order, and to communicate the resolution to the Board of Trade. The Sub-Committee, as the result of this reply, recommended the Council to inform the Board of Trade that they considered the construction put upon the matter by the Gas Company was not warranted by the facts of the case. On the other hand, the Corporation had been earnest in their endeavour to arrive at a satisfactory basis for settlement, and that the offer of arbitration, and the alternate scheme of receiving and submitting a price, showed the entire feeling of the Corporation in the matter; that the ratepayers had been twice convened and approved the principle of the gas undertaking being the property of the Corporation; that the Town Council by their resolution of the 9th inst., adopted the principle of arbitration as suggested by the Directors; that it was true the offer was not accepted by the Council within the period stated by the Directors, but the Board of Trade should bear in mind that, in a question of this kind, it was absolutely necessary to convene special meetings of the Council to consider such important matters, and in the interests of the ratepayers to consult them on the subject; that the Council had expressed themselves willing to purchase, leaving all questions to arbitration, but that they considered the demands put into the agreement by the Gas Company in regard to the purchase were such as would be manifestly unfair, and prejudicial to the minds of the arbitrators under either conditions; also to inform the Board of Trade that the Council had been given to understand that, at a meeting of the Company on the 12th inst., a proposal to confer the undertaking upon the Council on payment of £20 per share on the paid-up capital, and £250 in addition to clear all expenses (leaving £20 for each £10 share), was rejected. The report of the Sub-Committee was adopted; and the Sub-Committee were asked to continue their services, and take what measures they thought fit to oppose the granting of an Order to the Company. It was further agreed that a Committee, consisting of the whole Board, should consider the advisability of undertaking the public lighting, and also the plans sent in competition for lighting the town by electricity.

ELECTRIC LIGHTING QUESTIONS AT LIVERPOOL.

The Watch Committee of the Liverpool Corporation, at their meeting on the 7th inst., came to a decision in regard to the proposal to substitute electricity for gas in the lighting of the streets. A report was presented by Mr. H. P. Boulnois (the City Engineer), who had gone very carefully into the subject. After describing the action that had already been taken by the Council, and the results of the experiments that had been made, the Engineer embodied in his report the information he had obtained from other towns, where the electric light is now in use. But the most important part of Mr. Boulnois's statement is that dealing with local areas. He had prepared plans of two areas, one including the whole of the central portion of the city, and the other an equally central but much smaller section. In the consideration of this subject, two things, he said, had to be taken into account—first, the increase in the illuminating power; and, secondly, equal illumination at a reduced cost. As to the best method, he was of opinion that the best electrical system at present known was that of lighting the streets by means of arc lamps of from 1200 to 2000 candle power (nominal) each, placed at such heights and in such positions as would secure the maximum effect of the light. With regard to the probable cost of using the electric light in lieu of the present mode of lighting the city, the experience of other towns, he said, showed that the introduction of electric lights in place of gas-lamps invariably cost more; but this cost was accompanied by greatly increased efficiency of illumination. Mr. Boulnois was of opinion that overhead wiring would not be for one moment tolerated in Liverpool as a permanent means of supplying energy to the lamps; and consequently his estimates were based upon underground cables, and included lamps and standards of an ornamental character. The estimate was as follows—First cost: Electric installation, including land, buildings, machinery, dynamos, &c., cables, arc lamps, and standards, say £35,750. Annual cost: Supplying energy to, and maintenance and cleaning, &c., of lamps for the district bounded by Hanover Street on the one side and Tithebarn Street on the other, less the contribution from the Mersey Docks and Harbour Board for lighting the landing-stage, &c., £7900; interest and sinking fund on £28,650, say £1958—making the total estimated cost per annum £9858. There was some discussion on the report; and eventually the following resolution was passed: "That, pursuant to the resolution of the Council of the 28th of October, 1891, it be reported that the Watch Committee, having considered the question of using the electric light in lieu of the present mode of lighting the city, are of opinion that, having regard to the conditions of rapid development to which the system of electric lighting is now subject, it is not at present advisable to adopt the system in this city."

On the recommendation of the Watch Committee, the City Council, at their recent meeting, passed a resolution to the effect that the Board of Trade should be informed that the Corporation were willing to withdraw their opposition to the Order of the Liverpool Electric Supply Company (see *ante*, p. 263), and to give their consent to it being granted, provided it was amended in accordance with the terms approved of by the Committee. Mr. Hornby, the Chairman of the Committee, explained that this was a fair compromise; the Corporation securing power to purchase the undertaking after the lapse of a certain period. At particular intervals the Board of Trade might be approached, and might alter the mode and amount of payment.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

What, under the Act of Parliament, is called their annual meeting, but the foolishness of so naming it I have before pointed out, was held by the Edinburgh and Leith Gas Commission on Monday. It was arranged to hold the meeting on the day, when the Standing Committees of the Commission usually met; and the effect of the arrangement was that, when the hour arrived, the Committees had not finished their business, and so there would have been nothing to do except to make a correction on the minutes of the previous meeting, had not Mr. Kinloch Anderson introduced the subject of the extension of the Edinburgh works. The subject was before them last year; but it was then held over. It is now, Mr. Kinloch Anderson said, necessary to go on with the extension of the condensing plant, and the erection of new purifiers and a new gasholder. It is estimated that the cost will be over £44,000. The necessity for these works lies in the increased consumption of gas, and the loss in working consequent upon want of accommodation. Bailie Steel, in supporting the proposal, said they had not storage for one day's consumption, and several foggy days might throw them into darkness. It was agreed that the Works Committee should consider the subject, taking into account that it might be more suitable to construct the new plant at the Leith works, where there is more room than at the Edinburgh works. At the conclusion of the public meeting, the Committees resumed their business. There will now be no meeting of the Commission till the end of April; and therefore this so-called "annual meeting" may be the occasion of some inconvenience.

It is sometimes with a tinge of melancholy that one reads in the daily press of the great things which are being done to advance electric lighting—the melancholy arising from the knowledge that all that is stated is not solid truth, but is often as insubstantial as any "castle in the air." How very seldom does the ordinary newspaper scribe feel called upon to say a good word for gas-lighting? Occasionally, however, there does appear a statement relating to gas-lighting which bears an appreciative tone; and it is all the more refreshing that it is generally a record of hard fact. Such a statement is to-day made by a Dundee newspaper with reference to the output of gas in that city. The estimate for the current year, it is pointed out, was 490 million cubic feet, which was an increase of 20 million cubic feet upon last year; yet, although there are still two months of the year to run, the output at present is nearly 30 million cubic feet above what it was at the same date last year, and the largest which has ever been experienced within a corresponding period. There is also an increase of the gas-rental; but that is a natural consequence of the rise in price which was imposed last year. The important thing is that there has been a so much larger consumption in the face of the rise in price.

The dissatisfaction which has been expressed during the past year or two, both inside the Town Council of Stirling and amongst the ratepayers outside, with regard to the price charged for gas, seems now to have had the effect of inducing the Directors of the Stirling Gas Company to believe that there must have been some good reason for the complaints that were made from time to time; for on Monday it was resolved to reduce the price of the gas from 4s. 2d. to 3s. 11d. per 1000 cubic feet, the reduction to take effect on current accounts from the survey of meters in January last. It is said that this reduction has been rendered possible by some favourable contracts for coal which have been made by the Gas Company.

Gas matters were up before several Burgh Commissions and Town Councils at the monthly meetings held last Monday. The Lighting Committee of the Kirkintilloch Police Commission submitted plans of alterations at the gas-works, whereby the productive and storage capacity of the works will be considerably increased. The proposed alterations are estimated to cost £2700; and when the improvements are carried out, the works will be in a position, it is believed, to meet the demands of the town for many years to come. The Committee's recommendation was adopted. The Renfrew Town Council agreed to proceed with some contemplated extensions of the gas-works, at an estimated cost of £1650; and for this purpose it was agreed to purchase an adjoining property, at a cost of an additional sum of £1800. I may mention that at Renfrew, as at Kirkintilloch, Mr. James M'Gilchrist is the Gas Engineer appointed to plan and carry out the proposed works extensions. The same gentleman has also been commissioned by the Gourrock Gas Commissioners to inspect their gas-works and report as to what extensions are required in order to fit them to provide the increased quantity of gas that is likely to be needed for the rapidly-increasing population of the burgh.

On Wednesday evening the workpeople connected with the Dawsholm and Temple Farm gas-works of the Glasgow Corporation held their first annual social festival in the Burgh Hall, Maryhill. Mr. A. Wilson, Manager of the two stations, occupied the chair, and amongst those who supported him on the platform there were no fewer than five of the Glasgow Town Councillors, Dr. Macdonald, Mr. W. Foulis, and Mr. Key. After tea the Chairman delivered an interesting address. He said that ten years ago at Dawsholm, during the busiest fortnight of the year, the number of men employed was 300, who were paid in the shape of wages for the fortnight the sum of £760. During the corresponding fortnight of this year, however, there were 800 men employed at the works; and their wages amounted to £2030. Then again, ten years ago the annual consumption of coal was 58,000 tons; whereas it has now risen to 130,000 tons. In fact, so great had the demand for gas become, that the Gas Commissioners were under the necessity of largely increasing their plant so as to keep pace with it. They were at present putting down a large gasholder, which would contain four times as much gas as the largest of the present holders. Then, also, they were about to start a new retort-house, with all the necessary plant; so that when they got all the new additions ready, their works at Dawsholm would be fully double their present size, and there would be plenty of work in the future for the men to look forward to. Mr. Wilson subsequently addressed the men upon provident clubs, so as to secure medical attendance and pecuniary help in times of sickness or bereavement. Messrs. Foulis and Key also spoke, giving a few words of encouragement to the men and congratulating them upon

the good spirit which prevailed amongst them at the Temple Farm and Dawsholm works.

The Paisley Gas Commissioners, as also the consumers of gas throughout the town, have had a very decided "sensation" this week in connection with their local gas affairs, or rather in connection with a most extraordinary and unexpected increase in the gas bills. At a meeting of the Commissioners on Tuesday, the Gas Committee's minutes showed that at a meeting held in Committee, a letter was read from Mr. John Davie, Secretary of the Fifth Ward Committee, stating that various complaints regarding high gas bills had been fully considered by his Committee, who were unanimous in their finding that there was something seriously wrong; for, while the gas was cheaper, the accounts in many cases were almost double what they were formerly. A report on the subject was submitted, which led to a long and serious discussion; and eventually it was remitted back to the Gas Committee for further consideration before taking any action upon it.

Electric lighting business is not likely to be advanced much by an action which was decided by Lord Low in the Court of Session yesterday. The misfortune is that it has received but very scant notice at the hands of the daily press; and in the electrical press it will likely receive less, as its representatives in the Court professed to look upon the action as "a very small matter." A very small matter is sometimes a very significant one; and I look upon this as being in that position. Mr. Henry Grierson, a Glasgow merchant, who occupies a house in the neighbourhood of Edinburgh, in a district where he might easily have had a supply of Edinburgh gas for less than £100, inclusive of fittings, fancied that he would like to introduce the electric light; and he approached Messrs. Mavor and Coulson, of Glasgow, with a request for an estimate of the cost. An estimate was sent in of £1100, "as the cost of fitting up the house with 130 lamps of 16-candle power each, the price to be exclusive of all mason work, foundations for engine and dynamo, and fittings." The estimate led to some cavil by Mr. Grierson, as to additional lamps; and he was assured by the offerers that "they would carry out the work as economically as possible, but they did not bind him to the price." This satisfied Mr. Grierson, and the work was proceeded with. When the account came in, it amounted to £1471 14s. 9d. Of that sum Mr. Grierson paid £1302 4s. 2d., but declined to pay the balance of £169 10s. 7d., because he considered the account was overcharged. It was to recover the balance that the action was brought. His Lordship held the estimate to be only an approximate one; and he gave decree against Mr. Grierson for £128 4s. 2d. That makes Mr. Grierson's initial cost nearly £10 per lamp, which is sufficient to stamp electric lighting as what its friends are willing to have it called—"a light of luxury."

In prosecution of their quest for information as to what is being done in other towns in the matter of electric lighting, a Committee of the Edinburgh Town Council visited Glasgow on Wednesday, where they were met by the Gas and Electric Lighting Committee of the city, along with whom were Mr. W. Foulis, and also Mr. Arnot, the Electrical Engineer. The visitors were shown all that has been done in Glasgow; and had explained to them all that is proposed to be done, with the system and methods to be adopted and the estimated cost.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, March 19.

Sulphate of Ammonia.—The tone of the market has been quiet. But a steady feeling prevails; and there is every appearance as if the lowest point had been reached for the present. Shipments are on a satisfactory scale; stocks do not increase, the production beginning to fall off considerably, and more buyers are turning up; while the sudden advent of warmer and spring-like weather can only tend to stimulate the demand all round. The Hull market is therefore firm at £10 5s.; Liverpool, at £10 2s. 6d.; and a large business is reported at Leith at £10 3s. 9d. to £10 5s. Inquiries for future delivery (summer and autumn this year, and the spring of 1893) are coming up more freely; indicating confidence in this commodity, notwithstanding a falling nitrate market, and the considerably reduced quotations of the latter for summer shipments. This circumstance does not favourably impress buyers with the probability of high sulphate values during the summer; but evidently the fact, that sulphate is really so much cheaper than nitrate, weighs in the balance of opinion, and makes consumers think well of sulphate at current values, independent of any lower range in nitrate. Of course, no producers are willing to sell for forward delivery at present exceedingly low prices; and it seems doubtful whether speculators will run the same risk for late deliveries, which they do already for April-May shipments. Nitrate is now offering on spot at 9s. 3d.

LONDON, March 19.

Tar Products.—Benzols are flat; and the small quantity that has been sold during the week is at a lower price. There is very little business doing in any of the other tar products; and although pitch is being largely shipped, it is chiefly on account of the sales made last year. Two large contracts for tar have been made during the week—one at 12s. 9d., and the other at 14s. There is a little inquiry for carbolic acid; but buyers are offering less money than it can be produced at. Anthracene continues neglected; and the prices below are nominal. Stocks are accumulating; and it is more than likely that an offer considerably below the price quoted would lead to business. Prices are: Tar, 13s. Pitch, 30s. Benzol, 90's, 2s.; 50's, 1s. 6d. Toluol, 1s. 4d. Solvent naphtha, 1s. 3d. Crude benzol naphtha, 30 per cent., 10s. 4d. Creosote, 3d. Naphthalene salts, 20s.; pressed, 45s. Carbolic acid, crude, 60's, 1s.; 70's, 1s. 4d. Crystals, 4s. Cresol, 8d. Anthracene, 30 per cent., "A" quality, 11d.; "B," 8d.

Sulphate of Ammonia.—Sales are only possible at continually lower prices. There is an extraordinary absence of demand, taking into account the time of the year. It is expected, however, with better weather that buyers will purchase more freely. There are large stocks in makers' hands; and it is difficult to obtain more than £10, less 3½ per cent. Gas liquor (10 oz.) sells at 5s. 6d. to 7s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Except that collieries in most cases have on hand a large number of unexpected orders for the better qualities of round coal, which will probably take them two or three weeks to clear off, the coal-trade of this district, after the absurd and unnecessary excitement produced by the colliers' holiday stoppage of a week, may now be said to have got back into something like its normal condition. As anticipated, the Miners' Conference in London, decided not to prolong the stoppage beyond the week; and at a special meeting of the coalowners of Lancashire and Cheshire, held in Manchester on Thursday, it was practically agreed not to place any difficulties in the way of a resumption of work. The collieries throughout this district consequently resume their regular operations this week; and the exceptional prices which have recently been ruling, will necessarily speedily disappear. During the last few days, the new business coming forward has been extraordinarily small; and for the most part collieries have been doing little more than making deliveries on account of orders already placed, whilst in a good many instances consumers have got in large extra supplies which will meet their requirements considerably beyond the resumption of the regular output of the pits. Prices are already showing a very decided downward tendency; but for the present they are so very irregular, that definite quotations are scarcely reliable. Many of the leading firms have continued all through to supply their regular customers at the old rates; but in the open market all descriptions of round coal have been maintaining a substantial advance. Even now it would be difficult to place orders for best Wigan-Arley at under 13s. per ton, with Pemberton four-feet and second qualities ranging from 10s. 6d. to 11s. 6d. per ton, and common round coals at 9s. 6d. to 10s. per ton, at the pit mouth. Engine classes of fuel—owing to the increased quantity of slack that has been screened from the coal, in filling up out of stock—have been offering more freely in the market. Prices for these have been rapidly giving way—representatives of collieries in some instances pushing sales at fully 1s. per ton under recent quotations—and with the prospect of continued excessive supplies in the market, prices will no doubt quickly recede to something like old rates. At present, burgy may be readily bought at from 7s. 6d. to 8s. per ton; the better qualities of slack, at 5s. 6d. to 6s.; and common sorts, at about 4s. to 5s. per ton, at the pit mouth. For shipping coal, owing to the temporarily limited supplies, exceptional prices have been obtained; and for delivery at the Garston Docks, or the High Level, Liverpool, 14s. 6d. has been paid to secure prompt deliveries of ordinary descriptions of steam coal.

Northern Coal Trade.—There is still excitement in the Durham coal trade, though the recommencement of work by the Midland collieries has lessened it. The Northumbrian miners have continued at work throughout, and have produced very large quantities of steam coal, and comparatively heavy deliveries of gas coal for the few pits in that county that yield this class. Prices of steam coal shot up to 14s. per ton, but are now falling again; and there was a considerable quantity of Northumbrian coal sent out of the county for use as household coal at even higher prices. The gas coals that were produced naturally found a ready market in the absence of the supplies from Durham. After contracts were met, sales up to 10s. 6d. per ton were recorded on the first day of the strike; and on the following day 13s. was paid, and a still higher price asked. But it is obvious that such prices could be only for small lots, because the amount of uncontracted coal was limited. Household coal fluctuated in value—as high as 19s. per ton, delivered in Newcastle, was charged in some instances. Indeed, for certain classes of coal, where supplies were essential, it has been more a question of obtaining them in time than of price. But this is passing away; and the starting of the midland pits will throw surplus coal into Durham until the end of the strike there. Coke has been very scarce; and as high as 20s. per ton at the ovens has been paid for best Durham furnace coke. Gas coke has been a little more sold for household purposes; but it is still abundant, and the stoppage of some works has lessened the consumption for manufacturing purposes. The effects of the strike, indeed, will long be seriously felt on the Tyne and Wear and at Middlesbrough.

West of Scotland.—There is an absence of excitement in the coal trade in this district. Good business has been done, shipping to Ireland being particularly brisk, while a good many orders have been received from ports on the North-west coast of England. In connection with small coals, a better demand prevails for nuts. Prices are irregular; but the following are the rates at which business can be done at Glasgow harbour: Splint, 9s. to 9s. 6d. per ton f.o.b.; main coal, 8s. 3d. to 8s. 6d.; steam, 10s. to 10s. 6d.; ell, 8s. 6d. to 9s. 6d. The shipments of Scotch coal last week reached a total of 129,487 tons—an increase, compared with the corresponding week last year, of 13,217 tons. The increased shipments have been principally coastwise. For the year up to last Saturday, the shipments total to 1,086,858 tons—an increase of 164,054 tons over the corresponding period last year.

Bristol Water Company.—The Directors of this Company have resolved to recommend dividends for the half year ending the 31st of December last at the rate of 7½ per cent. per annum on the ordinary shares, and at the rate of 5½ per cent. per annum on the 7 per cent. maximum ordinary stock.

Buenos Ayres Water Supply and Drainage Company.—Mr. Justice North last Tuesday delivered judgment on the petition presented by this Company for the approval of a scheme of arrangement, under which certain bonds of the Argentine Government, delivered over in consideration of the concession being put an end to, and the works transferred to the Government, were to be allotted to the holders of debenture scrip and preference shares. The scheme was opposed by holders of ordinary shares, who contended that the contracts in question were *ultra vires*, and that the arrangement was made by Messrs. Baring in their own interest. His Lordship, however, after going through all the details of the matter, overruled the objections, and sanctioned the scheme as asked by the petition.

Increased Storage for the Ashton Local Board Gas-Works.—The Gas Committee of the Ashton Local Board have come to the conclusion that increased storage accommodation is necessary at their works; and they have appointed Mr. J. Timmins, the Gas Engineer of the Wigan Corporation, to carry out the work.

Increased Storage Capacity at the Truro Gas-Works.—The Truro Gas Company are about to increase the storage capacity of their works by the erection of an additional telescopic holder, capable of containing 60,000 cubic feet of gas, with a cast-iron tank. The work has been entrusted to Messrs. Willey & Co., of Exeter.

Important Extensions of Gas Plant.—Messrs. R. Dempster and Sons, Limited, of Elland, report that the prospects for manufacturers of gas plant for the current year are exceptionally good; a large number of inquiries (particularly for retort-house extensions) having already been received. The firm have recently secured a contract for a 40,000 cubic feet per hour rotary exhauster, with engine combined, for the Chorley Corporation.

New Water-Works for Mansfield.—A special meeting of the Mansfield Town Council was held last Wednesday, to consider the question of providing an additional water supply for the town. The existing works were purchased for about £20,000 a few years ago; and they have now become unsatisfactory. A new scheme has been propounded by Mr. Hodson, C.E., to carry out which an expense of about £25,000 would be incurred. Objection was taken to this undertaking; the Ratepayers' Association particularly urging that a sufficient supply could be obtained at the existing works if an additional boring was made. The question was fully considered by the Council; and eventually a resolution was adopted which embodied modifications of Mr. Hodson's scheme; and he was instructed to carry it out at a cost not exceeding £20,000.

Exhibitions of Gas Appliances.—An exhibition of gas appliances was opened last week in the crypt of the Town Hall, Middlesbrough, by Alderman Hugh Bell, J.P., Chairman of the Corporation Gas Committee. The stoves and lamps shown were supplied by Messrs. Richmond and Co., Limited, of Warrington and London, who also had a display at Southport, in which town an exhibition was at the same time held by Messrs. John Wright and Co., Limited, of Birmingham. Messrs. Richmond and Co. have commenced a series of exhibitions in the London district—the first being opened last week at Putney, where Mr. Elsener (a Swiss chef) and Mrs. Bennett gave lectures on cookery. This firm have just appointed Mr. Arthur Mead, Assoc. M. Inst. C. E., as their representative in the East and South-West of England, and South Wales.

The Career of a Steady Gas Stoker.—Nearly 40 years ago, one of the stokers at the York Gas-Works, named Robert Robson, left that city for the United States. He was a man of very steady habits; and therefore he attracted the attention of the present Manager, Mr. Charles Sellers, who was then a clerk; and an unbroken friendship was maintained between them. Robson landed in America with the intention of going to Buffalo; but as he had not the means of paying his travelling expenses, he walked by way of the track of the Grand Trunk Railway—occasionally working amongst the farmers by daylight, and lodging where he could at night. In this way, he finally reached Buffalo. He was a brickmaker by trade, but preferred gas stoking; and on arriving at Buffalo he went straight to the gas-works, and was put on to his favourite occupation. Here again his sobriety and intelligence were soon noticed by the Manager, who in a short time promoted Robson to the position of a foreman, from which he rose to that of Superintendent, and finally was made Manager. This latter position he held for a number of years, until he saw his way to turning his old brickmaking knowledge to account. He bought land and machinery, and became one of the principal brickmakers in Buffalo. Some five or six years ago, having made sufficient money to supply all his wants, he decided to give up business. He visited England four times after he first left it; and never failed to call on his old friend, Mr. Sellers, at the York Gas-Works. He took great interest in the working classes; and regarded drink as the greatest curse in society, and education as its greatest blessing. A short time ago he had an attack of paralysis, to which he succumbed on the 25th ult., at the age of 72.

The Newtownards Gas Undertaking.—As an instance of a successful gas undertaking, attention may be directed to that of the Newtownards Town Commissioners, the practical supervision of which is in the hands of Mr. A. Waddell. The works were purchased rather more than seven years ago at a cost of £9386, to pay which, and provide office furniture and stores, a sum of £10,000 was borrowed. Of this amount, £1750 had been repaid at the close of last year, and £1200 added to the capital of the concern out of revenue. The renewal account has been abnormally large—viz., £1438—partly owing to the fact that the retorts have been completely changed since Mr. Waddell took office, and the regenerative system adopted. Mr. A. Silverthorne gave the average production for three years, in his report recommending the purchase of the works, at 8128 feet per ton, less leakage 27·77 per cent., or 5872 cubic feet net sold. The present make is 10,000 cubic feet per ton, less 12 per cent. leakage, or 8775 feet sold; being an increase of nearly 3000 feet per ton. The residuals account has been about doubled. It may perhaps be asked: What has been done with the profits? The consumers had the first claim, and the price of gas was gradually reduced from 7s. 6d. to 4s. 2d. per 1000 cubic feet, with discounts to large consumers varying from 2½ to 12½ per cent. This has resulted in a saving to them, since the purchase of the works, of £6766; and the quality of the gas has been improved from 16 to 18 candles. Then the workmen have not been forgotten; for their wages have been raised 20 per cent., and in one instance by 33½ per cent. The Manager's salary has also been increased by 20 per cent. In putting these facts before the Commissioners, the Chairman of the Gas Committee said he did not believe this record could be broken in the history of any gas-works in Ireland. Their debt was smaller, the value of the premises had been increased, the gas consumers had upwards of £6000 in their pockets by reductions in price, the workers' wages had been considerably advanced, and the Committee had kept up their payments regularly and punctually.

The Liverpool Corporation and the Gas Company's Bill.—On Monday last week, a conference took place between the Parliamentary Committee of the Liverpool City Council and representatives of the Liverpool United Gaslight Company on the subject of the Company's Bill now before Parliament. The provisions of the measure were fully considered; and the Company agreed to certain modifications with reference to the proposed erection of additional gasholders. As the result of the discussion, the Committee decided to recommend the Council to withdraw their opposition to the Bill.

New Joint Stock Companies.—The Upton-on-Severn Gas Company, Limited, has been registered with a capital of £5000, in £5 shares, to carry on the business of gas supply at Upton-on-Severn, Worcester-shire. The Durham Coke and Bye-Products Company, which has been registered with a capital of £25,000, in £100 shares, is to acquire the right, title, and interest of Messrs. Simon, Carvès, Pernolet, and Mallet, under a contract made with Mr. S. A. Sadler, of Middlesbrough, and generally to carry on the business of carbonizing coal and manufacturing the residual products therefrom.

Hunts and Godmanchester Gas Company.—At the recent annual meeting of this Company, the Directors reported that the business of the half year ending Dec. 31 had been very satisfactory. The accounts showed that £1199 was available for dividend. As the Company have no working capital, they had been obliged to defray current expenditure out of the money earned last year. It was to avoid this difficulty that the Directors recommended in their previous report that no dividend should be then declared; but they now proposed the payment of a dividend of 8 per cent., free of income-tax. The retort-settings, they stated, had been re-constructed; and a new main had been laid down in Huntingdon, at a cost of £831, which had been defrayed partly by £500 raised on mortgage, partly by £250 raised by the sale of Consols from the reserve, and the remaining £81 from revenue.

Reduction in the Price of Gas at Carmarthen.—A letter was read at last Tuesday's meeting of the Carmarthen Town Council from the Directors of the Gas Company, in which they intimated their willingness to reduce the price of gas. Last year it was raised 6d. per 1000 cubic feet for private consumption, which enabled the Directors to pay a dividend for the past year of between 4 and 5 per cent. The Company now stated that they would reduce the charge to the private consumers from 5s. to 4s. 10d., and that to the town to 4s. 6d. net, from the 31st inst. At the previous meeting of the Council, it was decided to put out every alternate lamp at twelve o'clock at midnight, and thus save £100 a year, if the Company would not reduce the price to 4s. 6d., less 5 per cent. discount; and, now, after a protracted discussion, it was only agreed, by the casting vote of the Mayor, that the Company's offer be accepted.

Harrow District Gas Company.—The half-yearly report of the Directors of this Company has been circulated among the shareholders by the Secretary (Mr. J. L. Chapman). In the first place, the Board refer, with sincere regret, to the death of the Deputy-Chairman (Mr. John Chapman), who was the largest proprietor in the concern, a Director from its formation, and was always greatly interested in its progress and prosperity. The Directors do not, at present, recommend that the vacancy be filled up. The balance of the profit and loss account is £1989, out of which the Directors recommend the declaration of a dividend at the rate of 7½ per cent. per annum on the original "A" capital, of 7 per cent. on the first additional "B" capital, and of 5½ per cent. on the second additional "C" capital, all less income-tax. The accounts show that the receipts from gas and from meter and stove rental amounted to £4255, which is nearly £260 more than in the corresponding period of the previous year. The residual products realized £769, which was about the same as in 1890. Coke yielded less; but the deficiency was made up by the extra amount received for tar and sulphate of ammonia. The total revenue was £5025; and, deducting expenditure, a profit is left of £1689, compared with £1715.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 527.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.					£ s. d.
GAS COMPANIES.								
590,000	10	15 Oct.	10½	Alliance & Dublin 10 p. c.	10	16-17	..	6 3 6
100,000	10	"	7½	Do. 7 p. c.	10	11½-12½	..	6 0 0
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105-107	..	4 13 5
100,000	20	27 Nov.	8	Bahia, Limited	20	12-14	..	11 8 1
200,000	5	12 Nov.	7½	Bombay, Limited	5	6½-6¾	..	5 11 6
40,000	5	"	7½	Do. New	4	4½-5½	..	5 14 1
380,000	Stock.	26 Feb.	12½	Brentford Consolidated	100	205-215	..	5 14 1
150,000	"	"	9½	Do. New	100	153-158	..	5 17 1
220,000	20	11 Mar.	11½	Brighton & Hove Original	20	39-41*	..	5 12 2
888,500	Stock.	11 Mar.	5	Bristol	100	95-100*	..	5 0 0
320,000	20	15 Oct.	11½	British	20	43-45	..	5 0 0
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	10	19-20	..	5 15 0
51,510	10	"	8½	Do. 7 p. c.	10	14-15	..	5 13 4
328,750	10	"	—	Buenos Ayres (New) Limited	10	6-7	+	—
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	93-96	..	6 5 0
150,000	20	26 Feb.	8	Cagliari, Limited	20	24-26	..	6 3 1
550,000	Stock.	15 Oct.	13a	Commercial, Old Stock	100	244-249	..	4 5 5
165,000	"	"	10a	Do. New do.	100	190-195	..	5 2 7
130,000	"	30 Dec.	4½	Do. 4½ p. c. Deb. do.	100	118-123	..	3 13 2
800,000	Stock.	30 Dec.	13	Continental Union, Limited	100	221-226	..	5 15 1
200,000	"	"	10	Do. 7 p. c. Pref.	100	185-195	..	5 2 7
75,000	Stock.	16 Sept.	10	Crystal Palace District	100	190-200	..	5 0 0
486,090	10	29 Jan.	10	European, Limited	10	19-20	..	5 0 0
354,060	10	"	10	Do. Partly paid	7½	14-15	..	5 0 0
5,470,820	Stock.	12 Feb.	12	Gaslight & Coke, A, Ordinary	100	211-216	+	5 11 1
100,000	"	"	4	Do. B, 4 p. c. max.	100	94-97	..	4 2 5
665,000	"	"	10	Do. C, D, & E, 10 p. c. Pf.	100	244-249	..	4 0 4
30,000	"	"	5	Do. F, 5 p. c. Prf.	100	116-121	..	4 2 9
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	169-174	..	4 6 2
1,300,000	"	"	7	Do. H, 7 p. c. max.	100	150-154	..	4 10 11
463,000	"	"	10	Do. J, 10 p. c. Prf.	100	241-246	..	4 1 3
476,000	"	"	—	Do. K, 6 p. c. Prf.	100	145-150	..	4 0 0
1,061,150	"	11 Dec.	4	Do. 4 p. c. Deb. Stk.	100	113-116	..	3 9 0
294,850	"	"	4½	Do. 4½ p. c. do.	100	118-123	..	3 13 2
908,000	"	"	6	Do. 6 p. c. do	100	163-168	..	3 11 5
3,800,000	Stock.	12 Nov.	12	Imperial Continental	100	221-225	+	5 6 8
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4-4½	..	6 13 4
500,000	100	1 Oct.	5	Met. of Melbourne, 5 p. c. Deb.	100	108-110	..	4 10 11
541,920	20	27 Nov.	6½	Monte Video, Limited	20	14½-15½	..	8 7 8
150,000	5	27 Nov.	10	Oriental, Limited	5	8½-8¾	..	5 14 3
60,000	5	30 Sept.	7	Ottoman, Limited	5	4-5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited	10	2½-3½	..	—
People's Gas of Chicago—								
420,000	100	3 Nov.	6	1st Mtg. Bds.	100	100-105	..	5 14 3
500,000	100	1 Dec.	6	2nd Do.	100	100-105	..	5 14 3
150,000	10	15 Oct.	10	San Paulo, Limited	10	9-10	..	10 0 0
500,000	Stock.	26 Feb.	15½	South Metropolitan, A Stock	100	266-271	..	5 14 5
1,350,000	"	"	12	Do. B do.	100	220-225	..	5 6 8
200,000	"	"	13	Do. C do.	100	232-237	..	5 9 8
725,000	"	30 Dec.	5	Do. 5 p. c. Deb. Stk.	100	138-143	..	3 10 0
600,000	Stock.	11 Mar.	11½	Tottenham & Edm'ton, Orig.	100	—	..	—
WATER COMPANIES.								
729,331	Stock.	30 Dec.	10	Chelsea, Ordinary	100	230-240	-10	4 3 4
1,720,560	Stock.	15 Oct.	8	East London, Ordinary	100	190-200	-5½	4 0 0
544,440	"	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	136-140	..	3 4 3
700,000	50	11 Dec.	8	Grand Junction	50	90-95	-5	4 4 3
708,000	Stock.	12 Feb.	10½	Kent	100	250-260	-5	4 0 10
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max.	100	210-215	-6	4 8 4
406,200	100	"	7½	Do. 7½ p. c. max.	100	185-190	-2	3 19 0
260,000	Stock.	30 Sept.	4	Do. 4 p. c. Deb. Stk.	100	120-123	..	3 5 0
500,000	100	12 Feb.	12½	New River, New Shares	100	325-335	..	3 12 4
1,000,000	Stock.	29 Jan.	4	Do. 4 p. c. Deb. Stk.	100	125-128	+	3 2 6
902,300	Stock.	30 Dec.	6½	S'hwk & V'xhall, 10 p. c. max.	100	135-140	-2½	4 12 10
126,500	100	"	6½	Do. D 7½ p. c. do.	100	140-145	..	4 9 8
1,155,066	Stock.	11 Dec.	10	West Middlesex	100	235-245	-4½	4 1 7

a Next dividends will be at this rate.

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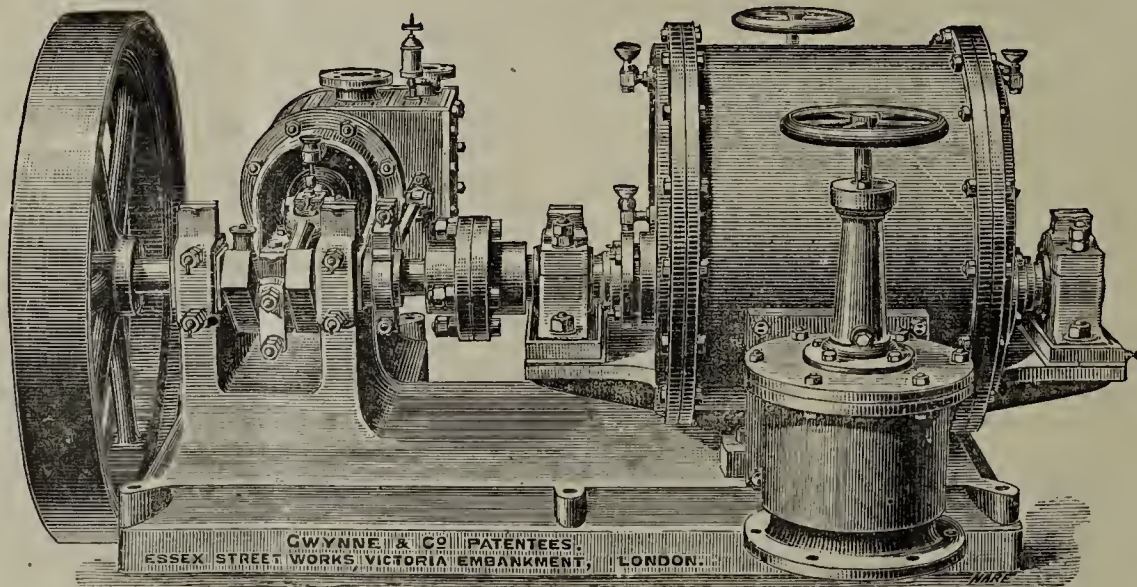
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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MARCH 29, 1892.

A Particular Aspect of Municipalism.

FOLLOWING up the subject of our first leading article of last week, we notice that, upon the initiative of Lord Rosebery, a Special Committee of the London County Council has been appointed to consider the subject of the organization of the whole body for detail work. It will be worth while for members of other and older local governing authorities to keep an eye upon the outcome of this inquiry, which is of particular interest wherever bodies of this character, with their perpetual changes of

membership, have to administer permanent undertakings such as gas supply. It is to be supposed, of course, that the County Council Committee will put themselves into communication with municipalities all over the country, and perhaps abroad, with the object of collecting information as to how responsibilities of this kind are actually borne at present; but it by no means follows that they will recommend that any existing practice shall be implicitly followed. The London County Council are so large a body, and so peculiarly circumstanced, that they will, in all probability, strike out a new method of doing their detail and routine work.

What is imperatively needed, in the case of a shifting body with permanent responsibilities, is some administrative device for ensuring a reasonable continuity in their external policy. It would obviously be destructive of financial credit and executive discipline if the whole principle of administration of an important county or municipal authority were subject to alteration at any general election, or by a "snap" division in the body itself. Changes, of course, there must be, as time goes on; but it is eminently desirable that these should be gradual, regular, and natural. In the actual municipal organizations of England, there is no formal provision for ensuring continuity of executive policy other than such as may be deduced from the permanence of the aldermen, who naturally perpetuate the traditions of the old order, and compel the due consideration of all proposed innovations. Subject to this aldermanic influence, the management of water and gas supply, and of other permanent undertakings, is, in the English municipal system, a function of committees of the local authority—apparently the most changeable of bodies. In Scotland these things are ordered differently, more or less stable Boards of Commissioners, charged with definite responsibilities, being preferred in most instances to the English system of "scratch" committees. The same remark holds good for Ireland.

It is plain that the newest-made local authorities, such as the London County Council, are more directly subject to the popular voice than the older organizations. Their constitution is more democratic. They are consequently more likely to fall under the seduction of the idea that "to the victors belong the spoils"—not, we are happy to think, in the bad sense attached to this phrase across the Atlantic, but in the general application of the principles, crotchets, and notions of the victorious party of a general election to all the offices and work of the organization. General elections are won upon all sorts of cries; and—the possibility of corruption apart—it is clearly desirable that there should be some better guarantee for continuity of policy than serves for a gradually-changed corporation, in the case of an elective authority subject to frequent dissolution and reconstruction. High officials in permanent employment constitute a powerful conservative force in the working of a shifting body; but an officer-ridden authority is not entitled to respect. We are the firmest and most insistent of advocates for the honourable and liberal treatment of officers of municipalities and companies; but they have their proper place, which is altogether different from that of the superior authority whose counsels it is their duty to carry out to the best possible effect.

The question comes to this: Supposing a new local authority, constructed upon the most democratic lines, to be entrusted with the discharge of certain permanent responsibilities, such as the supply of gas or water, the care of the highways, the finances of a district, &c., what would be the best way to organize the departmental control? Should this be done by committees, by commissioners, by paid administrators filling the place of company directors, or how? This is by no means an easy problem to solve. In regard to gas supply, directors of gas companies are paid, and members of gas committees of corporations are not paid; and there are good and bad administrators of both orders. There is greater executive force in a board of directors than there is in most corporation committees; but it is an open question which can do more mischief when badly constituted. Although a committee is answerable to the whole body of the council, whereas in practice directors are afraid of nobody, the worst of it is that, when corporations overrule their committees, it is generally for the worse. It is fair matter for argument whether, in place of the loosely-organized and little-instructed committees of municipal corporations,

it would not be better to administer such undertakings as gas or water works through small commissions, the head of which (under the Mayor) should be paid for his work. Something in this direction has already been adopted in the case of the London County Council, the Deputy-Chairman of which receives a respectable, but not an excessive, salary. In the old Metropolitan Board of Works it was the Chairman who was paid; but this arrangement was not the best conceivable, because there was nobody to overlook the paid representative of the Board, who was consequently able to do pretty much as he liked. At any rate, it appears to be a more reasonable and hopeful idea to pay the real working administrators of a Council or a Corporation, while keeping them subordinate to the official head, than to pay either the head or the general body of members—which latter, be it observed, is equally a question of the day. Upon all these matters, it is to be expected that more will be heard in future.

The Commercial Report and Accounts.

THE report of the Directors and the statement of accounts relating to the past half-year's working of the Commercial Gas Company have been issued, and will be found in another column; the ordinary general meeting of the shareholders being fixed for Friday next. The half year has again turned out badly; the revenue account showing a net profit of only £27,666, as compared with £38,760 made during the corresponding period of 1890, and exhibiting a further, although slight, falling off as compared with the immediately preceding half year. Dividends after the rate of 13 and 10 per cent. upon the Company's old and new stock respectively are recommended, payment of which will reduce the undivided balance to £18,494. Further capital being required, the Directors have resolved to issue the £35,000 of debenture stock already authorized to be raised; and, in the circumstances, it is not to be wondered at that the price of gas is, after all, to be increased to 2s. 6d. per 1000 cubic feet. It is to be hoped that this small increase will meet the necessities of the case; but it must be borne in mind that it will only come into operation for the summer quarters, and cannot therefore do the Company so much good as it would have done if the resolution had been acted upon at Christmastide. The Commercial Directors deserve sympathy for their evident desire to hold on as long as possible without raising their charge; and it must be admitted that, even with their gas selling as it now does at the rate of 2s. 6d. per 1000 cubic feet, they supply a remarkable commentary upon Colonel Makins's *dictum*, that the price of gas north of the Thames must be expected to be at least 3d. per 1000 cubic feet in excess of the prevailing rate across the river. As is customary with this Company, the Directors' report does not offer any explanation of the condition of the undertaking. It is to be feared that when the Chairman (Mr. J. Blacket Gill) essays this task on Friday, he will hardly be more cheerful over it than he was when he made his last appearance before the Commercial proprietors. It is true that the gas-rental has increased from £120,133 to £124,946, which is something to be thankful for; as is the corresponding increase of meter and stove rental from £2466 to £2647—the difference meaning practically many new consumers. The expansion of business is also shown in the increase of gas sold by just over 4 per cent. Here, however, satisfaction must stop. Residuals have dropped from £55,625 to £45,898. Most of this depreciation is in the coke sales; for sulphate even shows an improvement. On breeze, however, there has been an actual loss of £155. Moreover, the labour upon both coke and breeze cost more than when these commodities were more profitable. The gross effect of these altered values is that the total revenue has fallen from £178,275 to £173,668. On the other side of the account, we find the cost of manufacture risen from £117,284 to £125,132. Every item shows an increase; but the heaviest additions are, as might be supposed, for coal and labour. The weight of coal and cannel carbonized rose from 109,862 to 115,132 tons, or by nearly 4·8 per cent.; while the cost of it rose from £79,611 to £84,997, or by 6·7 per cent., and the cost of handling it increased from £18,546 to £20,160, or by as much as 8·7 per cent. The last figure illustrates painfully the effect of the combined influence of the Gas Workers' and the Coal Porters' Unions upon the manufacture of gas. A saving of £1720 has been secured under the heading

of "distribution," by cutting down the repairs account. Altogether, the expenditure shows a rise from £139,515 to £146,001, with regard to which the proprietors are entitled to full and particular explanation. Nobody, of course, would wish to be hard upon the Directors in respect of the difficulties that have come upon them from without, among which dear coal is the most serious. It is obvious, however, especially in view of the issue of their extraordinary circular to their consumers, that it should be made known who is really responsible for the conduct of the Company's business, and the performance of their duty to the public. There must be something very wrong with any gas company to account for the directors issuing an appeal to their customers not to burn more gas than they can help. Such is, at any rate, the impression which the average man would receive from the recent proceeding of the Commercial Board. If Mr. Gill can put a different aspect upon this questionable affair, the friends of the gas industry in general will be greatly obliged to him.

The Costs of the Chartered Assessment Appeals.

IT was stated, in the course of the last day's proceedings in the great assessment appeal of The Gaslight and Coke Company, that the costs of this long litigation amount to £30,000, which must be a figure well within the mark, even of the taxed costs, to say nothing of the costs as between solicitor and client. It is not often that one hears the leading Counsel in a lawsuit speak fearfully of the expenses of the action; but this has been done repeatedly in the instance of this appeal, and the last few days' arguments bore exclusively upon this subject. The appellants for some time allowed it to be clearly seen that they thought themselves hardly dealt with by the Court; but when the result could no more be varied, and it became perfectly clear that the winning side would have the best of it in the matter of costs, they soon changed their tune, and claimed to have won in every instance where they had reduced their assessment by ever so little. Briefly stated, Mr. Littler's argument with a view to getting his costs was this: "We were compelled to appeal as the only means of avoiding payment under what we considered as an exorbitant assessment. The Court reduces this assessment by £40,000 or thereabouts; which is our justification. *Ergo* we win, and the respondents should be cast in costs." The other side say: "Not so. If the assessment was too high by £40,000, your offer was too low by nearly £210,000; and so you are five times as much in error as we were. Moreover, all this might have been spared if you had come before the Assessment Committee with more reasonable figures, between which and ours there might have been some compromise." There are two sides to every question; and it is not for us to say in the present case which is the more reasonable view of the facts. The lawyers, at any rate, are fairly well satisfied with the result.

The State of Private Bill Business.

THE Private Bill business at Westminster has been very brisk during the past week. The opposition to the Oxford Gas Company's Bill was withdrawn, and this measure will therefore go forward quietly in due course. The Bill of the Liverpool United Gas Company now meets the wishes of the Corporation; and therefore it has been passed by the Chairman of Committees as an unopposed measure. The Swinton and Pendlebury Local Board Bill, which was promoted by the Local Authorities interested in giving practical effect to the provisions of the Salford Gas Act of last year, enabling certain outlying districts to supply themselves with gas, passed the Lords' Committee. The evidence in this case, a report of which will be given in the JOURNAL next week, should be carefully read by everybody who may be disposed to believe, upon general principles, that the control of gas supply by local authorities necessarily gives general satisfaction. Many eminent professional men were engaged upon this Bill, the preamble of which was eventually declared to have been proved, with the modification that Eccles, Barton, and Little Hulton were cut out from the proposed Swinton district. The Southend Gas Bill was also considered last week, the opposition in this case being apparently inspired by the usual town's jealousy of a rising Company. The Subways Bill promoted by the London County Council has been in Committee; and the

differences which arose between the Council and some of the parties affected by the measure, including the Gas and Water Companies, have not yet been satisfactorily disposed of. The Government have made progress with the Bill for altering Private Bill procedure for Scotland, to which country its operation is now restricted. This has always appeared to us to be an uncalled-for piece of tinkering with the general question, seeing that the amount of Private Bill business that comes to Westminster from Scotland is very small; and it is difficult to believe that the gentlemen whose duty calls them south to look after it take this necessity as a hardship. The reform, such as it is, will probably be carried out, however; and it will at least serve to throw some light upon the question as to whether any further system of devolution is practicable or desirable in regard to Private Bill Legislation.

The Durham Coal Famine—German Gas Coal for London.

THE question of coal, as it was presented to the country last week, was prettily complicated in several respects. We had the dupes of the Federation so far persuaded of the failure of their grand "play-week" experiment as to go to work wherever the owners of pits would allow mining to be resumed. On the other hand, the Durham miners persisted in following out their own quarrel with their bread-and-butter; emphasizing their independence, as usual, with violence and riot. Meanwhile, the working of economical laws was exemplified by the importation of Scotch coal into the Hartlepoons, and by the purchase of an experimental cargo of Westphalian gas coal by the South Metropolitan Gas Company. As may be supposed, the latter incident attracted a good deal of notice; and Mr. Frank Livesey, the Chief Engineer of the Company, was promptly interviewed, on the transaction getting into print, by representatives of the newspapers. Mr. Livesey's explanation was very much to the point, and contained several things for leaders of the New Unionism and their supporters in the Press to think about. He declared that Durham coal is the best all-round gas coal that comes into the Thames; and so long as he can get it at a reasonable figure, he will be content therewith. But if the miners indulge in "play" to such an extent as to imperil the coal supply of the Company which lights the larger part of South London, those who are responsible for this lighting will go elsewhere for the necessary raw material. The South Metropolitan Company can do this without consulting the leaders of any Union; being free from all this kind of coercion, and able to manage their business in their own way. This news is, of course, what Mr. Richard Swiveller would call a "staggerer" for the unionists. The Commercial Gas Company had "taken it lying down;" and although the Federation blunder had only resulted in enriching a few coal merchants, the believers in the omnipotence of the British workman still hoped that the Durham men might have succeeded in making a few more gas directors uncomfortable. Once more, however, it has appeared that the South Metropolitan Board are inclined to "take it fighting;" and the consequent dismay in the unionist camp is ludicrously abject. It is significant of the weakness of the journalistic applauders of the Unions that they can only chronicle this bold proceeding on the part of the South Metropolitan management; they do not attempt to criticize the policy of independence which it signalizes. It is only fair to Mr. Frank Livesey to state that he does not seek to pose as a defier of the Unions, a vindicator of the liberty of trading, or anything of the kind. Everyone who knows him needs no further assurance that self-advertisement of this sort is wholly foreign to the nature of this most retiring of gas-works administrators. When Mr. Livesey tells the newspaper reporters that the purchase of German coal is only an experiment, and when he uses language deprecating the ascription of undue importance to the incident, he is to be taken as absolutely candid and sincere. But this mild-spoken gentleman is also perfectly sincere in stating that he has no fear of "coalies," or of any other unionists; and it is this that makes his actions so terribly interesting to the whole tribe of the latter.

Messrs. James Milne and Son, Limited.—The well-known firm of Messrs. James Milne and Son, of Edinburgh, has been converted into a limited liability Company, with a capital of £75,000 in £10 shares, and £25,000 in 4 per cent. debentures.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 593.)

BUSINESS in the Stock Markets was very quiet last week; and prices accordingly were inclined to drop for lack of support. Incidents were few. The Behring Sea affair was estimated at about its full value—viz., an election job. The silver question, however, is more serious. No financial nostrums will remedy it, though they may partially cover it; and nothing but the curative power of time will be effectual. The long nineteen day account, which seems to blow nobody any good, is at an end at last; and the settlement ought to go through without difficulty. Money has naturally been in better demand; but the outlook is unchanged. The Gas Market has been much more quiet—markedly so in comparison with the preceding week. The tendency, however, was quite favourable nevertheless. Changes in value are few in number, and moderate in degree; but they are all in the upward direction, and are almost restricted to the heavier issues. Gaslight "A" opened firm on Monday; and, advancing one point the next day, maintained its advance to the close, though prices actually marked were not quite so good as Monday's. A good deal more business was done in the other issues; and prices were very steady—the debenture stocks being about the firmest. South Metropolitan "B" was steadily dealt in at better than average figures; but the quotation did not move. A bargain in the "C," however, was marked at 240, and this sent the quotation up 3. Nothing was done in Commercial, except one deal in debenture. The Company's report and accounts for the past half year are out; and they exhibit that increase in expenditure and falling off in revenue to which the previously-issued accounts of numerous other Companies have familiarized our senses. With dear coal and labour, and with cheap gas and residuals, it is, of course, impossible to preserve an equilibrium; and the result is naturally a heavy balance on the wrong side. We are glad to see that the Company are raising their price. With this aid, with the reserves in hand, and (last but not least) with the prudent reduction of the rate of dividend, they may confidently await the returning swing of the pendulum bringing cheaper coal and a better demand for its products. The Suburban and Provincial Companies have been almost wholly neglected; and the only move is a rise of 2 in Brentford new. The Continentals were fairly active, all things considered, and steady. Imperial advanced 1. None of the rest presented any feature whatever; being quiet and unchanged. The Water Companies generally have made a further decline during the week; but there are symptoms of a revulsion setting in.

The daily operations were: The Gas Market opened well on Monday; and prices were favourable all round. Brentford new and Imperial Continental rose 1 each. In Water, Chelsea and Kent fell 5 each; and Lambeth, 2½. Gas was quieter on Tuesday; but prices still looked up, and Gaslight "A" rose 1. Wednesday was equally inactive; and the only feature was another rise of 1 in Brentford new. Water continued to fall. Kent dropped 5; Southwark, 3; Chelsea and Lambeth, 2½ each; and East London and West Middlesex, ½ each. On Thursday, the Gas Market underwent no change; but Water picked up a little—Lambeth being 2½ higher; and Southwark, 1. On Friday, Gas was very quiet, and presented nothing for remark. Waterslightly relapsed; Southwark and Vauxhall and West Middlesex each receding 1. Gas continued quite featureless on Saturday; but in Water, Grand Junction rose 1½.

ELECTRIC LIGHTING MEMORANDA.

Increase of Capital by the Electric Construction Corporation—The Cheapest Electric Lighting on Record—The Westminster Electric Lighting Corporation—Electric Lighting Companies and Fires.

THE fact of the Electric Construction Corporation having resolved to increase their capital, by the issue of 7 per cent. preference shares, to the very respectable nominal amount of £750,000, is an incident of the contemporary development of the electrical industry not to be overlooked. It goes to support the evidence of the Crystal Palace exhibition, that there is a good deal of trade being done in this line, although the lighting branch is not turning out the gold mine it was expected to prove. The success, such as it is, of the Electric Construction Corporation, the Crompton Company, and other joint-stock ventures of the same order, is traceable mainly to the manufacturing business which they carry on. These firms require a large amount of capital, because they have to finance their best customers, as well as supply them with goods. Indeed, the inner history of the electric lighting enterprise of the present day is a marvellous tale of "wheels within wheels"—of complex reciprocal arrangements, and of liabilities borne by ingeniously managed suspense accounts until they could be deftly planted out among genuine investors. When all the skill and resources of the promoters, brokers, bankers, company solicitors, and money-spinners who constitute the modern world of finance are combined to make things go well enough to inspire the investing

public with a desire to come into any concern, the result generally happens as arranged. And when the business which is worked in this way is not a downright swindle, it is astonishing how much is done upon the basis of a little positive present prosperity and a large proportion of hope.

According to figures published in the *Engineer* with regard to the expense of electric lighting for a steam mill at Barrow-in-Furness, it may be gathered that the cost of an incandescent lamp service is at the lowest possible rate in the circumstances existing in this example. The installation consists of a No. 5 Mather and Platt dynamo, capable of supplying from 150 to 200 lamps of nominally 16-candle power at 100 volts. The dynamo runs at 1115 revolutions per minute (so that it must be classed among the high-speed machines); and it is driven by a horizontal engine of 10-horse power nominal, by Messrs. Marshall and Co. This engine is supplied with steam at 65 lbs. pressure from the mill boilers, is steam-jacketed, and is fitted with automatic expansion gear and a Hartnell governor. The plant was put down in 1885, and must be regarded as ranking among the best of its kind. It has cost altogether £420. The indicated horse power, taken over three years, varied from about 12 to about 20; and the lamps per indicated horse power averaged, as nearly as possible, 7·8. The fuel account is based on the assumed consumption of 3½ lbs. per indicated horse power per hour. Charging interest on capital at 5 per cent., depreciation another 5 per cent., all lamp and machinery renewals and repairs as they occurred, but nothing for attendance or management, the yearly expenses ranged from £105 at first to £84 last year. The cost per lamp-hour was similarly from 0·079d. to 0·048d. Taking all the averages for six years, the accounts work out as follows: Annual cost, £92; cost per lamp-hour, 0·059d.; number of lamps lit one hour for 1d. = 16·9; hours run, 3392; lamps lit, 112·1; lamp-hours, 380,243; average cost of gas in Barrow, 3s. per 1000 cubic feet; calculated annual cost of equivalent lighting by gas, £313. Of course, it is admitted that the fact of no labour being charged to the electric lighting account renders these figures inapplicable to central station or private house lighting. We may also point out that the fuel account is remarkably low—averaging about £22 per annum, or less than £2 per horse power per annum. The price of gas as sold by the local undertaking also carries a profit. The statement is, however, interesting as showing what can be done in the circumstances. We also notice that the average life of the lamps was 3384 hours, which is pretty good evidence that they were not worked to their full illuminating power; and we should therefore not be surprised to learn that the lighting was by no means as brilliant as it was cheap.

The system of supply adopted by the Westminster Electric Lighting Corporation has been recently described, and the plant illustrated, in the *Electrical Review*, from which we take the following particulars. The system generally used is the low-tension feeder, with secondary batteries; three stations being at present required to generate the current, of which the principal or "head-centre" station is situated in Eccleston Place. Professor Kennedy is the Company's Engineer, and every section of the work has been put out for construction independently. Willans triple-expansion engines, directly coupled to Crompton dynamos, appear to be the favourite type of generators; and the efficiency of the combined machines is stated to be very high. Davey-Paxman "Windsor" engines are also employed. The steam-boilers are of the marine tubular type, provided with Green's economizers. The Crompton-Howell batteries play an important part in the working of the stations; being charged in parallel with the circuit during the hours of light load, so as to increase the load at these times. By the evening they are full, and remain standing so until the load has fallen to a point at which they can be allowed to discharge. The engines are then stopped, and the station shut down for the night; the batteries supplying all the electricity needed. In the summer months, the batteries will run all the morning also. It is to be remarked that these batteries do not answer all the purposes of a gasholder, inasmuch as they cannot reinforce the steam plant when a heavy load is suddenly cast upon it by a fog or a snowstorm. Upon a recent occasion of this kind, the load was multiplied five times within ten minutes, which means that a large reserve of boiler power is imperatively needed for these stations.

Electric lighting cables are not only capable of causing fires, but they are also, when in certain situations, liable to be damaged by fires otherwise originated. Thus the ever-unfortunate London Electric Supply Corporation suffered an interruption of service recently through a fire in one of the railway arches over which their mains run from Rotherhithe to London. It is true that the subscribers only had to do without light for one evening; but it is obvious that even this brief collapse will militate against the Company's prospects of recovering from the discredit into which they fell as the result of the burning out of their distributing station at the Grosvenor Gallery. The consumer does not pause to "reason why" when his lights go out, but promptly bestows his patronage upon some other system of lighting which he is persuaded is more to be relied upon. With regard to the risks and injuries ascribable to electric lighting systems generally, Mr. Allen R. Foote reported to the last meeting of the Electric Light Association of the United States that in the year 1890, in 425 cities of the Union, there were 518 fires directly caused by electric currents, 1719 injuries were sustained

by servants of electrical companies on duty, 35 injuries from electric currents were received by men on duty at fires, 60 men were killed, and one man had a shock which knocked him off a pole 35 feet high, so that it was impossible to say whether he was killed by the shock or by the fall. It is sometimes said that electric lighting progress is much more generally visible in the United States than anywhere else; and, in view of these figures, we may be pardoned for feeling thankful that this is so.

THE TASK OF THE STANDARDS OF LIGHT COMMISSION.

THE Standards of Light Commission have been in existence long enough for the members one and all to appreciate the bearings of the matter submitted to their arbitrament. By this time the least technical among the Commissioners should have mastered the work that has been done by their predecessors in this line of inquiry, and the *ultra*-scientific gentlemen who have been introduced for the first time to the statutory and commercial aspects of photometry will have realized the great practical importance of those refinements of photometrical instruments and methods which are sometimes accused of overloading and complicating the essentially simple laws applying to the phenomena of radiation. It may be months before the Commission are in a position to report; and meanwhile we have a suggestion to lay before all British Associations of Gas Managers, or of electricians, or other organizations of technicians interested in the subject generally. It is that as many of these societies as can conveniently do so should arrange to hold at least one full debate upon the matters understood to be occupying the attention of the Commission, in order that every possible aspect of the subject should find mention before it is too late. It often happens that when an official body of this character, after having held what is really a "fishing" inquiry into certain matters, has formulated the results in a report, somebody wakes up to a sense of what has been going on, and offers a suggestion which might have been fruitful if it had been timely, but which is perforce neglected because it is felt to be not worth while to reopen the inquiry for the sake of one detail consideration. In the present case of the Standards of Light Commission, the subject of the labours of the Commission was mentioned in an informal way at the recent meeting of the Southern District Association of Gas Engineers and Managers; and on this occasion several important remarks transpired, which would have been added to, in all probability, but for the scant time available for the purpose. As it was, however, statements were made at this meeting which are well worthy of the attention of the Standards Commission.

A fuller discussion of the subject would have been held at the recent Midland Association, but for unpropitious circumstances; and it is to be hoped that this debate is only deferred, not abandoned. It would be quite worth while to call a special meeting of the Association for the purpose, seeing that there are several members of this body who are known to take a particular interest in the matter; and it also embraces what may be called the border land reaching from the 14-candle districts of the South and West, to the cannel-gas regions of the Northern Midlands. This, however, is a question for the officers of the Association. We trust that at any rate photometrical subjects will not be lost sight of by the ruling authorities of the two national associations of gas engineers and managers who will meet in the course of the summer.

The electricians are taking a good deal of notice of the proceedings of the Commission, because they feel that, although they are not immediately concerned with these transactions, the finding of such a strong body cannot fail to impress all lighting industries. It is worthy of remark here that the report presented last year by the British Association Committee on Electrical Standards, of which Mr. R. T. Glazebrook, F.R.S., is the Secretary, contained a reference to the resolutions passed at the Paris Electrical Congress, which was attended by Sir W. Thomson and Mr. W. H. Preece, members of the Committee. As an English equivalent of the resolutions there passed, the Committee formulated certain recommendations, which they hoped would meet with general acceptance. The third of these resolutions is as follows: "The name of the practical unit of light intensity shall be the candle. The candle is equal to the twentieth part of the absolute standard of light as defined by the International Conference of 1884." Thus it will be seen that we were not speaking without book when, in a recent notice of the work of the Commission, we expressed the confident anticipation that the candle would be adopted by the Commission as the nominal standard of light. It remains to be ascertained, however, what a candle light really is. It is to be hoped that there will not be two or three different candle units in vogue as the result of the tendency actually operating in England, France, and Germany to adopt the candle unit without agreement on the subject; but there is great danger of this happening. We trust that the Commission will not propound their candle standard without referring to other candles; and that if it should be found impracticable to unite these standards, both the reason for the discrepancy and its amount will be placed upon record.

It is obvious that, although the Commission may take cognizance of the different standard candles in existence, they cannot follow them in the selection of their own. Indeed, the

work of the Commission in this regard is not, strictly speaking, one of selection, but rather of definition. They cannot get away from the parliamentary standard candle which is mentioned in the Acts of Parliament relating to the gas supply of London; and what they have to do is to define the value of this statutory candle at the time when it was legalized. Scientifically speaking, the parliamentary standard candle light may be as vague and unsatisfactory a quantity as the "size of a piece of chalk" mentioned in the legendary culinary recipe given by Captain Marryatt's black cook; but there it is, and its value must be settled before its equivalent representation can be decided upon. The ultimate candle light, of which the Commission can say, "this is what Parliament bound the London Gas Companies to observe as the measure of the illuminating power of their gas," must and will prevail over the less authoritative candles of the other standard-makers. But if it should be found to differ from them, there may be a period of irritating confusion before unanimity is attained—especially if the British Association candle should turn out to be more favourable to the electricians.

It is desirable to point out in this connection that the so-called "decimal candle" adopted by the French electricians, and after them by the British Association Committee, is hardly deserving of much respect. Its origin is about as unscientific and fantastical as can be imagined; and if anybody else than modern "scientists" had committed themselves to such a curiously illogical and unpractical way of deducing a standard of measurement, our modern materialistic philosophers would have poked any amount of fun at them for it. In 1884, on the occasion of the holding of a "scratch" International Congress of Electricians in Paris, which was in point of fact a meeting of more or less eminent personages who did not and could not represent anybody but themselves, it was proposed that an absolute standard of light suggested by a Frenchman—M. Violle—and defined as the light radiated from a square centimetre of the surface of molten platinum at the point of solidification, should be adopted. This was done forthwith; and the assembled notables flattered themselves upon having settled an old difficulty, and at the same time passed a graceful compliment to French science. From that moment nothing has been seen of the Violle standard, which has become a figment of science. Last year, however, by way of whitewashing the resolution of the former congress, the electricians adopted the so-called decimal candle, which may or may not be a real candle light, but is taken, for the sake of verbal exactitude, to be the one-twentieth part of the Violle standard. So far as is known, this decimal candle has no simple ratio to either the French carcel or the English candle. We do not even know whether it has real existence; but surely, out of Laputa, where the tailors took their customers' altitude by the sextant in preference to using a tape measure, there has been no such example of scientific pedantry as this of the derivation of the "decimal candle" from a fictitious unit in preference to taking the candle as it is. It is something that the electricians have been sensible enough to call their chosen working unit of light by the common name of candle, instead of naming it a "thomson," or a "swan," or a something else intended to immortalize one of themselves. When the present Commissioners, who have nobody to whitewash, tell the world exactly what a candle light is, and how it can best be obtained, we have little doubt that their valuation will prevail over all other less carefully derived standards called by the same name.

It is one thing to resolve upon the adoption of the parliamentary standard candle as the unit of light for photometrical purposes, and to state how this amount of light may be obtained; but it is quite another business to render its reproduction easy and reliable, and to arrange a convenient system of photometry in connection with it. Our electrical friends feel somewhat reproached on account of their inability to produce an electric lamp which can be trusted to represent the standard candle or any multiple thereof. Upon this topic the *Electrical Review* remarks: "After vain endeavours to trace a proposal of this nature, in the search for which we have had the assistance of many kind friends of the highest eminence in the scientific world, we are reluctantly compelled to say that there exists no simple and practical electric means of comparing lights." Discussing various projects that have been advanced to this effect, our contemporary dismisses platinum (molten or incandescent) and selenium, as too untrustworthy to enter into the composition of photometrical apparatus. It is suggested, however, that "Mr. Swan or Mr. Swinburne would undertake the production of vacuum lamps with a straight filament of carbon of the hardest kind, and having a smooth polished surface of sufficient constancy for practical purposes; and that such lamps, properly standardized and occasionally renewed, and used with an ammeter, would give greater uniformity of measurement than the standard candle, and with much less trouble." The main difficulty here would be the impossibility of saying when, and to what extent, such a lamp has gone wrong.

It is so far satisfactory to note that the *Electrical Review* is not particularly taken with the amyl-acetate lamp. The suggestion is thrown out that if a non-portable arrangement would be of any use, something might be done with a radio-micrometer; but no attempt is made to show that spectro-photometry is of any avail for commercial purposes. It may be remarked here that a "Treatise on Photometry," with special regard to electric

lighting, by M. Palaz, has been recently published by G. Carré, Paris, which contains a good deal of information upon the subject of standards of light. This author, however, while criticizing all known standards, does not suggest anything better. As an indication of the uncertainty that prevails with regard to the relationship of the usual standards, it may be stated that M. Palaz gives the following comparison: One Violle unit = 2.08 carcel; or 16.4 German normal candles; or 18.5 English candles; or 18.9 Hefner-Altneck lamps. This valuation differs from all others previously published.

In view of the length to which this article has already extended, it will be impossible to do more than refer to the questions of the value of the working photometrical standard, the method of its production, and the design of the photometer—all of which await the attention of the Commission after the basis of exact photometry shall have been laid by the definition of a satisfactory standard of light. We shall return to these considerations on a future opportunity.

LEWES ON AIR AND WATER.*

ONE of the latest additions to the useful University Extension Series of books published at the uniform price of half-a-crown by Messrs. Methuen and Co. is a small volume bearing the title "Air and Water," written by Professor Vivian B. Lewes. It is an unpretentious work; but it can be confidently recommended to science students and home reading circles as "elementary" in the very best sense of this much-abused term—that is to say, it is sound, reliable matter, expressed in the simplest and clearest language. It is elementary as Professor Huxley's educational works are elementary; and no higher praise can be accorded to the author than to rank his book with those of the great teacher who, treating of Physiology, Physiography, and so forth, showed learners for the first time how much scientific truth can be expounded in simple words. Time was, and is unfortunately not yet wholly past, when the preparation of popular handbooks of science was left for smatterers—the adepts despising such things; with the deplorable result that beginners picked up in their most impressionable years as much error as truth, and perhaps, on the whole, more of the former than of the latter, to their lasting detriment. The admirable University Extension movement has altered this for the better; and whoever follows the teaching of the lecturers and writers who are connected with this and certain other well accredited modern agencies for disseminating useful knowledge, need not fear having to go over the ground again before proceeding to more advanced studies. Younger readers of the *JOURNAL*, and even some of an older growth, will be sure to find in Professor Lewes's little book much instruction in subjects in which gas engineers must now be fairly well versed. Lighting, warming, and ventilation come in for a share of the author's attention; and it is hardly necessary to state that the references to these matters are always fresh and reliable. So far as we have been able to test it, the book is absolutely free from padding. All the information given is either first-hand, or its source acknowledged and its value criticized. The difficult question of the injury done by burning gas in badly-ventilated rooms, for instance, is treated in the light of the author's latest researches, which have exculpated the "sulphur compounds" from the blame of causing all the destruction to leather bookbindings, &c., once exclusively attributed to them. In the other division of the book, the equally debateable subject of the sewage contamination of water supply is similarly well dealt with. Understanding of the lucid text is facilitated by illustrations wherever necessary; and the book has an index. The printing is clear and the paper good. Altogether, we have sincere pleasure in testifying to the value of this admirable little volume, the readableness of which has been preserved, albeit at no sacrifice of clearness, by the absolute exclusion of all chemical and mathematical formulæ, and of everything ever so distantly resembling a diagram.

Mr. R. J. Jenkins, C.E. (of the firm of Messrs. Newton, Jenkins, and Co.) has been appointed Chairman of the Bridport Water-Works Company, Limited.

The City Gas Examinership.—At their meeting last Thursday, the Committee of the Common Council who were entrusted with investigating the qualifications of the various candidates for the appointment of Gas Examiner to the Corporation, rendered vacant by the death of Mr. Charles Heisch, decided to submit to the Council the names of Professor Vivian B. Lewes and Dr. S. Rideal.

Mr. S. Hesketh, an assistant at the Wallasey Gas and Water Works, has been appointed Assistant-Manager of the Wrexham Gas Company. There were 64 candidates for the situation, in response to the advertisement which appeared in the *JOURNAL* early in the year, under No. 2057; and it may be mentioned that the applicant selected owes his success, in a measure, to his having obtained an Honours certificate at the last examinations in Gas Manufacture.

* "Air and Water." By Vivian B. Lewes, F.I.C., F.C.S., Professor of Chemistry at the Royal Naval College, Greenwich, and Lecturer on Chemistry to the London University Extension Society. London: Methuen and Co.; 1892.

NOTES.

Coke-Breeze Concrete.

The discussion upon the subject of coke-breeze concrete, which has recently run through the correspondence columns of the *Builder*, has left the reputation of this material unimpaired. One writer avers that he has used it for the last 24 years, principally on account of its lightness; and he pronounces it an invaluable material for landings, stairs, floors, balconies on cantilevers, and other purposes too numerous to mention. He also says that he has known shingle concrete, gauged in precisely the same manner, to crack while breeze concrete has stood without the slightest indication of failure. The proportions recommended by this writer are six parts of breeze to one part of cement, with care not to use too much water, and to keep the concrete damp for a few days if exposed to the sun, but not otherwise. A thickness of $2\frac{1}{2}$ inches is stated to be sufficient for landings, &c.; and the great secret is defined to lie in gently tapping the concrete with a broad-bottomed wood punner till the whole is brought up to a level surface. When thoroughly dry, flooring-boards may be nailed directly upon the concrete. This correspondent also states that he has just completed a theatre, all the landings and stairs of which are of coke-breeze concrete, which was only completed eight or nine days before the opening, yet stood perfectly under heavy loading. Mr. W. Simmons describes how he constructed some years ago, in London, about sixty floors of coke-breeze concrete without joists, and with spans of 12 and 14 feet the narrow way of the rooms. The concrete was laid 7 inches thick, and had $2\frac{1}{2}$ -inch by $\frac{1}{2}$ -inch flat-iron bars on edge buried in it 18 inches apart an inch above the soffit; the ends being threaded on continuous iron rods built into the walls. Each floor was made as the walls reached the required level. A cement ceiling and floor surface afterwards increased the thickness to 9 inches. The roofs were similar, but asphalted on the top. The only fault was that the rooms were cold in winter, owing to the rapid conduction of heat through the concrete. Mr. Simmons remarks that, if he were repeating the construction, he should make the floors double, by putting a second skin of concrete 3 or 4 inches thick on rough boards, on bearers resting on the main slab. These boards would have to remain in, as they could not be taken out. It may be questioned whether this is not a superfluously heavy construction.

Test of a Locomotive-Type Boiler.

Mr. Bryan Donkin, jun., and Professor Kennedy, F.R.S., in the course of their standardized steam-boiler experiments, already referred to in the *JOURNAL*, tested a new portable locomotive type of boiler with a steel shell, by Messrs. Marshall and Co. It was working without any brickwork protection, and was not housed in any way. The boiler got up 70 lbs. of steam in $39\frac{1}{2}$ minutes, starting all cold. It was fired by hand in small quantities, very frequently; the fire-door being kept open as short a time as possible. The boiler was lagged in the usual way with felt and sheet iron; and the steam, which was kept at about 61 lbs. during the test, was used to supply a compound steam-engine. The general dimensions of the boiler were as follows: Fire-box inside, 3 ft. 3 in. by 2 ft. 11 in., and 3 ft. 1 in. high from the fire-bars; diameter of barrel, 3 ft. 7 in., and 7 ft. 9 in. long, with 50 tubes $2\frac{1}{2}$ inches in diameter. The total heating surface of the boiler was 316 square feet. In the course of the eight hours' trial, the furnace burnt 960 lbs. of coal; and the equivalent evaporation per pound of coal from and at 212° Fahr. was 10.78 lbs. of water, corresponding to 11.25 lbs. per pound of pure and dry coal. According to the balance-sheet of the boiler, 69.8 per cent. of the total heat went to heating and evaporating the water; 18 per cent. is accounted for in the furnace gases; and 5.7 per cent. was lost by radiation—leaving 5.2 per cent. unaccounted for.

Flared Coal Tar for Waterproofing.

According to the *Revue des Travaux Publics*, the use of coal tar as a means of rendering masonry impervious to water is much favoured in France. There are two ways of preparing the tar for this use—boiling and flaring. The former method is suitable for surfaces intended to be exposed to the atmosphere; while the latter is appropriate for surfaces to be covered up by masonry, earth, &c. By adding to the coal tar a paste made by dissolving india-rubber clippings in benzene, a coating may be obtained which is still more resistant, elastic, and durable. For roofs, the heat-absorbing quality of these black varnishes may be overcome by dusting them with any permanent white earth before they are quite dry. For masonry to be covered up, the use of flared tar is highly recommended. This is prepared by boiling the tar in a cauldron, and filling a bucket two-thirds full from it. The tar is then lighted at the surface, and allowed to blaze for 15 or 20 minutes; being constantly stirred the while with an iron rod. When a drop from the blazing bucket upon cold stone has the consistency of thick soup, the flare is extinguished by covering down the bucket with an iron lid. The tar will then be reduced to one-third its original bulk; and it must be spread as rapidly as possible upon the work with a cod-tail brush of vegetable fibre—care being taken to dip often, so as to prevent its cooling and hardening prematurely. If the flaring process is prolonged beyond the proper moment, the result is a brittle product like sealing-wax. When the flare is

stopped at the right time, the resultant tar adheres very firmly to any surface, and can be immediately covered up with earth. It has a skin both hard and tough, underneath which is a viscous layer about 1-25th of an inch thick, which preserves its integrity for any length of time.

An Explosion Experiment for the Lecture-Room.

A pretty and simple lecture experiment, illustrating the explosion of coal gas, is described by Dr. T. O'Connor Sloane in the *Scientific American*. The only apparatus required for it are a couple of common tin funnels of the same size, and a wide india-rubber band. The funnels are placed mouth to mouth together; and the band is sprung over their junction. It is well to secure this band by a string, in order to prevent it from being blown too far by the explosion. The funnels thus adjusted are then placed over a gas-burner, unlighted; and the gas is turned on for a few seconds, to drive out the air in the interior of the funnels. It is then lighted at the upper end, where, of course, it will burn quietly enough if the arrangement is properly made. After the gas-flame has been fairly established, the funnels are taken off from the gas connection, which is turned off. It is only necessary to hold the funnels quite free in the hand, taking care that neither end is in line with the clothing or any part of the body. The flame continues to burn at the top as the gaseous contents of the funnels rise, until the presence of the air that flows in at the bottom betrays itself by the increasing blueness and diminishing luminosity of the flame. The flame grows rapidly smaller, until it turns green and disappears down the tin tube. Soon afterwards, the explosion occurs; forcing the funnels apart with a startling report. With hydrogen, the explosion is much more violent.

The Liberty and Property Defence League—an organization for "maintaining freedom of contract, upholding proprietary rights, and resisting socialistic legislation"—whose efforts in the direction indicated in their title have been frequently noticed in our columns, give tangible proof of their alertness by their liberal distribution of leaflets or pamphlets bearing upon questions which affect the class who have much to lose, and little to gain, by the progress we are making towards democracy. The "Taxation of Ground Values" is ably dealt with in two leaflets just to hand; and, under the title of "Property in Land," Mr. J. C. Spence presents, in a small pamphlet, a defence of individual ownership.

The Murdoch Memorial.—In the *JOURNAL* for Jan. 12 last (p. 61), it was mentioned that the Secretary and Treasurer of the Murdoch Memorial Committee of the North British Association of Gas Managers (Mr. James M'Gilchrist, of Dumbarton) had applied to the Custodians of the Wallace Monument at Stirling for permission to place therein a bust of William Murdoch, the inventor of gas lighting. Last week he received from the Town Clerk a communication announcing the acceptance of the offer; and as either bronze or marble was the material suggested in Mr. M'Gilchrist's letter, the Custodians have expressed a preference for the latter. The next meeting of the Association will accordingly be held in Stirling in July; and occasion will then be taken to unveil the bust.

Sad Death of a Water Engineer.—On Sunday, the 13th inst., Mr. Lean, the Engineer of the proposed extension of the water-works on Booth Dean, belonging to the Wakefield Corporation, died somewhat unexpectedly at Rishworth, at the early age of 31. He had been away on the moors on the preceding Monday in the discharge of his duties; and it is supposed that, owing to the extreme severity of the weather, he contracted a cold which developed into influenza, followed by other complications. Medical aid was obtained; but, despite all efforts, he succumbed to the disease. Mr. Lean was from Gloucestershire, and only took up his residence at Rishworth (with his wife and one of his children) about three weeks previous to his death. His remains were removed to Gloucester for interment.

Annealing in Coal Gas.—Referring to the process described in the "Note" under this heading in a recent number of the *JOURNAL*, Mr. Thomas Fletcher writes that, like many others, it appears to be an old English one, taken abroad and brought back again as a novelty. He says it was used by himself fully ten years ago; and he found by experiment that it was quite unnecessary to fill the annealing chamber with either coal gas or nitrogen, as a small jet of coal gas burning at the openings ensured a perfect reducing atmosphere. In a lecture delivered by him before the Society of Arts on Jan. 30, 1884, and which was published in our columns, he described the simplest method of using coal gas for preventing oxidation, and ensuring a reducing atmosphere in heating and annealing chambers without the necessity for sealing these closely. In fact, the process was, he says, first devised for heating and hardening polished steel wire in continuous lengths. Another method tried in close chambers was a slow continuous dropping of petroleum into the chamber; but this was not carried out in practice at the time, as the gas was found simpler and safer. Mr. Fletcher states that if a large chamber is used, the opening of this, when filled with either coal gas or petroleum vapour, is sometimes neither a pleasant nor a safe operation; whereas if comparatively small jets of gas are employed at the openings, they will burn inside the chamber until the oxygen is exhausted, and will then burn at the openings.

COMMUNICATED ARTICLE.

THE CONSUMERS' INTEREST IN THE RATING OF GAS-WORKS.

By Norton H. Humphrys, Assoc. M. Inst. C. E.

Several recent rating appeals made by gas companies, and the costly legal proceedings in connection with them, naturally direct attention to the questions of who is to pay for it all; and so much misapprehension prevails on this point, outside the circle of those really concerned in the matter, that it seems desirable to trace the actual facts. The contest is usually supposed to rest between the gas company and the rating authorities. If the result has any marked effect, one way or the other, on existing arrangements, the one is said to be so much the better, and the other so much the worse off. Gas consumers, through their public representatives, will with one breath say that the company have so much money to spare that imaginary "repairs and renewals" have to be conjured up as a means of disposing of the surplus, and with another blame them as parsimonious for resisting an increase in the rating assessment. They will even rejoice if the company's appeal is unsuccessful; apparently on the ground that the shareholders will be compelled to disgorge some of the exorbitant profits, which popular prejudice, founded on the slight basis of high nominal rates of dividend, accredits them with receiving. This sort of reasoning appears to be founded on the tacit assumption that the amount due for rates is chargeable upon the profits, like income-tax.

The suggestion that the company are not fighting their own, but the consumers' battle, may perhaps be almost received with derision; yet such is the fact. A glance at any statutory balance-sheet will reveal the fact that the rates are one of the charges on the "Dr." side of the revenue account; and therefore as much a part of the expenses of producing gas as the cost of coal or labour. Turning to the balance-sheet of the South Metropolitan Gas Company for the six months ended Dec. 31, 1891, as an illustration, there will be found, among other items, the sum of nearly £18,000 paid as rates. The Gaslight and Coke Company, during the same period, paid upwards of £79,000. To all intents and purposes, so far as the profit is concerned, these amounts might be represented by additional cost of coal, labour, or any other of the items in the revenue account. The charge is in no sense a deduction from the rates of profit; on the other hand, it is a *direct tax on the consumer of gas*. It means that, for each 1000 cubic feet of gas sold by these two Companies, the purchaser has to pay something like 1½d. or 2d. towards the rates. The case may be fairly put by supposing the company to pay no rates themselves, but simply to act as the collectors thereof from the consumers. Or, to put the matter in another way. If a gas company's payment, as shown in their revenue account, represents (say) 2d. per 1000 cubic feet, we may suppose that the company, having no rates to pay, sell their gas for 2d. per 1000 cubic feet less, and that the rate collector has the power of examining the gas bills, and mulcting each consumer to the extent of 2d. per 1000 cubic feet of gas used. Such a plan would apparently put the matter in a very different light, so far as the user of gas is concerned; but, in reality, it would not disturb the condition of things at all, with one slight exception, to which attention must be drawn.

Gas companies subject to fixed rates of dividend would pay that rate as before. The price of gas being 2d. per 1000 cubic feet lower, would not have the slightest effect. But where the sliding scale is in force, with the usual provision of an increased rate of dividend at the rate of 5s. per cent. for each 1d. below the initial price per 1000 cubic feet, it would give some little advantage to the company, by enabling them to pay the shareholders an additional ½ per cent. dividend. Here we touch upon one of the defects of the sliding-scale system, which would be perfect if the price of gas depended entirely upon the results of careful administration. It is possible to conceive such a thing as a saving of 2d. per 1000 cubic feet by good management, combined with a loss of 4d. due to increased price of coal; and thus a circumstance over which the company have no control may swallow up the effects of their skill, and with it the right to the reward to which they may justly be entitled. On the other hand, we may have a badly-managed concern, able to sell gas cheaply on account of fortunate circumstances, and therefore reaping, by the medium of the sliding scale, large benefits which they do not actually deserve. Of course, all trading concerns are subjected to risks of a commercial nature; but it is not just that such risks should bulk largely in a parliamentary regulation that professes to offer both a reward and an inducement to careful and skilled administration.

Having advanced so far, we are in a position to appreciate the effect of a substantial increase in the rateable value of a gas undertaking, from the shareholders' point of view. It may be very briefly stated thus: Where standard or maximum rates of dividend are in force, the company could, and probably would, go on paying them as before. But with the sliding scale, the allowable rate of dividend would be moved down a few points. It has just been observed that the amount payable for rates in one case represents 2d. per 1000 cubic feet. If the increase was at the rate of 50 per cent., that item would then represent 3d.; and the cost of producing gas would be increased to the extent of 1d. per 1000 cubic feet, which would be a difference to dividend of 5s. per cent. Even supposing a direct connection between

the increased rate and the sliding scale, the effect would not be very important.

To all this a rejoinder may be made, in the form of a question as to why the companies concern themselves about the matter of rating at all, beyond paying whatever may be demanded. Granted that the standard-dividend gas undertakings are not affected at all, and the sliding-scale ones very slightly, it seems rather Quixotic to fight the consumers' battles for them. Is it sentiment or sheer obstinacy that makes gas companies look carefully after the rating assessments? The fact is that, though no direct effect is visible, in the form of a levy from the dividend-box, gas companies are indirectly interested in selling gas as cheaply as possible. Notwithstanding the popular prejudice, based upon high nominal dividends and large sums carried to reserve, it may be taken as a fact that, as a general rule, the endeavours of the Board are directed towards the goal of cheap gas. Whether or not they always follow the best means to that end, is, of course, a matter that is open to debate. They know that it is only by selling gas at a reasonable rate, capable of bearing fair comparison with what is usual in undertakings of similar size and circumstances, that they can hope to maintain the good-will of their customers, and the solidity and security of the interests in their charge. And therefore it is that gas companies protest against anything beyond a fair and reasonable assessment of their property.

The usual way of meeting arguments of this kind is to refer to actual practice as a different thing from theory, and to say that, although the principle may be wrong, there are compensating influences that come in under actual working, and that the thing rights itself. A common feature in this style of reply is to mix up the gas consumer and the ratepayer in the manner peculiar to members of the gas committees in towns where the gas supply is in the hands of the public, and large sums are annually subsidized from the gas revenue for public improvements; or, putting it more euphemistically, for the relief of the rates. When gas was employed only for lighting, it was possible that, if a ratepayer used gas at all, there was some sort of rough-and-ready proportion between the gas bill and the rate demand-note. But in these days of stoves, engines, and technical appliances, a small ratepayer may be a very large gas consumer, or *vice versa*. In the case of the high gas bill, it is a question whether the consumer would be pacified by knowing that the extra 1d. per 1000 cubic feet went in relief of the rates. It is evident that the gas undertaking should be fairly, and not exorbitantly rated, and that more in the interests of the consumers than in those of the shareholders. I think that, if the question were more generally clearly understood, we should find the gas consumers represented at rating appeals; and there would be an end to the unique spectacle of the appeal being presented by those who have only a secondary interest in it, while the primary party not only stands aloof as an indifferent spectator, but frequently ranks itself on the opposite side.

The Royal Commission on Water Supply.—The first meeting of the Commissioners appointed to consider the question of the Metropolitan Water Supply took place last Wednesday, at the Board of Trade, under the presidency of Lord Balfour of Burleigh; the other Commissioners present being Sir G. B. Bruce, Professor Dewar, Mr. G. H. Hill, Mr. J. Mansergh, and Dr. Ogle. The preliminary procedure was the only matter discussed; and the Commission adjourned till to-morrow. Mr. F. Gaskell, Secretary to the Local Government Act Commission, has been appointed Secretary.

Rainfall Statistics.—At the Institution of Civil Engineers last Tuesday, Mr. A. R. Binnie, M. Inst. C. E., Chief Engineer of the London County Council, read a paper "On Mean or Average Annual Rainfall." After an examination of 42 records from various parts of the world, extending over periods of from 50 to 97 years, and comprising 2535 annual observations, the author showed that the extreme deviation from the mean of different periods of observation might be: For 5 years, 14.93 per cent.; for 10 years, 8.22 per cent.; for 15 years, 4.75 per cent.; for 20 years, 3.24 per cent.; for 25 years, 2.75 per cent.; for 30 years, 2.26 per cent.; and for 35 years, 1.78 per cent. It was also shown that these probable errors were very similar in value both above and below the mean; there being but a small difference of about 1 per cent. between the values for these errors when they were considered as *plus* or *minus*. From a comparison of the various records, it did not appear that the geographical position of the stations had any effect on the amount of the above errors, but that they could be applied, within the limits noted in the paper, to rainfall observations in all parts of the world. An examination of 13 records and 688 annual observations, having falls of from 30.27 up to 94.13 inches, the mean of the whole being 43.62 inches, with 13 similar stations and 686 annual observations, the falls of which varied from 19.83 up to 30.20 inches, and averaged on the whole 26.27 inches, resulted in a difference of about 1 per cent. in the values of the errors derived from the two groups—a difference within what the author showed to be the probable error of all similar investigations. There was, however, he said, a small, though marked, tendency to a greater amount of probable error in the group of 13 stations of low fall, and a corresponding tendency to a decrease of the probable error in the group of 13 stations which had the greater rainfall.

TECHNICAL RECORD.

NEW ENGLAND ASSOCIATION OF GAS MANAGERS.

Annual Meeting at Boston.

The Twenty-second Annual Meeting of this Association was held at Young's Hotel, Boston, on the 17th and 18th ult., under the chairmanship of Mr. H. A. ALLYN, of Cambridge (Mass.), the President.

After the usual preliminary and routine business had been transacted, the President delivered an Inaugural Address, in the course of which he congratulated the members on the increase in the demand for gas, which was reported on all sides. He referred to a Bill passed by the Massachusetts Legislature during the year, entitled "A Bill to enable Municipalities in Massachusetts to distribute Gas and Electricity," which, he said, was undoubtedly carried through by the Nationalists. It enacted that any city or town might construct or control works for these purposes, provided that such a course was approved by a majority of two-thirds of the City Council for two consecutive years, and ratified by a majority of the voters at an annual election. In the case of existing gas or electric lighting works, they are to be purchased, subject to arbitration, &c., in the event of disagreement as to terms. As first submitted, the Bill was different in tone; but as passed, the rights of the companies appeared to be properly protected. Turning to the gas industry generally, he said, as regarded residuals, the advances in price of coke, tar, and ammoniacal liquor were extremely satisfactory. Electric lighting was becoming steadily developed; and those who did not intend to become identified with it must exercise determined and persistent effort if they were to hold their own. The price of gas should be reduced as low as possible, and energetic action taken for securing increased business. If it paid other people to keep travelling salesmen, why should it not pay gas companies to do so? He would like to see infused into gas directors some of the push and energy that characterized the managers of the electric light companies. As to the proposition to combine gas and electric lighting interests, in the majority of cases he considered that no benefit could accrue to the gas company by such coalition. He was not yet satisfied as to the profit earned by the supply of electric lighting, and he thought that where a gas engineer was called upon to take on the management of a supply station, in addition to his ordinary duties, the chances were that the new branch would occupy too much of his time and attention, to the detriment, of course, of the other. Notwithstanding numerous improvements in gas-burners, there was still room for one that gave a high duty, and was also cheap, simple, and durable. Speaking of water gas, he mentioned that a mixture of one part of water gas to two parts of coal gas gave satisfaction to the users, and enabled a high-quality gas to be sent out. Although the supply of coal had been abundant during the year, there was a great deal of complaint as to the quality. In conclusion, he offered a few words of advice to the younger members of the Association. They should, he said, control their tempers, and cultivate a cordial and friendly feeling with city or town officials, with whom they had business. It was even more important that they should retain the goodwill and confidence of the consumers, by uniform courtesy and careful attention to complaints.

Mr. F. Richardson, of North Adams (Mass.), then read a paper on the desirability and advantage of gas companies owning and operating a combined gas and electric lighting plant. He said that less than ten years ago his sale of gas was about 5 million cubic feet per annum, and the price 12s. 6d. per 1000 cubic feet. Now it was nearly 24 millions, and the price 7s. 6d. and 6s. 8d.; in addition to which 140 arc and upwards of 500 incandescent electric lights were supplied from a central station under the same roof. In 1885 an electric light and power company was formed in his district; and as it was found that it was well supported, and that the demand for gas was diminished in consequence, his Company gradually bought up all the shares, and obtained powers from the Commissioners to generate and furnish electricity. It was thought that £5000 would cover the cost of a new electric station; but nearly double that amount was actually spent. They took care to secure the best machinery and plant obtainable; and the outlay had proved a judicious one. The retort-house was extended to include a building 20 ft. by 37 ft., which served as a boiler-house; and adjoining this was the engine-room, 36 ft. by 55 ft., which contained a 150-horse power engine, and all the generating machinery. The boiler put in was of an upright tubular pattern, with very large heating surfaces. It was capable of evaporating 7 lbs. of water per pound of coke, or 10 lbs. per pound of soft coal used in the furnace, and was very efficient both in rapidly getting up and also in retaining heat. The engine was supplied with steam at 100 lbs. per square inch, and ran at 125 revolutions per minute. The floor of the machine-room was distinct from the side walls—being supported by piers; and thus all jar or shaking from the machinery was avoided. The commercial circuits were run till midnight; the arc lamps being charged 1s. 4d. to 1s. 8d. per night each, and the incandescent lamps 3s. 6d. to 4s. 2d. each per month. The public lamps were supplied all night; but only charged for at the rate of 1s. 3d. per night. Altogether, he was very well satisfied with the step he had taken.

In opening the discussion on the paper, Mr. Stiness said he agreed that an electric light plant could be run more economically, and would give better service, when in combination with a gas plant, than in any other way. In his case, the gas portion of the undertaking had not suffered, while the electric light department had increased beyond their most sanguine expectations. He was engaged in erecting a 4000-horse power plant, which when complete would cost £30,000. He thought the reader of the paper had put the advantages of the combined plant before the meeting in a very fair and temperate way. Dr. Amory, of Boston, said that in his case he had not applied surplus earnings, but had a separate capital for the electric lighting plant. After trying everything in the way of introducing stoves, lamps, &c., they found that the introduction of electricity reduced the consumption of gas; and therefore, like the author of the paper, they had bought up the electric light undertaking. It was better to do this at a fair price than to lose money in competing. The electric light was very useful on a gas-works, in the purifier-house and other places where it was not wise to have a naked light. Mr. C. H. Nettleton, of Birmingham (Conn.), said he was glad that his Company had taken up the electric light, although they had not made much profit from it. From his five years' experience, he could say that the combination worked well for small companies. He was surprised to hear that 1 lb. of coal would evaporate more water than 1 lb. of coke; having always understood that the reverse was the case. Mr. Harbison remarked that he had not yet heard, either from the author of the paper or from previous speakers, of any definite advantage to a gas company from having an electric lighting plant connected with it. He gathered that both Mr. Richardson and Mr. Stiness had invested in the electric light business surplus earnings derived from the sale of gas, after paying dividends. In that case, their profits must be large, and their prices high, and therefore sensitive to competition. He had hoped to hear how many stoves had been sent out, and by how much the cost of gas had been reduced, or the quality improved, during the time the electric light had been worked; but he had been disappointed. Nor had he heard how many million cubic feet were added to the annual output of gas by taking up the electric light. The Association represented men engaged in the gas industry, to whom such details would be more interesting than those about electric lighting. He apprehended that all the time bestowed by a gas manager on anything outside his proper business was employed at a loss to the industry with which he was connected. He hoped those who took up electricity would not overlook the fact that the gas business was still alive, that money might be made in it, and that in all towns there was yet a large field for extension. He agreed with a remark in the presidential address, as to the desirability of employing salesmen for extending the use of gas. In making these remarks, he had no feeling of hostility to the electric light; and he wished his friends every success with it. At Hartford there were two electric light companies, and they took away the public lighting—one-eighth of his total output; but he had quite recouped that loss. A year ago he increased the illuminating power of the gas 20 per cent., by the admixture of water gas with it—keeping the price the same. He believed in low prices for gas, with discounts for cash and for large consumption. Mr. A. C. Humphreys said he did not believe that a hard-and-fast rule should be laid down, but that the managers of each company should investigate local conditions for themselves. In small companies there was a certain waste that might be profitably employed in electric lighting; but this did not exist in large companies. Mr. Lamson agreed that the question was worth careful consideration; but said he believed that, in most places where the combined plants were worked, it was the gas business only that earned the dividends. In a small works there was undoubtedly some waste of labour that might be utilized in working the electric light. Mr. Neal said that, in the case of two companies with which he was concerned, the electric light department had been a paying one, though perhaps not so profitable as gas. He had no cause to regret having adopted the electric light. Mr. Lane pointed out that in some small towns the gas company earned a 5 or 6 per cent. dividend; but the electric light company were running as much the other way. Where, he asked, was the advantage of combining in that case? Mr. Richardson, in reply, said he was a staunch gas man, but also a firm believer in the advantage of operating a combined gas and electric lighting plant. In his case, the electric light department earned 12 per cent. profit. Perhaps it might not do in large towns; but it was a decided success in his particular case. His was a factory town, with but a small consumption for dwelling-houses.

Mr. Saville produced a specimen of wooden gas-pipe, which had been in use for 17 years, and was quite sound. He said he laid about 1 mile of 4-inch and 1½ miles of 2-inch wood pipe; but the smaller size was made of sappy material, and it rotted so quickly that he had to take it all up in two or three years. He was gradually doing away with the 4-inch, as it was leaky. Perhaps one pipe in 20 showed signs of decay; and the town authorities had requested him to remove it. He supplied oil gas, made by the Hanlon process; and at the time the pipes were laid, it was thought that the gas would tend to preserve the wood. Mr. Richards said that at a town in Michigan some miles of wood pipes were laid; but they had to be taken up

again. It was put down in hot weather, and he was told that the soil, after being for some hours exposed to the sun, was so hot that when it was filled in round the pipes, it caused them to crack and shrink. Mr. Todd observed that he had in use about 600 feet of 3-inch wood pipe. It was laid 16 years ago, and was now getting leaky. Several joints had sprung; but it was only where the tar coating was damaged that the pipes themselves had rotted.

The Committee appointed to secure a representation of the interests of the gas industry at the Chicago Exhibition then presented their report. It set forth that a representative Council had been formed in New York, and that Mr. M. S. Greenough was present that day as a deputation. Mr. Greenough then read copies of two circulars which had been issued to every gas undertaking in America. The first stated that a Committee had been formed, for the purpose of erecting a building, securing exhibits, and maintaining a creditable show of gas appliances at the exhibition. After giving details of the scheme, support was solicited on its behalf. It was signed by a large body of gas engineers and others, well known in the American gas industry. The second circular stated that space for a building 300 ft. by 150 ft. had been secured, and that no time should be lost. As a guide to the amount of subscriptions required, it was suggested that a sum equivalent to \$4 per million cubic feet of gas made per annum would be needed for the successful completion of the scheme. It concluded with the suggestion that a general assembly and reading room for subscribers might be provided, in which the 1893 meeting of the American Gaslight Association could be appropriately held. Mr. Greenough proceeded to enlarge on the necessity of the proper representation of the gas interests at Chicago, which, he said, involved a capital of four or five hundred million dollars. If sufficiently supported, the Committee proposed to follow the action of the French gas companies at the last Paris Exhibition, and show the latest developments in gas appliances. Visitors from every town would go to the exhibition; and therefore every gas company in America would be directly benefited by it. He also thought it would be possible to communicate with gas engineers in Europe, with the view of securing models, plans, and other interesting exhibits. Mr. A. C. Humphreys followed; and said that, if the thing was to be done at all, from £40,000 to £50,000 must be provided. Mr. Slater moved that the action taken in this matter should be approved and heartily endorsed by the Association. Dr. Amory seconded the motion; and it was carried unanimously. (To be continued.)

EXPLOSIONS CAUSED BY COAL DUST.

At the Meeting of the Chemical Society last Thursday week Professor T. E. Thorpe, F.R.S., contributed a paper, entitled "A Lecture Experiment to Illustrate the Phenomena of Coal-Dust Explosions." The evidence of experts was summarized in support of the contention that air charged with finely-divided coal dust may propagate an explosion in the absence of fire-damp. Brief details of some of the most disastrous colliery explosions of the last two decades were given; and the manner in which the aggregation of charred dust and *débris* gave a clue to the direction of the wave was explained. The instrument by which the phenomena were illustrated consisted of an oak tunnel, 20 feet in length and 4 inches square, with side limbs. The lid was in sections and hinged, to enable small obstacles to be placed in the channel prior to the experiment, and the depositions of charred dust to be examined afterwards. One end of the main tube communicated with a chamber which was filled with a mixture of air and coal gas in explosive proportions. It was demonstrated that the concussion caused by firing the gaseous mixture brought about the ignition and combustion with explosive violence of fine coal dust or lycopodium powder suspended in the air in the tube. The phenomenon did not occur with some varieties of coal; but no evidence was forthcoming to prove a relation between chemical composition and explosive properties.

Professor Thorpe afterwards exhibited an invention of Mr. Liveing, a student of the Royal School of Mines, for the detection and approximate estimation of fire-damp or gas in air. The apparatus consisted of two small chambers, in which were platinum wires of equal electrical resistance. The one chamber was filled with pure air; while the air to be tested was drawn into the other. An electric current was passed through the wires, when, if fire-damp was present in the air under examination, the wire in that chamber glowed with greater intensity than the one in pure air; the amount of light augmenting with an increase in the quantity of fire-damp. The rays from each wire, concentrated by lenses, were received on opposite sides of a screen, which was moved on a graduated scale until equal illumination was obtained on both sides. The scale was empirically graduated and marked in percentages of fire-damp. It was stated that one-fourth per cent. could be detected with certainty by this apparatus. An improved safety-lamp constructed for the same purpose, and not for illuminating, was also exhibited. These instruments should prove useful in purifying houses and other buildings of a gas-works,

REGISTER OF PATENTS.

Gas-Engines.—Hughes, F.; communicated from F. Cordenous, of Padua, Italy. No. 2976; Feb. 18, 1891.

This invention, relating to gas-engines, refers to a rotary engine consisting of three cylinders having a circular motion around the shaft, and furnished with pistons receiving the usual to-and-fro motion; the whole engine being so arranged and constructed that two strokes are produced at each explosion, instead of four strokes as in gas-engines hitherto constructed.

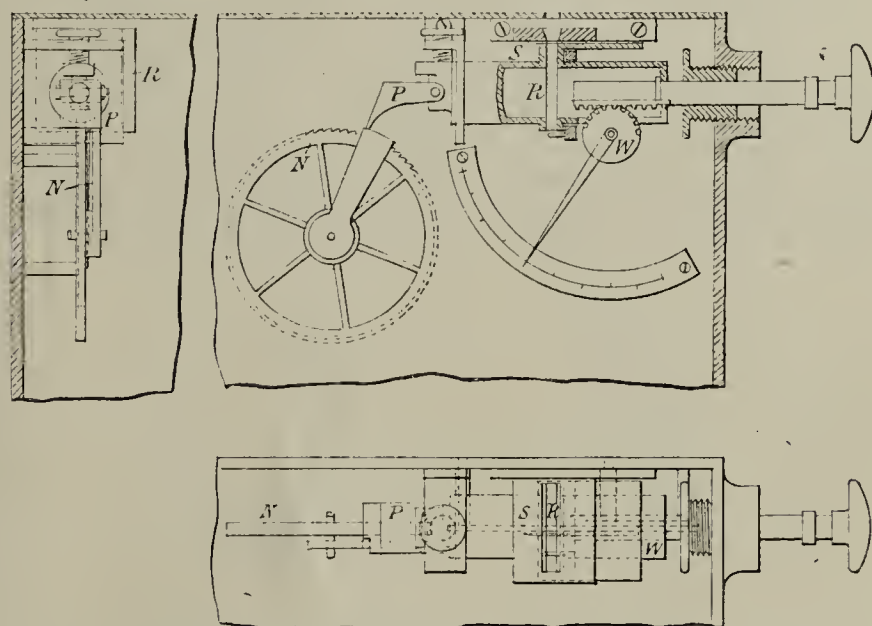
The rotary motion of the whole of the engine, with the exception of the framework, is produced by the six explosions of the three cylinders; and it is communicated to the motor shaft by the aid of centrifugal force—the three cylinders and their valve gears acting as a fly-wheel. Upon the two pedestals, arranged on each side of the engine, are rigidly bolted two stop-pieces, against which the heads of the connecting-rods abut in turn; so that, as the explosion occurs at this moment, the corresponding cylinder receives an impulse, and is caused to rotate while the piston remains momentarily a fixture. The motor shaft carries two cams firmly fixed together, one of which actuates the slide-valves distributing to the cylinder the charge exhausted from a suitable gas-conduit and from the atmosphere by a valve actuated by the other cam. The products of combustion are allowed to escape through any suitable arrangement of pipe; and the ignition is effected by an electric spark produced, when the circuit from a battery is completed by means of suitable contacts, between the two pointed ends of two rods separated at the time.

Gas Cooking and Heating Stove.—Billing, C. E., of High Holborn. No. 3167; Feb. 21, 1891.

This invention—which relates to a gas cooking and heating stove, so arranged that roasting, boiling, and baking may be accomplished at the same time by the aid of one burner so constructed that the heat flames burn vertically and horizontally simultaneously—was sufficiently described in the JOURNAL for June 9 last year, p. 1127.

Prepayment Gas-Meters.—Cowan, W., of Edinburgh. No. 3575; Feb. 27, 1891.

This invention (which relates to improvements in prepayment gas-meters of the coin-freed type, and in part applicable to non-prepayment gas-meters) consists of improvements in and modifications of, as well as of additions to, the patentee's previous invention No. 11,537, of 1890. One portion of the present invention is an improved method of keeping the lever opening in the side of the supplementary valve-box gas-tight. Another part has reference only or chiefly to the coin form of prepayment meters, as described in the former specification. The improvements (like those of the previous invention) apply both to wet and dry meters.



In the improvements applicable only or chiefly to the coin form of prepayment meters, the patentee proposes to dispense with most of the mechanism for discharging the coin into the money-box and for driving the pawl P of the prepayment wheel N, which was described in the previous specification; and he substitutes therefor more simple means for effecting these purposes. The arrangement of the index and the prepayment wheel, together with the means employed for opening, keeping open, and closing the supplementary valve, and also the price changing platform and its appendages, will be practically the same as is described in the previous specification. But in this invention the slot into which the coin is dropped is formed in a moveable slot-piece R, which is joined or linked at its side or end on to the pawl P of the prepayment wheel N. The slot-piece will also be so joined at its other side or end to near the extremity of the pusher-rod, that all three—pusher, slot-piece, and pawl—will move forward and return backward together. But in order to make this united action entirely dependent on the presence of the coin in the slot, an opening is made through the slot; and through this the pusher will pass unimpeded and without result if no coin be present. In the event, however, of a coin being in the slot, the opening is closed or obstructed, with the result that the pusher in moving carries with it the slot piece, the coin, and the pawl, and so drives forward the prepayment wheel.

The slot-piece R, which is capable of a forward and backward movement, is suitably guided in brackets secured to the inside of the index-box; and it is so placed that, when in its normal position, the upper or inlet end of the slot is immediately under a corresponding opening formed in a fixed guard-plate S, whose opening is immediately under the usual opening or slot in the cover of the index-box; the guard-plate being for the purpose of preventing the coin from being surreptitiously withdrawn after the pusher has been operated—this being assisted by the tail piece or plate formed on the slot-piece. The slots are so

arranged that, on a coin being passed through the outer one, it at once enters the main slot, in which position it is held until the pusher has (by pressing against the coin,) given it the necessary support, by an independently fixed guard. This may take the form of one or more pins mounted directly over the entrance to the money-box, so as to cover enough of the bottom or outlet end of the slot to prevent the escape of the particular size of coin it is necessary to employ. A coin of smaller size will not, however, be obstructed by the guard, but will fall at once through into the money-box. When the pusher is operated, by being pressed inwards, its pressure against the coin is sufficient to maintain the coin in position after the slot has been moved away from the supporting guard or pins; but in the event of any attempt being made to withdraw the pusher, and hence relax the pressure on the coin before the proper point has been reached, the coin will at once fall through the slot into the money-box. When, however, the pusher has moved the slot-piece R and pawl P the required distance, and is then withdrawn ever so little, the pressure upon the coin is relaxed, and the coin then falls into the money-box, and is no longer available to give power to the pusher.

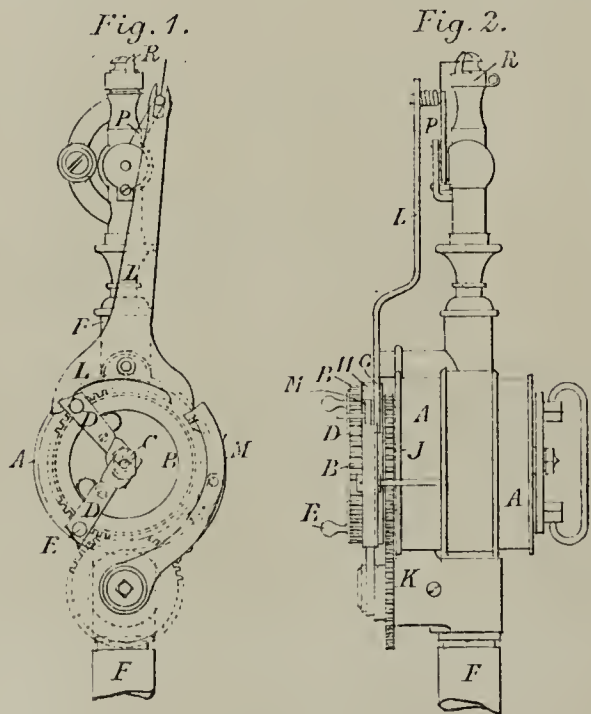
It may sometimes happen (either accidentally or intentionally) that a coin coated with fatty or other adhesive material may be passed into the slot, and be retained there by adhesion between it and the surface with which it is in contact. In order to prevent such an occurrence, and a fraudulent use of such a possibility, the slot is ribbed, or it may have pins, so as to reduce the contact between the coin and the slot to the least possible amount of touching surface, as shown.

Another part of this invention consists of a method of adapting the prepayment mechanism to changes in the price of gas. It will be noticed that the length of travel given to the pusher determines the distance the pawl P will traverse, and consequently the extent of the movement it will give to the prepayment wheel N. The patentee therefore provides the pusher with an adjusting arrangement W, which, on being operated, will increase or decrease the travel, and so alter the movement the pusher gives to the wheel N, which in this case has a stationary platform. The arrangement W is composed of an adjustable screwed nut, accessible to the gas official only, and which may be screwed in or out of the boss of the index-case; the exact distance being regulated on a scale by means of a pointer, which is geared by means of a spur-pinion with a spur-rack formed on the end of the pusher, and so makes the change a very simple operation.

In some instances a "stop" may be employed, instead of a valve, to terminate the supply of gas, by offering an obstruction to the progress of the meter's mechanism. For this purpose a "stop lever" may be employed, under the control of a grooved disc or band having a notch or opening in it, or else of an arm projecting from the prepayment-wheel.

Gas Lighting and Extinguishing Apparatus.—Adkins, W., of Birmingham, and Melville, J., of Pall Mall, S.W. No. 5417; March 26, 1891.

This invention refers to apparatus for turning on, lighting, and turning off gas-lamps at predetermined times. It primarily consists of ordinary chronometric mechanism, operating a time disc carrying adjustable cam-tappet devices for releasing a toothed or star wheel; the latter being moved (when released) by a separate or secondary wound spring or its equivalent—for example, by a weight. The star-wheel acts on "anchor pallets," which rock an upper arm for turning the gas off or on; and it makes contact for igniting the gas by an electric spark.



The illustrations are a front and side view of the appliance.

A is a casing containing clock-work mechanism of ordinary character, capable of rotating the time-disc B (fixed to the clock-spindle C) one complete revolution every twenty-four hours. The time-disc is divided into 96 divisions, to represent quarter hours, and is formed with teeth at the periphery. D and D¹ are the cam-tappets; the inner ends being forked or slotted and embracing the spindle C, and the outer ends having teeth with springs to hold them normally in between the teeth on the time-disc, so that the tappets may be shifted to any position around the time-disc and there retained. E are handles for moving the tappets. F is the gas-supply pipe passing from below; and being continued on each side of the clock through an annular passage, it again joins into a vertical tube leading to the gas-burner. Supported on the same spindle as the time-disc, is the star-wheel G, the ratchet-wheel H, and a spur-wheel J, all of which are fixed together, but are free to turn together independently of the clock mechanism. K is the secondary spring case, the spindle of which, by means of a ratchet-wheel and pawl, drives a pinion gearing with the spur-wheel J. Above the clock is

pivoted a rocking-arm L, having its lower end bifurcated so as to form anchor pallets, which are acted upon by the teeth of the star-wheel. M is a jointed pawl for controlling the ratchet-wheel H; and there is a projecting pin on the pawl M, to be acted upon by the inclined heads of the cam-tappets. The ratchet-wheel H has (say) twice the number of teeth on the star-wheel G; and therefore, when it is allowed to move through the space of one tooth, the star-wheel will cause the lever arm L to rock in one direction; and on the ratchet H again moving through the space of another tooth, the arm will be rocked in the opposite direction.

The plug of the tap controlling the supply of gas is provided with an arm P, having a projecting pin engaging in a slot in the arm L, by which the tap is operated. On the pin is a spring wire conductor having an upper bent end; and on the burner is an insulated conducting ring R—both wire and ring being in connection with an electric battery and coil apparatus.

The operation of the apparatus is effected as follows: The attendant sets the cam-tappets D and D¹ in the proper positions relatively to each other, and adjusts the distance of the tappet D¹ from the pin of the pawl M. The clockwork in the case A is then wound by a handle at the back; also the secondary spring at K is wound up. The apparatus will now act automatically. On the cam-tappet D¹ (carried by the revolving time-disc) passing the pawl pin, the inclined edge of the tappet will force the pawl away from the ratchet-wheel H; and the secondary spring will act through spur-wheels and rotate the wheels G and H the space of one tooth of the ratchet, and rock the arm L, turn on the gas-tap by the arm P, and immediately afterwards bring the wire past the contact-ring R, causing an electric spark, and thereby lighting the gas. The continued rotation of the dial will, at a fixed time (according to the distance which the tappets have been set apart), bring the tappet D against the pawl pin; and the mechanical movements already described will again occur, excepting that the arm L will move in the reverse direction, and the gas will be turned off.

Gas-Fittings.—Fairbank, J., of Hoxton. No. 6839; April 21, 1891.

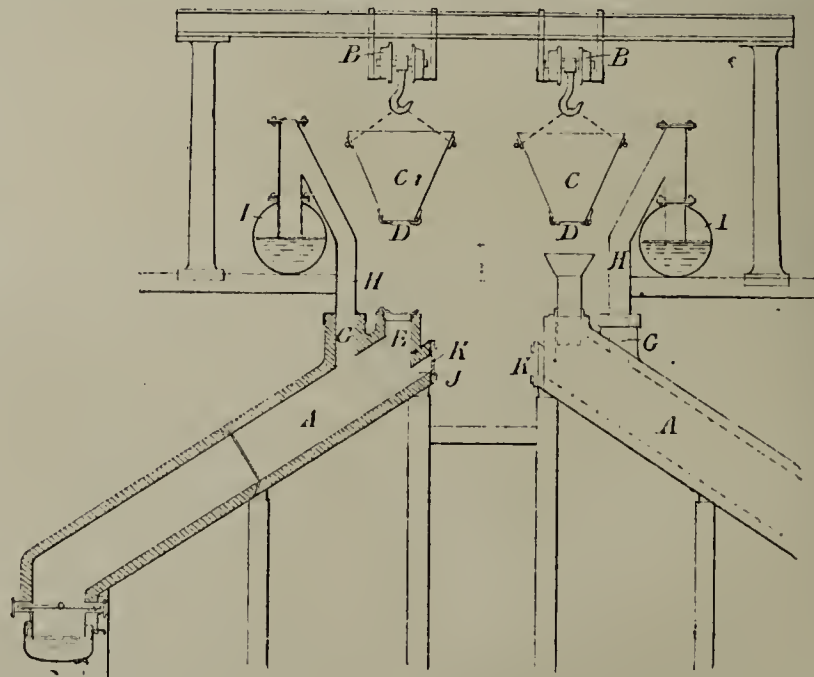
This "invention" in gas-fittings has for its object the prevention of waste of gas while alight and the escape of gas when not burning. The cock is constructed with locking devices, by means of which the gas is turned off to the lowest limit and locked there, if it is desired to leave it burning; or if it is to be extinguished entirely, the cock is pressed past the first lock on to a second, where it is firmly fixed, and cannot be knocked on by accident or turned too far. In order to apply the idea to existing fittings; a metal spring is provided, having notches, grooves, or stops at one end, and a clipping apparatus at the other end for securing it to the gas-pipe. The spring presses upon the tap, and holds it firmly in the position in which it is placed, and answers in all ways the purposes above described.

An Electro-Magnetic Gas Controller.—M'Laren, J., of Edinburgh. No. 6908; April 22, 1891.

This instrument has been designed to automatically turn up the gas light in any building where the electric light is used, whenever the latter fails. A valve is placed in a convenient part of the gas service-pipe; the spindle which is fixed to the valve passes through a stuffing-box, where a small iron armature is fixed to it; and on a small frame which connects the whole instrument together, two electro-magnets are held in position by screws. When the electric light is on, a strong magnetism is produced in the cores of the electro-magnets, which immediately draws the armature towards them; and the valve, being fixed to the same spindle, is also drawn down, and therefore closes the gas-valve. There is a bye-pass valve arranged so that, when the main valve is closed, the bye-pass supplies a sufficient quantity of gas to keep a "peep" in the burners which are to be operated by the apparatus.

Gas-Retorts.—Cotton, W. T., of Brixton, S.W., and Crowther, E. F. B., of Withington, Lancs. No. 6947; April 22, 1891.

This invention in gas-retorts is designed (1) to enable the gaseous products to be taken from the top of the retort to the hydraulic main; (2) to enable the coal to be fed directly into the retort from an overhead tram or railway without having to lift the coal or use a shovel; and (3) to enable the retorts to be effectually cleaned of any coke or carbon which may cling thereto.



In the accompanying illustration—a gas-retort half in section and half in elevation, together with the hydraulic main and an overhead tramway by which coal may be conveyed to the retorts—A is the retort; and B, an overhead tram or railway, from which trucks C containing the coal to be carbonized are suspended, and can be conducted

on the rails to the retorts. D are doors in the bottom of the trucks for discharging the coal. E is the aperture in the retort for charging it with coal, which can be regulated in its descent into the retort by partially or entirely opening the doors D, while a funnel or hopper may be used to facilitate the charging of the retort. After the retort is sufficiently charged with coal, a fire-clay slab or lid is placed over the aperture E to keep in the heat; and any suitable metallic door or dome may be mounted over it to make a gas-tight joint. In proximity to the aperture E, is another aperture G, through which the crude gas produced in the retort ascends into the stand-pipes H, and is then conducted through the dip-pipes into the hydraulic main I. In the end of the retort, and underneath the aperture E, is another aperture J, through which an iron rod or poker may be inserted to remove any coke or carbon that may adhere to the inner walls after the retort has been discharged. This aperture is provided with a lid K, to be opened when the retort has to be cleared out.

Spreading Disc for Gas-Burners.—Ephraim, A., of Berlin. No. 7269; April 27, 1891.

Alluding to his proposal, the patentee says: As is well known, gas-flames give out a yellowish light if the heat of combustion is not sufficiently high for heating to incandescence the lighting materials contained in the combustible gas—more especially the carbon carried away; and this heat may be increased by spreading or broadening them in order to afford the air better access. Moreover, it is well known that (as in the Welsbach incandescent gas-light) the illuminating power of the flames may be considerably increased by the insertion of incandescent bodies presenting a great power of radiating light; but the fabric of these lamps is too liable to break to be used in small gas-lamps.

The present invention therefore is intended to enable the advantages of the spreading discs to be combined with those of solid incandescent bodies in the flame; use being made of discs of asbestos. Discs possessing parts of metal—for instance, platinum—as solid incandescent bodies have already been employed for this purpose; and use has heretofore been made of discs of asbestos saturated with a solution of a platinum salt. Experience has, however, demonstrated the impossibility of uniformly distributing the platinum in the asbestos mill-board; and the incandescent disc made in this way subsequently shows a spotty light. The same defective result is produced in the case of all the metallic salts that may be employed which also possess the property of liberating the metal in the heat. In contradistinction to this, the patentee proposes to use, in the preparation of the asbestos mill-board, a chemical compound which is not liable to be decomposed in the heat—namely, a solution of silicate; and water-glass appears to be best adapted. If then, by the action of the heat, the mill-board is destroyed, a mass as hard as stone is produced, which constitutes an excellent incandescent body.

Gas-Engines.—Pinkney, C. W., of Smethwick. No. 7313; April 28, 1891.

This invention in engines worked by the explosion of gas has reference more especially to "four-cycle engines." To render such engines capable of working with less shock than hitherto, the combustion chamber is made conical or lessening in capacity as it recedes from the working cylinder; the smaller or rear end being turned down or round in a curve towards the gas inlet and igniter passage. The charge, as it thus enters the combustion chamber, easily spreads out and clears the chamber of burnt gases; presenting the pure or practically pure gaseous mixture to the igniter. The ignition thus commences at the smaller end, and spreads without shock to the larger end of the combustion chamber. The main body and spindle of the valve are made of a non-oxidizable metal or alloy—such as brass or bronze; and there is attached thereto (preferably by screwing into the end of the spindle) a hard metal piece, which bears upon the seat, and acts as the valve proper. The igniter-tube extends upwards from the combustion chamber into the chimney, into which opens the nozzle of a Bunsen burner, the flame of which plays upon and heats the igniter-tube. This burner is made telescopic, so that the part secured to the chimney can be moved with the chimney attached to the combustion chamber or other suitable part; and in this way, by a screw or otherwise, the chimney and the part of the burner carried by it can be moved relatively to the igniter-tube, so as to allow of the lamp flame playing upon any part of the igniter-tube according to the period of ignition desired.

The governing is preferably effected by an arrangement analogous to that described in patent No. 1218 of 1885; but instead of being fitted in the way there explained, it works off the second motion shaft by means of a cam; the lever or pusher which acts upon the valve-opening arrangement, and is provided with the incline described in the 1885 specification, being carried by a lever arm centered to any suitable part of the engine, and being provided with springs, which keep it in proper position, and enable the governing arrangement to be used in any position. One of the springs can, by means of a screw, be employed as a regulating spring; so that, by operating the screw, the speed of the engine is regulated without stopping it.

To ensure the gas and air being properly mixed, they enter directly at or about right angles to each other—the gas flowing round an annular passage surrounding the inlet-chamber beneath the inlet-valve, and passing from this passage through a number of small openings into the inlet-chamber; the air entering into the inlet-chamber also from an annular passage surrounding it, so that it cuts across the incoming streams of gas. To ensure the gas being cleared out of the annular gas passage, the gas supply-valve is closed just before the piston of the working cylinder reaches the end of its charging stroke, so that air alone then enters and passes by a communicating passage leading from the air passage into the gas passage to clear it of gas. Gas cannot pass down the communicating passage, owing to the vacuum necessary for charging purposes in the inlet-chamber being greater above the air-inlet passage to the chamber than below it, which can be effected by contracting the space above the air-inlet passage.

To prevent or lessen the noise arising from the inrush of air when charging, there are provided in the air-inlet pipe or passage baffles, against which the air strikes, and so is diverted or broken up, and noise is prevented or greatly lessened.

Gas-Engines.—Southall, J., of Worcester. No. 9038; May 28, 1891.

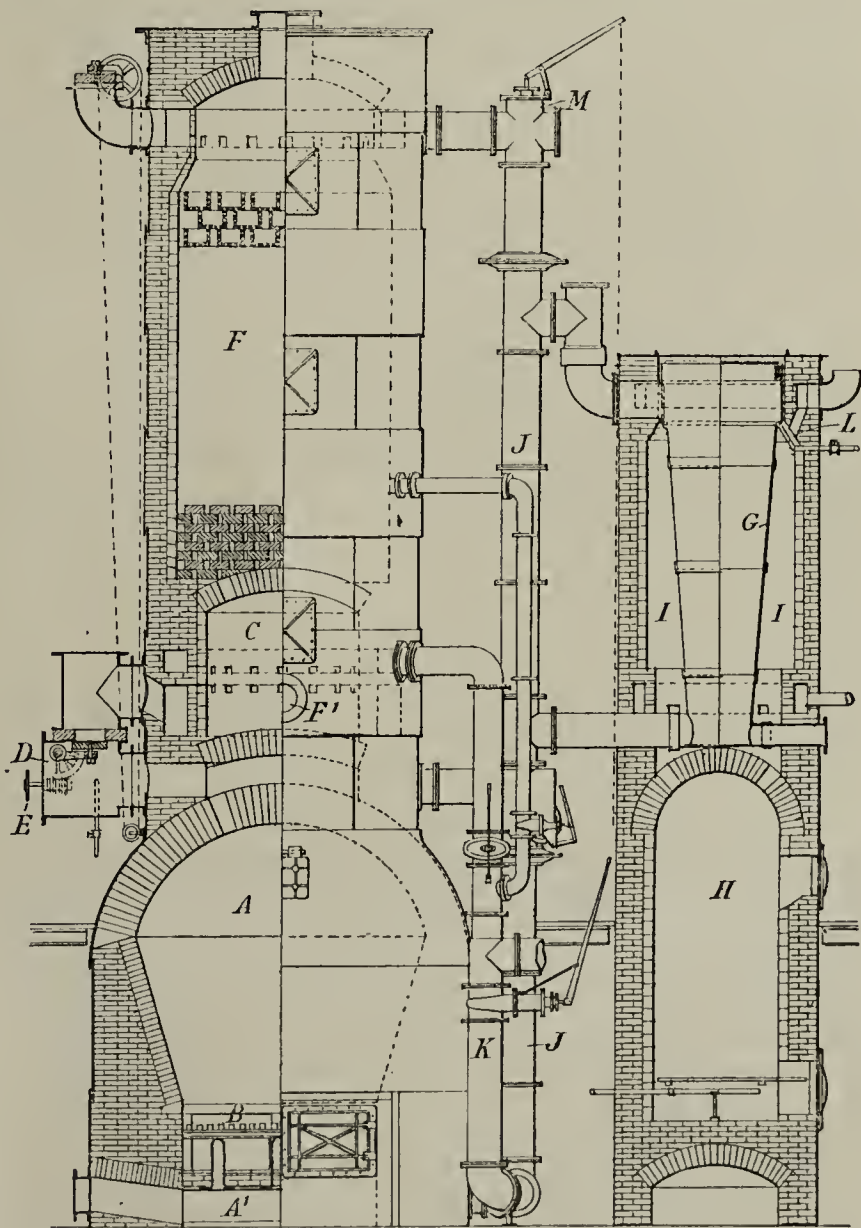
The main object of this invention in the matter of gas-engines relates to making the larger sizes in such a way that they may be started with compressed air controlled by a hand-lever. To accomplish these objects, a valve is arranged so made as to perform the double duty of admitting the gas and air to the cylinder, and also of letting out the products of combustion during the exhaust stroke; and the front end of the cylinder is closed in, as in a double-acting steam cylinder—using on this front end a special arrangement of valves, so that it acts simply as an air-pump, and is available for starting—the clearance space in the front end of the cylinder being as small as practicable. The front end of the cylinder is provided with a port, which connects with a chamber in which are two valves, working in the same manner as in a force-pump, excepting that they are so made that, by means of a lever in the chamber working on a spindle passing air-tight out through one side of it, they can be controlled by an exterior hand-lever, so that whilst the suction-valve is on its seat, the delivery-valve can be raised off its seat, or *vice versa*; or if the lever is put in a neutral position, both valves are free to rise and fall.

Supposing the engine is running with the lever in this last-named position, the front space of the cylinder will be acting as an air-pump, drawing in air through the suction-valve, and forcing it up through the delivery-valve, thence into a reservoir provided to receive it. This is allowed to go on until a pressure-gauge on the reservoir shows the desired pressure has been reached. The lever is then moved, and fixed so as to hold the suction-valve open, and allow the piston to simply draw in air and expel it without effort; the delivery-valve serving to retain the pressure in the reservoir.

Water-Gas Apparatus.—Springer, T. G., of Chicago, Ill., U.S.A. No. 19,641; Nov. 12, 1891.

This invention has reference to "apparatus wherein steam is decomposed into hydrogen and carbonic acid gas, by passing it through a body of incandescent carbon in a closed chamber, and caused to mix with vaporized oil or liquid hydrocarbons; the mixture being finally passed through a chamber (called a fixing chamber), containing refractory material in a highly-heated state, wherein the combined gases are rendered a fixed illuminating gas."

In carrying out the manufacture of such gas, says the patentee, it is found desirable to provide for the treatment of oils of different specific gravity—that is to say, a heavy oil will require a different heat to properly vaporize it from a lighter oil. It is expedient, therefore, to make provision for the regulation of the oil-vaporizing portion of the apparatus independent of the water or steam gasifier, in order to suit the requirements of each oil under treatment, whatever may be the specific gravity. The object of the invention is "to provide for such regulation, and thereby to render the apparatus available under all circumstances, no matter what oils are submitted for treatment."



The accompanying illustration shows a complete gas-making cupola, with the present improvements applied thereto.

A is the cupola furnace or generator (with suitable doors for charging, stoking, &c.), wherein steam is decomposed. Beneath the grate-bars B is an enclosed ash-pit A'. Within the ash-pit are air-supply pipes for blasting the fuel in the furnace and getting up a heat. Above the furnace is a combustion chamber C, having communication with the furnace through the valve-box D. This box is furnished with a flap-valve opening downwards, operated by a sector rack keyed on the rock-shaft end outside the valve-box. A worm gears with the rack

upon a shaft turning in bearings upon the outside of the valve-box; and the hand-wheel E operates the worm. F is the fixing chamber, situated above the combustion chamber C, containing refractory material, and shallow perforated trays holding lime for purifying the gas.

A purge-valve is provided for allowing the escape of products of combustion during the heating up of the fuel in the furnace to an incandescent state. J is what is called the hydrogen-pipe, which, for convenience, is carried up the whole height of the cupola; but is blocked, so that there is no passage from end to end of the pipe. At its lower end the pipe communicates, by a three-way junction, with the blast-pipe K, and with the ash-pit. The blast-pipe has communication with the combustion chamber C, as well as with the ash-pit. The admission of air to the combustion chamber is desirable for completing the combustion of the gases generated during the blasting of the fuel in the furnace or generating chamber. Should the combustion be still incomplete in the chamber, air is admitted to the fixing chamber F at F¹, where the remainder of the products of combustion (if any) can be consumed. G is the oil-vaporizing retort (made in sections of cast rings or tubes, hooped around at the joints) situated in a separate setting alongside the cupola, but communicating with it at its lower end by a pipe which delivers the water gas from the cupola through the hydrogen-pipe J. H is the furnace, which delivers its heat through apertures in the dome to the space I around the retort G; whence the products of combustion, after heating the retort, pass to the escape-flue. L is a ring oil-pipe leading from a suitable supply, for delivering oil in a thin stream upon the inner surface of the retort. The retort is connected with the upper portion of the pipe J, and thereby with the upper part of the fixing chamber F of the cupola. M is a valve for controlling the passage from the retort to the chamber F, as required. There is an air-blast pipe below the fire-bars of the furnace H, by means of which the heat of the furnace, and consequently of the retort G, may be increased, or allowed to diminish, in accordance with the requirements of the oil to be vaporized. By this means, the oil gas within the retort can be brought into the most favourable state for combining with the hot water gas as it comes from the cupola and mixes with the oil vapours in the retort, before passing to the fixing chamber.

The action of the apparatus is as follows: The furnace A, being charged with fuel, the air-blast from the pipe K is first admitted by the ash-pit. The blast carries up the products of combustion from the furnace through the valve-box D and its valve, which is open to the combustion chamber C, where they meet a current of air. Thence the heated products pass to the chamber, rendering the refractory material and lime troughs therein very hot. From the chamber F, the waste products of combustion from the cupola escape through the purge-valve into the open air. When sufficient heat is obtained in the cupola, the air-blast is cut off, and all the valves are closed in the air-pipe; the purge-valve being also closed. Steam is then admitted into the space above the furnace A; and being under high pressure, it is forced downward through the fuel to the ash-pit, and being converted into hydrogen and carbonic oxide, the steam enters the base of the hydrogen-pipe J, and passes upwards through it, and thence into the retort G. At the same time, the air-blast is turned into the furnace H; and the heat therefrom, regulated (as explained) by the power of the blast, impinges upon the exterior of the retort, so as to vaporize the oil flowing from the pipe L. The mixed gases and oil vapour pass together to the chamber F, thence down through the lime, which takes up any carbonic acid present, and down through the refractory material, thereby being converted into a fixed illuminating gas.

APPLICATIONS FOR LETTERS PATENT.

- 4969.—THORPE, H., "Gas-brackets." March 14.
 4981.—DOWSON, J. E., "Gas and oil engines." March 14.
 4993.—O'GORMAN, M., "Gas-regulators." March 14.
 5032.—GLEGG, A., "Gas-fires." March 15.
 5108.—FISH, R., and SMITH, W., "Regulating liquid seals in gas-washers and the like." March 15.
 5122.—TAYLOR, J. W., and RADERMACHER, J., "Water and other fluid meters." March 15.
 5198.—LAYCOCK, J., and CLAPHAM, S. B., "Purification of coal gas." March 16.
 5226.—ZEITSCHER, B., "Gas-lamps." March 16.
 5228.—BOULT, A. J., "Wet gas-meters." A communication from G. W. Gay. March 16.
 5239.—YEADON, J. A., and ADGIE, W., "Revivifying gas lime (sulphide of calcium) and other analogous materials." March 16.
 5428.—PADGHAM, G. H., "Gas and petroleum engines." March 19.
 5444.—PAYNE, F., and FROST, T., "Gas and oil motors." March 19.

The Purchase of the Rhyl Gas-Works by the Commissioners.—A public meeting of ratepayers and owners was held at Rhyl on Monday last week, for the purpose of considering a resolution in favour of an application by the Improvement Commissioners to the Local Government Board for sanction to borrow £35,000 for the purchase of the gas-works. Mr. W. E. Williams, the Chairman of the Commissioners, presided; and, in his opening remarks, argued that it would be one of the best things that could happen if they were empowered to acquire the works. Captain Keatinge moved the resolution expressing approval of the application. This was seconded by Mr. P. Mostyn Williams; and was carried, with very little opposition.

Armagh Gas Company.—In their annual report, which was submitted for adoption at the meeting of this Company held yesterday week, the Directors referred, in the first place, to the increased price which they had had to pay for coal. In 1889, they stated, coal advanced 1s. per ton; in the second six months of 1890, it was 2s. 6d. additional; and in 1891, all the coal used was at this high figure. This exceptional rate incurred an outlay of about £400 per annum, after the price of gas had been reduced to 4s. 2d. per 1000 cubic feet. To assist the Town Commissioners in improving the public lighting of the streets, the price charged to them was further reduced to 3s. 6d. per 1000 feet. The Directors recommended a dividend at the rate of 1s. 9d. per share, free of income-tax, absorbing £945. The report was adopted.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

Standards of Light.

SIR,—I have been considering the vexed question of standards of light, and trying to evolve something new, but have returned to the much-abused candles for a basis. An improvement in the present method of testing might be effected by multiplying the number of candles used; two being insufficient to correct for the irregularities of burning, &c. With an increased number—say four, six, or eight—a great regularity would possibly accrue; and a single reading in the centre of the bar would suffice; while one tester might read and another check it without a chance of dispute as to the reading.

I have tried numerous experiments with four candles, by using an arrangement having four spring sockets, soldered to a strip of brass, in a straight line, at the usual centres (about 1½ inch); and the results are most satisfactory.

The advantages of the four-candle tests are—

1. The disc being brought nearer the centre of the bar, where the divisions are wider, it is far easier to read; and as the difference is so conspicuous, it is difficult to make a mistake of even a single decimal point.
2. The variations in the readings do not exceed more than 3 or 4 points all through a test.
3. The time waiting for the candles to consume sufficient sperm to balance over the centre, when ready to commence a test, is only one-half as long as required with two candles.
4. The irregularities of each candle are corrected almost imperceptibly; and the 80 grains of sperm are more nearly adhered to than are the 40 grains with two candles.
5. The illuminating power is more accurately obtained.

March 26, 1892.

LIGHT.

Regulating the Seal in, and Drawing the Tar from, Hydraulic Mains.

SIR,—I am surprised at Mr. Hislop's letter in your last issue, where he says that the illustrations of his patent "possess no features of similarity" to those in the JOURNAL for Dec. 16, 1879, "excepting that in both the connecting-pipe is attached to the bottom of the main." Has Mr. Hislop examined the number of the JOURNAL mentioned? for the connecting-pipe is shown attached to the end of the main as well as to the bottom; but that was merely to suit existing circumstances. There is a closer resemblance between the illustrations than the above—viz., the method of regulating the seal. In the 1879 illustrations, this is done by raising or lowering a screwed piece on the top of the upstand pipe; while Mr. Hislop's plan is a piece fitted close over that pipe, and raised or lowered by a screw, as required. In every way the result is the same; and one wonders at the patent, when, as Mr. Ellery says, so many similar regulators, "even to some small details," are in use.

March 24, 1892.

J. H.

The Action of Gasholder-Tank Water upon Cement.

SIR,—I am about to put down a new gasholder, the tank for which will be 25 feet deep. About one-half of its depth will be in the new red sandstone rock, which I intend to have sawn-faced, and any fissures which may occur plugged. In front of the rock wall, I purpose building a 4½-inch brick ring in cement, with a cavity of 1½ inches between, filled in with Portland cement grouting. As the water in the tank will eventually become ammoniated, I have some misgivings as to whether or not its action on the cement may, in course of time, cause it to become leaky. I shall therefore be glad if some of your readers will express their opinions and experience in connection with tanks so constructed.

March 26, 1892.

AN OLD SUBSCRIBER.

Fourness's Gas Patents.

SIR,—It may interest the above-named inventor, as well as others of your readers, to learn that the Gaseous and Liquid Fuel Supply Company, Limited, hold patents for injecting oil under pressure for the purpose of enriching generator gas. Further, that contracts were made so long as 3½ years ago to erect plants for generator gas to be enriched by oil injected into retorts through which the gas passed on its way to the purifying plant. It was found that, in injecting oil into full-sized retorts, the difficulty was to prevent leakage in the absence of the graphite which forms in coal-gas retorts. There is therefore no patentable novelty in this arrangement.

D. H. NOAR, Secretary,

The Gaseous and Liquid Fuel Supply Company, Limited.
 Manchester, March 25, 1892.

Sales of Shares.—Among some miscellaneous shares sold by auction at Portsea last Wednesday week, were two £53 fully-paid shares, "A" series, in the *Portsea Gas Company*, which realized £112 each; two £50 ditto "B" series, which produced £106 each; and ten fully-paid £10 original shares in the *Portsmouth-Water Works Company*, for which £28 2s. 6d. each was obtained.—Five £100 bonds in the perpetual debenture stock of the *Lowestoft Water and Gas Company* (bearing interest at the rate of 4 per cent. per annum) realized, at a sale by auction on the 16th inst., £112 and £113 each; and ten fully paid-up preference shares of £10 each (receiving interest at the rate of 5 per cent.) sold equally well.—The following new shares in the *Maidstone Gas Company* have been disposed of at the prices stated: Four lots of £100 consolidated stock fetched £201 and £202 each; six £50 do. were disposed of at prices ranging from £100 to £102; four £25 do. realized £51 and £52 each; and two £30 do., £63 each.—Four lots of five £10 ordinary 7 per cent. shares in the *Maidstone Water Company* have been sold for £17 10s. each.—Twenty £10 shares in the *Crays Gas Company* have lately changed hands at £19 15s. each.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress was made with Bills last week :—

Bills referred to a Select Committee consisting of Lord Basing (Chairman), Earl Faversham, Lord Colchester, Lord Seaton, and Lord Revelstoke; to meet on Thursday, March 24 : Llanbra-dach District and Aber Valley Water Bill; Pontypridd Water Bill; Rhymney Valley Gas and Water Bill; Tredegar Local Board Water Bill; Western Valleys (Mon.) Water (Gas Purchase) Bill.

Bills referred to a Select Committee consisting of Earl Lauderdale (Chairman), Earl Romney, Lord Camoys, Lord Monteagle of Brandon, and Lord Hillingdon; to meet on Monday, March 28 : Glasgow Corporation Water Bill; Newport Corporation Bill; Swansea Corporation Water Bill.

Bills reported, with amendments : Barrow-in-Furness Corporation Water Bill; Bradford Corporation Water Bill; Cleator Moor Local Board (Gas) Bill; Liverpool United Gas Bill.

Bills read the third time and passed : Barrow-in-Furness Corporation Water Bill; Bristol Gas Bill; Cleator Moor Local Board Bill; Kilmarnock Corporation Water Bill.

Opposition withdrawn : Oxford Gas Bill; Western Valleys (Mon.) Water (Gas Purchase) Bill.

HOUSE OF COMMONS.

The following progress was made with Bills last week :—

Further Standing Orders complied with : Rhyl District Water Bill. Bills read the first time : Bristol Gas Bill; Kilmarnock Corporation Water Bill.

Bills read a second time and committed : Mold Water Bill; Stamford and St. Martin's Stamford Baron Gas Bill.

Bill withdrawn : Barry and Cadoxton Gas and Water Bill.

Petitions against the Birmingham Corporation Water Bill were presented from the Corporation of Worcester and owners of property in Birmingham.

Petitions against the following Bills were withdrawn :—

Exmouth and District Water Bill, from the Budleigh Salterton Local Board.

Mold Water Bill, from the Hawarden District Water Company.

HOUSE OF LORDS COMMITTEE.

(Before Earl RAVENSWORTH, Chairman; Viscount BANGOR, Lord WINDSOR, Lord ZOUCH OF HARYNGWORTH, and Lord SHUTE.)

BARROW-IN-FURNESS CORPORATION WATER BILL.

This Bill, by which the Corporation of Barrow-in-Furness seek power to obtain an additional supply of water, and to construct the necessary works, came on the 15th inst. before a Select Committee constituted as above. It was opposed by the Dalton-in-Furness Local Board, on the ground that proposed further supply is not needed.

Mr. PEMBER, Q.C., and Mr. FREEMAN appeared for the promoters; Mr. SAUNDERS, Q.C., and Mr. CLIFFORD represented the opponents.

Mr. PEMBER, in his opening statement, described the vicissitudes experienced by the town and port of Barrow. He said that in 1842, Barrow was a hamlet of ten or a dozen houses; whereas now it had a population of 65,000. When the town was incorporated in 1868, the water supply was derived from wells. In 1864 the Furness Gas and Water Company was formed; and they took over a reservoir belonging to the Furness Railway Company, and another belonging to Messrs. Sneider and Hannay, the founders of the Hematite Steel Company, the establishment of which laid the foundation of Barrow's prosperity. In 1872 the Barrow Corporation acquired the Furness Water Company's powers, and made two other reservoirs—the Pennington and the Poakabeck—at a cost of £60,000; the original estimate having been £28,000. The Corporation in 1874 obtained powers to make the Harlock reservoir, and to raise the banks of the Poakabeck reservoir in order to increase its capacity. These works had never been carried out, because in the following year a great check was given to the iron trade; and the consumption of water fell off from 737 million gallons to 595 million gallons in 1875, and to 544 millions in 1885. With the revival of trade, the Corporation obtained a ten years' extension of time for carrying out the works. Once more, however, there was another fluctuation in trade, and the consumption of water again dropped, and the powers were allowed to lapse. In 1889 the Barrow Corporation applied to Parliament for the purpose of tapping the head waters of the Duggan, and for a further extension of time. But the House of Commons held that the Corporation had not then exhausted their existing powers; and the Bill was thrown out. The years 1889 and 1890 were very wet ones, and the supply was fairly adequate; but 1891 being a dry year, the supply was short, both for domestic consumption and trade purposes. The present daily demand was 2,700,000 gallons; and the daily supply, 2,500,000 gallons. The Ulverston Local Board, whom the Barrow Corporation supplied with water, opposed the Bill mainly on the ground that the existing supply was adequate, or, at all events, if it was inadequate, it was owing to the large quantity of water given to traders. The learned Counsel said he was quite prepared to admit this. He contended, however, that it was as essential to the life of the town that trade requirements should be met as domestic and sanitary needs; because if the trade were not served, the town would cease to exist. The proposed works would increase the supply of water by about a million gallons a day by the enlargement of the Harlock reservoir and the construction of a new one at Holebeck.

Evidence having been given for the promoters,

The CHAIRMAN said the Committee were of opinion that the case for more water had been fully made out.

The opposition of Dalton being mainly with a view of obtaining protective clauses, evidence was given by the Surveyor to the Local Board

(Mr. C. C. Smith) and Mr. Pickering, C.E., of Whitehaven. An analysis of the water, prepared by the late Dr. Tidy, was also put in.

The CHAIRMAN intimated that the Committee were unanimously of opinion that powers of inspection should be given to the Local Board, so that they might see that the water supplied to them was properly filtered.

Mr. PEMBER undertook to bring up a suitable clause; and this was subsequently done. It was as follows :—

In order to ensure the purity of the water supplied by the Corporation, they shall effectually filter all water before the same shall be put into their pipes for distribution for domestic purposes. If the Corporation make default in complying with this section, they shall, on summary conviction thereof, be liable to a penalty not exceeding £5 for every day on which such default shall continue after complaint in writing thereof shall have been sent to the Town Clerk; and such penalty may be recovered by the Local Board for the district of Dalton-in-Furness. The Surveyor or other authorized officer of the Local Board for the district of Dalton-in-Furness shall be at liberty to inspect twice in every year such of the filter-beds of the Corporation as shall for the time being be used for the supply of that district upon their giving not less than 48 hours' notice to the Town Clerk of their intending inspection: Provided that, for the purpose of this inspection, the Corporation shall not be required to empty the said filter-beds. Before emptying a filter-bed used for the supply of the said district, the Corporation shall, except in case of emergency, give to the Clerk of the Local Board reasonable notice of the day or days on which the filter-beds should be emptied; and the Surveyor or other authorized officers of the Local Board shall be at liberty to inspect the filter-beds on such day or days.

With the insertion of this clause, and some minor verbal amendments, the Committee passed the Bill.

BRADFORD CORPORATION WATER BILL.

This Bill, which is to authorize the abandonment of certain works authorized by an Act obtained by the Bradford Corporation in 1890, and the construction of new works to enable them to change the points at which water is to be taken from the River Nidd, and also to empower the Corporation to raise for these purposes £100,000 beyond their existing borrowing powers, came before the above-named Select Committee on the 16th inst., and occupied their attention for three days. The only opponents were the Liversedge Local Board.

Mr. LITTLER, Q.C., and Mr. BALFOUR BROWNE, Q.C., appeared for the promoters; Mr. PEMBROKE STEPHENS, Q.C., and Mr. RAM represented the opponents.

Mr. LITTLER, in opening the case, said the Bill was promoted by the Corporation of Bradford in connection with their extensive water-works. Under ordinary circumstances, he would have had to trouble the Committee at some length with statistics as to the increase in the population of Bradford, the needs of a supply of water, and so on; but it was not necessary to do this to any extent, except so far as was needful to show the importance to the town of Bradford to have the matter before their Lordships settled. The population of the borough had nearly doubled since 1851; and within the last ten years the receipts for water had increased from £83,000 to £118,000. The quantity of water consumed for trade purposes had risen from 1000 million gallons in 1877 to 1706 million gallons; and the outlying consumption, from 330,000 to 510,000 gallons. But during that time, instead of increasing the charge, the Corporation had been lowering it. In 1890 they were forced to the conclusion that their enormous district required a fresh supply; and then they came for power to take the upper waters of the River Nidd. After much discussion, and very careful protection being given to every local interest on the stream, the Corporation acquired the power sought. When this scheme was devised, there was considerable difference of opinion among the members of the Corporation themselves as to the level at which the water should be supplied; and the proposal then presented to Parliament was one which brought water by a line of pipes, by a somewhat more circuitous route than that at present suggested, coming from practically the same point, but at a lower level. The result was that, when the water arrived at the Heaton reservoir, it would have had to be pumped. The cost of pumping such an enormous quantity of water would be a very serious item; and the Corporation came to the conclusion it would be far better to carry out the works at a higher level. This would cost about £100,000 more in works; but if the cost of running the engines for pumping were capitalized, it represented a sum of £300,000. The Corporation would therefore be spending £100,000 to save £300,000, which, of course, would be a clear gain of £200,000. No one in the whole area affected had the slightest objection to that. The only opponents were the Local Board of Liversedge, which was one of the out-townships supplied by Bradford, and which was dependent upon the Corporation for its water supply. Liversedge had been placed in the supply district of Bradford; and at the time they were included, they made no objection. They had had their water supply without incurring any cost for works, and had had no trouble with respect to their water other than that which Bradford had itself had by being at times short—a condition of things which the present scheme was intended to prevent. There were altogether 29 parishes in the district; and out of the whole of them, Liversedge was the only one petitioning, and the only one discontented. The learned Counsel then proceeded to deal with the petition of the Local Board, which alleged that they had been inadequately supplied by the Corporation. If this were so, he said, the Public Health Act gave them the remedy of supplying themselves. It seemed ludicrous to suppose that they were not adequately served, when Bradford and the other townships were content with the same identical supply, and when they themselves were content with it in 1890. Then the Local Board said that other Corporations with mains running through their district were able and willing to serve them; and Batley was specially mentioned. But the Batley Corporation could not give them a supply because their Act had in it a clause prohibiting them from serving any district which was within the supply district of Bradford. The Batley Act was passed in 1871; and Liversedge had been in the Bradford area since 1868. The petitioners alleged that Batley could supply them at a less price. But the fact was that Batley had temporarily more water than it wanted; and therefore would be glad to dispose of it at a price at which it would

not sell it eventually. The Bradford Corporation were glad to sell once for 3d. per 1000 gallons; but now they sold it at 9d., both outside and inside the borough. The Bill would not alter the rate at which water was sold to Liversedge, which was an agreed price of 9d.

The CHAIRMAN remarked that, according to the petition, the opponents had to pay from 9d. to 10½d. per 1000 gallons; and this margin of 1½d. was considerable.

Mr. LITTLER said, whatever the figure was, the Bill did not alter it. [The learned Counsel subsequently explained that, although the cost was to Liversedge 10½d., only 9d. reached the Bradford Corporation. Liversedge obtained its supply through the pipes of one of the intervening Local Authorities, who were also supplied by Bradford; and this Authority charged them a sort of way-leave or toll for the use of the pipes. If, however, the Liversedge people would put down their own main, they would have their water for 9d.] In conclusion, he objected to the *locus standi* of the petitioners; stating that, if the provisions they required to be inserted in the Bill were granted, it would be impossible that it could proceed.

Mr. PEMBROKE STEPHENS remarked that, in order to understand whether or not the petitioners properly had a right to come before the Committee, their Lordships must hear what the position of the parties was, and what the Bill proposed. The measure was an outcome of the scheme of 1890. By the preamble of the Bill for 1890, it was asserted that the water supply had become insufficient for the requirements of the people of Bradford; and by the present Bill the Corporation sought to abandon nine of the works then authorized, and to substitute fourteen new ones.

After considering the matter in private, the Committee decided that Liversedge had sustained its claim to be heard.

The following evidence was then given:—

Mr. J. Watson, M. Inst. C. E., the Water Engineer of the Corporation, spoke to the desirability of deviating the works as proposed; and said that, if their Lordships saw fit to reject the Bill, it would mean that the Corporation would have to waste £19,000 a year. After all that had been done, the water supply of Bradford was insufficient; but he disputed the assertion that Liversedge was suffering from an inadequate supply. At the present time, the Corporation had an abundance of water for Bradford and all the out-townships; but he should not be at all surprised if they should at any time run short. If they did, Liversedge would not suffer more than the other townships.

Mr. Charles Gott, M. Inst. C. E., who was formerly the Corporation Engineer, gave evidence in support of the Bill. He said the town of Liversedge was incorporated with the Bradford district in 1868, at the request of the inhabitants; there being at that time no other source of supply open to them. The water sent out by the Corporation was of specially good quality, and of great excellence both for domestic and trade purposes; and the Liversedge people obtained all the advantages of it without incurring any responsibility except that of paying for what they actually used. The supply cost 8d. or 9d. per 1000 gallons; and no profit was made upon its sale. Liversedge might get it for less for a short time from some other body; but they would not be able to do so for any lengthened period. If they were released, they should compensate the Bradford Corporation in some way for the expense the borough had been put to in providing the supply. If Liversedge went out of the area, the Bradford rate would have to be increased to make up the loss. For £100 a year Liversedge could put itself in direct communication with the Bradford pipes.

Mr. Thomas Hawksley, C. E., explained the various advantages of the scheme before the Committee, as compared with taking the upper waters of the River Wharfe, which, owing to their hardness, were much less suitable for domestic and general purposes. The supply of water to Liversedge was a gain of 1d. per 1000 gallons to Bradford; and the borough was entitled to retain this advantage for all time, unless Liversedge contributed its proportion of the capital Bradford had had to provide. The separation was a question of principle, not of terms.

Mr. G. H. Hill, M. Inst. C. E., stated that he considered the Bill an improvement on that of 1890, as it would take water from a higher source, which would save pumping, and tend to reduce the cost of the water. So long as Bradford was able and willing to supply the out-lying districts, they ought not to be allowed to withdraw from it.

The CHAIRMAN: The Committee are quite satisfied upon certain points; but what we want to hear is what Liversedge has to say in regard to the difference the price they are obliged to pay Bradford for water makes to them in their competition with other places.

Mr. PEMBROKE STEPHENS said that this would come from the Liversedge witnesses.

In cross-examination by Mr. PEMBROKE STEPHENS, witness said he was Engineer of the Batley Water-Works; and it would be possible to supply Liversedge from the Batley pipes. He could not, however, say what would be the cost of such a supply compared with what Bradford was charging.

The opponents' case was then commenced.

Mr. S. Kellett, a member of the Liversedge Local Board, was the first witness. He said that ever since 1878 the supply of water in Liversedge from Bradford had been very scanty. Complaints as to the inadequacy of the supply and its quality were so rife from 1878 to 1882, that it became almost intolerable to be a member of the Local Board. Only evasive answers were received from Bradford in reply to the representations of Liversedge in regard to this.

The CHAIRMAN: The Committee require information only upon two points. We do not want any more evidence about quantity, because it is apparent that the object of the Bill is to increase it; but we desire some evidence upon the purity of the water for domestic purposes. What we particularly wish, however, is to ascertain the truth of the allegation of the petitioners that the traders at Liversedge are placed upon an unfair footing in competition with traders in other districts, in consequence of the price of their water. That is the gravamen of the charge.

Mr. LITTLER asked for the production of a letter of agreement between the Batley Corporation and the Liversedge Local Board for the supply of water by the former.

Mr. PEMBROKE STEPHENS said that for the moment he could not give his learned friend the document asked for.

The CHAIRMAN: It is quite as well to be frank about these matters.

I may say at once that we decline absolutely to be parties to breaking the original contract of Liversedge with Bradford. The Committee will not create any such precedent. Now you know where you are.

Mr. Kellett, examined further by Mr. PEMBROKE STEPHENS, said the water supplied was dirty, and that the service was only periodical. Owing to being at the end of the supply, the water was dirtier than would be the case if it was at the centre. The Liversedge Local Board charged 1s. 3d. per 1000 gallons.

The CHAIRMAN: I suppose if there was a catch reservoir at Liversedge, the water would purify itself?

Mr. LITTLER: Yes, my Lord. This complaint arises because of the circuitous route they take. In 1888 we offered them an independent main; or, as an alternative, that we should come and serve them with a main. What we offer to Liversedge now is this—that if they put themselves on the same footing as Bradford, we will put them on the same terms of supply as the ratepayers of Bradford. We will supply Liversedge if it chooses to put down an independent main; or we will consider whether we should not contribute towards their pipe, if they make out a case for it.

Mr. PEMBROKE STEPHENS said that Liversedge was not, and could not be put, in the same position as Bradford. They did not touch Bradford. There were intervening districts between Liversedge and Bradford; and they could not lay pipes through those districts. It was Bradford's business, and any other suppliers of water would have attended to it. But they were only willing to deliver water at the boundary, and leave Liversedge to get it into their district as best they could. It would be improper and irregular for him to struggle against an expressed opinion of their Lordships; but the point of his petition dealing with an adequate supply was not disposed of.

After some discussion, the room was cleared. On the re-admission of the parties,

The CHAIRMAN said: We have come to this conclusion: There are two distinct alternatives offered. One is that Bradford will supply water to Liversedge in bulk at the present price, and leave Liversedge to distribute its own water; the other is that Bradford should supply water to a given point to be specified, leaving Liversedge to distribute it by itself. We should like to have, in writing, that which the Bradford Corporation has already offered, and which has been refused, and that which is offered again now. Put that before the Committee, and we will consider it.

Mr. LITTLER: We offer, first, to supply from the high-level works to be constructed under this Act—which will give Liversedge the best and purest supply of water—at a point to be agreed on, or, in default of agreement, to be fixed by arbitrators; secondly, to supply water in bulk to the end of Tong Street nearest Liversedge; thirdly, to purchase the pipes at their present value, and to undertake the supply and distribution of water upon the same terms as prevail in Bradford.

The opponents and their Counsel retired to consider these offers. On their return,

Mr. PEMBROKE STEPHENS said his clients could not accept any of the propositions as submitted. He suggested various alterations which would meet their views; and said that, if they were not agreed to, they must "fight."

As the parties were unable to come to an understanding,

The CHAIRMAN said the Committee were of opinion that the Bradford Corporation had made generous offers, and that they could impose no further obligations upon them.

Mr. PEMBROKE STEPHENS said in that case his clients would withdraw from further participation in the proceedings.

The Committee then passed the preamble of the Bill.

HOUSE OF COMMONS COMMITTEE.

Tuesday, March 22.

(Before Mr. HERBERT GLADSTONE, Chairman; Mr. W. F. LAWRENCE, Mr. A. C. CORBETT, and Mr. DUNN.)

LONDON COUNTY COUNCIL (SUBWAYS) BILL.

This Bill—in which the London County Council seek power to extend the system of subways in the Metropolis, and to require gas and water companies, and other persons having authority to interfere with the streets, to make use of such subways, and pay rent therefor—came last Tuesday before a Select Committee constituted as above. It was opposed by the various parties whose interests are affected.

Mr. LITTLER, Q.C., Mr. PEMBER, Q.C., and Mr. FREEMAN appeared for the promoters of the Bill; Mr. BIDDER, Q.C., for the Associated Water Companies and for The Gaslight and Coke Company. The Commercial Gas Company, the Electric Lighting and Telephone Companies, and the London Hydraulic Power Supply Company were also represented in opposition.

Mr. LITTLER, in opening the case, said the Bill was promoted by the London County Council for the purpose of obtaining further powers over subways. As the members of the Committee were probably aware, under certain streets there were now subways which were specially constructed with the object of enclosing all sorts of pipes and wires. These subways the Council proposed to further extend. There was no doubt that the existence of easily-accessible subways would save most of the expense and annoyance to the public at present caused by each gas or water company breaking up the streets whenever they wanted to get to their pipes. The existing subways were in Garrick Street, Southwark Street, Commercial Road East, Queen Victoria Street, Victoria Embankment, Northumberland Avenue, Shaftesbury Avenue, Charing Cross Road, and Rosebery Avenue. Each subway had been so constructed that the sewer was underneath; so that if any accident took place, such as the bursting of a water-pipe, the result would be nothing more serious than the loss of water. These subways cost several thousand pounds per mile; and therefore he thought it was only reasonable that something in the shape of rent should be paid for the use of them.

The following evidence was then given:—

Mr. A. R. Binnie, M. Inst. C. E., Engineer-in-Chief to the County

Council, said the gross total length of subways now existing was 7810 yards. The subways in Southwark Street, Commercial Road East, Queen Victoria Street, and Victoria Embankment were constructed under the Act of 1868; but the others were not. The Council had experienced great inconvenience in being able to have bye-laws over one set of subways and not over the other. When the subways were first made, there was considerable doubt about their utility, especially with regard to the earlier ones in Garrick Street and Southwark Street. This doubt was mainly expressed by the Gas and Water Companies. The consequence was that these two subways were not so much used as had been expected, and remained so until the present day. Subways had increased very much since that time; the fears expressed as to their usefulness having been found to be totally groundless, as there was no danger in placing gas and water pipes and electric light wires therein. The Council found that the subways were now extensively used by all companies. They were making them 12 feet wide and 7 ft. 6 in. high; though in some cases they were as small as 9 feet wide and 6 feet high. They were generally laid along the centres of the roads. They were regularly inspected once a day; and therefore it was impossible for leakage to any extent to take place without its being at once discovered. In the subways at present there were 15,043 yards of gas-pipes, 6492 yards of water-pipes, 7614 yards of pipes for the supply of hydraulic power, and 20,887 yards of various other lines of communication. From his long experience, he could say there was a large amount of leakage always going on from water-pipes; and the statistics of the gas companies also showed that they had considerable leakage. In both cases this could be detected and prevented in subways. It had been alleged more than once that it would be a source of danger to carry the electric lighting companies' wires in the same subway as the gas-mains; but this argument could not be supported by experience, as they had now 5000 yards of electric light wires running in the same subways with gas and water pipes, and no danger had resulted. The inconvenience and permanent injury caused by the breaking up of the newly-made streets, in order to put down the mains of the different companies, was known throughout the whole of the Metropolis; and it was a matter which should certainly be stopped.

Mr. BIDDER: Did I understand you to say there was danger to the community if the pipes were under the control of the companies themselves and not of the Council?

Witness: Where you have as many as eight companies with lines of communication in a channel of that description, if you do not have someone charged with the responsibility of seeing that the rules and regulations for their proper guidance are observed, there will some day be a great public disaster.

As a matter of fact, is it not the case, both in regard to water and gas mains, that when buried in the soil they become practically almost imperishable?—As regards the equalization of the temperature, undoubtedly that is so; but there are some soils through which pipes are laid that are very destructive. Pipes placed in the London clay are very well protected, no doubt.

Will not iron pipes in a subway be exposed to the vicissitudes and fluctuations of temperature, and drought and moisture? and will not the iron require to be treated in the ordinary way by painting occasionally?—Nearly all modern water-pipes are dipped in Angus Smith's preparation, which is quite enough prevention.

Will not that composition peel off if it is exposed to the open air?—I am afraid that applies to paint or anything else. In time it will no doubt wear off. But what I would say is that pipes in a subway are more easily protected than when they are buried in the ground.

Are you aware that the London Water Companies have close upon 3000 miles of pipes; so that, if additional expense is cast upon them in consequence of their removal, it is rather a serious matter?—If the Companies come into new streets which we are about to make, or into a street already made, they having no previous right in that street till it is made, surely they must comply with what is for the public advantage.

But your Bill is not confined to new streets, is it?—I believe so. In the first instance, it deals with existing subways; and in the future it applies to such new ones as may be made in new streets.

In the case of the five original streets named by you in which subways were first laid, substantially the provisions of the Act of 1868 have been put in force, and the pipes are in the subways, are they not?—Yes; but the Water Companies have come in more or less voluntarily in the other cases where the Act does not apply.

What more do you want than to extend the legislation of this Act to subways?—There is, in the first place, a very important point raised by the Electric Lighting Acts, and settled by the Companies' Provisional Orders, that they should pay a reasonable amount of rent for the accommodation afforded.

You are proposing to enact that we should pay rent?—Yes; and the Board of Trade will see that it is a reasonable rent.

After conferring with his clients,

Mr. BIDDER, addressing the Committee, said: I am told I may shorten your proceedings, because one of my clients informs me that terms have been arranged between the Water Companies and the County Council which will render it unnecessary to ask any further questions on their behalf. I believe a clause is being prepared; and if that is so, perhaps it will be better that we should wait until the clause is completed. I have now a few questions to ask for another client—The Gaslight and Coke Company. Of course, what you have conceded to the Water Companies, you cannot possibly, upon any principle, refuse to the Gas Companies.

Mr. PEMBER: I do not know about that.

Mr. BIDDER (to witness): If a water-main burst, and the subway was temporarily filled with water, what would become of the gas-pipes, would they float?

Witness: They might float.

Then the consequence of that would be that that movement of the pipe would probably draw the joints, and make them leaky?—It is quite possible. Under the present arrangement, there are brackets placed at the top and round the pipe, at the expense of the Gas Company, when the pipes are being laid.

I understand that this arrangement to prevent them from floating is necessary now in the subway. Is it necessary in the ground?—No.

So that there at once you come upon an additional expense which you are proposing to impose upon the Company in order that their pipes may lie safely in the subway. Do you propose that the County Council should defray that as part of the cost of removal?—I do not.

Assuming that it is for the public good and advantage that, instead of having as we have now, the statutory right to lay our pipes in the soil of the street, we should be compelled to go into the subway, how can you justify making us pay a rent for having our pipes in that subway?—Because it is cheaper to lay the pipes in the subway, and by that you save leakage; besides, it is altogether more convenient for working.

You think that the various Companies should, among them, pay a rent which is equivalent to the interest upon the cost of the subway?—I think that is a just principle.

Mr. CRIPPS: Supposing there was a leakage of gas in one of the subways, and an electric lighting main was near, and there was also a leakage from the electric lighting main, do you say that there would be no risk of accident?

Witness: There would be no risk until the whole of the air in the subway was charged up to the explosive point.

Have you considered the question of danger at all as regards putting the electric lighting cables and the gas-mains in the same subway?—I have, very repeatedly; and I do not believe there is any danger. I think there is less danger from wires and gas-pipes placed under proper regulations in a subway than there is when they are laid outside.

Wednesday, March 23.

On the re-assembling of the Committee this morning, Mr. Blinnie gave further evidence, on which he was not cross-examined, as the matter was deemed to be one on which an arrangement could be come to between the Gas Company and the Council. He was then questioned on points bearing upon the Electric Lighting Companies' lines of communication.

Mr. H. L. Cripps, Parliamentary Agent of the Council, said he wrote to all the petitioners against the Bill, asking them to meet him and discuss the terms of the measure. The result of the conference had been to practically settle the matter with the telephone companies, the Hydraulic Power Supply Company, the railway companies, and—perhaps more important than any of the others—all the London Water Companies. They had practically settled the terms on which the Bill could be framed, which would be considered reasonable both by the County Council and by the Water Companies. The Gaslight and Coke Company wrote to say they did not intend to discuss the matter. One of the amendments they now had was the definition of the word "subway," which ran as follows: "The expression subway means an arched passage or covered way belonging to the Council, under the surface of a street, which passage or way is adapted for the reception of, or affording convenient access to, the pipes and wires." This amendment had been arranged with Mr. Hollams for the Water Companies. As he had very fairly pointed out, there being no definition in the original draft Bill of the word "subway," it might be that, although there was something under a street which was not adapted for pipes or wires, the effect would have been to limit the Water Companies' powers. The Companies rather suggested that they should draft a separate Bill altogether to deal with their case. But it was thought better to make the present measure one of general application; and so they had met the Companies' views by amalgamating clauses 3 and 4, with, of course, some little alteration. The clause, as amended, would read as follows:—

The company shall not, in a street where there is a subway, without the consent of the Council, interfere with the surface for the purpose of laying or renewing a pipe other than a communication or supply pipe, unless they shall have given notice to the Council of their intention so to do; and the Council may require the company to lay such pipe in such subway. Where the Council have a subway in any street, it shall be lawful for the Council at any time to require the company, by notice in writing, to place in such subway any pipes which they may thereafter desire to place in the street; and it shall also be lawful for the Council to remove into such subway any then existing pipes or wires of the company in the street for the reception of which such subway shall be convenient.

As regarded removal, he thought the provision they had added to this clause was in the Bill as originally submitted to the Committee and the opponents. This was the provision that had been adopted from the Subways Act of 1868, requiring the Council to pay the cost of the removal, provided that, as respected pipes for the supply of water, no removal should be required to be made in such manner as to interfere, during such removal, with the obligations of the company in regard to the supply of water. The next clause represented the settlement of the basis upon which the charge ought to be made upon those companies who, like the Water Companies, had certain statutory rights of using the streets. What had been proposed in that case was this:—

It shall be lawful for the County Council to make on the company using any subway a charge for such use and supervision of such subway, and the pipes and wires therein, according to a scale to be determined as hereinafter provided; and until such scale is so determined, the amount of such charge (if not agreed between the Council and the company using such subway) shall be determined by an arbitrator. In the determination of such scale, or of the amount of any such charge, regard shall, as regards water companies, be had only to such saving (if any) as may be effected to the company by reason of the pipe being laid and accessible in a subway, instead of being laid or remaining under a street, or otherwise by reason of the subway, and to the cost of management and supervision of the subway and the pipes and wires therein.

The original proposal had been that, in fixing the charge to be made on the Companies, the arbitrator settling the terms should have regard not only to those matters, but to the cost of construction and maintenance of the subway. He thought Mr. G. Livesey, the Chairman of the South Metropolitan Gas Company, had expressed some apprehension upon the general question which The Gaslight and Coke Company also raised with regard to the juxtaposition of electric lines and gas-pipes; but, speaking generally on the other terms of the Bill, he believed this would meet the views of his Company.

Mr. PEMBER: Then there is the scale of fees and charges to be paid by companies using any such subway?

Witness: Yes; the Companies have assented to that. Continuing, witness said the suggestion of the Water Companies seemed to them to

be rather a good one—that the Act should comprise, in regard to the subways, a code of legislation which might be capable of general application afterwards to the question of any subways to which it might be appropriate; and a clause was inserted to incorporate this suggestion.

Mr. BIDDER: You have made certain provisions for the protection of the Water Companies. Why are they not equally applicable to the Gas Companies?

Witness: I think the Council would probably consider that, if the Bill, amended as we propose to amend it for the Water Companies, would also satisfy the Gas Companies, there is not sufficient distinction to be drawn between the cases of Water and Gas Companies to justify them in objecting to extending those amendments to the latter.

This is a Bill to move the pipes from the road into the subway, in the public interest; and when I am there, I am quite content, if I find I am saved money by being there, to pay the County Council. But why am I to pay a share of the management of the subway, which exists, not for my sake, but for the sake of the public?—You gain rather more than the actual cost in the way of street digging—first of all, by reason of the pipes being more accessible; and you very likely gain a certain amount in reducing leakage.

Mr. BIDDER: The principle is settled I know; and nobody is objecting to it. But I say that, when I have paid the whole pecuniary value of this benefit to me, I have paid for what I get; and you cannot have it twice over.

Mr. Bassett Hopkins, a member of the Highways Committee of the County Council, said this Committee had the whole subject of subways referred to them. The present Bill represented the strong views of the Council. With regard to the pipes at present laid in the subways, he had examined the records made under the Metropolitan Board of Works; and there had never been a case of explosion or accident other than of the most trifling character. By being placed in a chamber, the danger to pipes from steam-rollers and things of that kind was very much obviated. The inspection of subways was carried out by a sufficient number of persons to secure constant supervision.

Mr. FREEMAN: You are aware that a clause has been added to the Bill to satisfy the wishes of the Water Companies. Would you be content, and would the Council be content, that this clause should be extended in favour of the other Companies?

Witness: Yes; I think the Council would be content with that. I am fairly satisfied the Highways Committee would not hesitate to recommend such a modification; and I have no doubt the Council would follow their view in the matter.

Mr. LITTLER stated that this was the case for the promoters.

Mr. BIDDER: With regard to the Gas Company's case, we are so nearly settled with it that I almost think if the matter were to stand over, it would probably save trouble. I have no authority to speak for them; but I think you may take it that, if I am satisfied, probably the Commercial Gas Company will not trouble you much more. I think what will satisfy The Gaslight and Coke Company will pretty well satisfy the others.

Mr. LITTLER: I think I may say that the South Metropolitan Gas Company are satisfied; so that it looks as if everybody was getting very much nearer a settlement.

The Committee then adjourned till yesterday.

The Committee on the Birmingham Corporation Water Bill.—Mr. Causton, Mr. Sydney Gedge, Sir W. Houldsworth, Mr. P. Stanhope, and Mr. Powell-Williams have been nominated by the House to serve on the Select Committee on the Birmingham Corporation Water Bill, in association with Mr. Campbell-Bannerman, Mr. Bryce, Mr. Llewellyn, and Mr. Wharton, named by the Committee of Selection. The preliminary meeting of the Committee will take place to-morrow, under the presidency of Mr. Campbell-Bannerman; and the inquiry will be commenced forthwith, in the hope that the Bill may be disposed of before Easter.

The Swinton and Pendlebury Local Board Bill.—The Bill promoted by the Swinton and Pendlebury Local Board to enable them, in pursuance of a clause inserted in the Salford Gas Act of last year, to acquire the portion of the gas undertaking of the Salford Corporation lying within the districts of Swinton, Barton, Eccles, and Little Hulton, came before a Select Committee of the House of Lords on the 18th inst. It was opposed by the Local Boards of Barton, Eccles, Winton, Monton, and Little Hulton, as well as by the Barton Rural Sanitary Authority and the Corporation of Salford. The consideration of the Bill occupied their Lordships till last Tuesday afternoon, when the preamble was passed; but the Committee declined to include the districts of the Eccles and Little Hulton Local Boards and the Barton Rural Sanitary Authority in the scope of the measure. A report of the proceedings will be given next week.

Oldbury Local Board Gas Department.—The annual statement of accounts of the Oldbury Local Board Gas Department for the year ended Dec. 31, 1891, was issued last Saturday by Mr. C. Meiklejohn, the Engineer and Manager. It shows that the total amount borrowed up to that date was £79,199; the loans outstanding amounting to £72,212. During the past year, £217 was expended on new buildings and manufacturing plant, and £60 for new mains, &c. The total expenditure up to Dec. 31 last was £76,147. The manufacture of gas cost £6064, including £4426 for coal, £696 for wages, and £393 for the repairs and maintenance of works. In the distribution of gas, a sum of £260 was expended; and for lighting and repairing public lamps, £257. Rents, rates, and taxes absorbed £524; and the management expenses amounted to £361; the total expenditure being £7478. The gross profit was £3955. The sale of gas realized £8564; the residual products, £2764—the aggregate income being £11,434. After paying interest and instalments for the repayment of the loans, there remained a net profit of £346 on the year's trading. During the twelve months there were sold 3071 tons 19 cwt. of coke, 3 tons 12 cwt. of breeze, 86,564 gallons of tar, and 183,491 gallons of ammoniacal liquor. The quantities of these residuals made in that period were: Coke, 3475 tons; breeze, 218 tons; tar, 80,314 gallons; ammoniacal liquor, 188,971 gallons.

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Friday, March 18.

(Before Lords Justices LINDLEY, BOWEN, and KAY.)

The Staffordshire Gas and Coke Company, Limited, and the Companies' Acts.

This was an appeal by the Liquidator from an order made by Mr. Justice Kekewich on Dec. 8, 1891, as recorded in the JOURNAL at the time, striking the names of Mr. J. F. Rushworth and other persons from the list of contributories of the Company.

Mr. RENSHAW, Q.C., in support of the appeal, said the order was made on a summons taken out by Mr. J. F. Rushworth, of Bradford, and others, to vary the Chief Clerk's certificate as to the contributories. The case was taken in the Court below as a test one, which would bind the others; the facts in all being identical. Mr. Justice Kekewich expunged Mr. Rushworth's name from the list. The point for decision was: Was Mr. Rushworth a member of the Company at the time when it went into liquidation? The order for winding up was made on the 1st of November, 1890. He would give their Lordships a narrative of the Company's history. There was a certain Company called the Mercantile and Domestic Gas Company, which was formed for the purpose of working the patents of one Nicholson; and in that Company Mr. Rushworth held ten shares. On May 16, 1889, an agreement was entered into between the Company of the first part, Francis Nicholson of the second part, and one Joseph Burrows of the third part. This was an agreement by which the Company and Nicholson agreed to sell a certain right to use the patent for the sum of £60,000, payable £500 in shares, and as to £59,500, either in cash or shares "as hereafter provided." The 100 shares were to be treated as founders' shares. There was then an agreement that the name should be altered to the Staffordshire Water Gas Company, Limited; and the Company was incorporated under that name. It was afterwards changed to the Staffordshire Gas and Coke Company by a special resolution. The newly-named Company proceeded to allot ten shares each to Mr. Burrows and the other shareholders in the Mercantile and Domestic Gas Company. They were allotted as fully-paid shares before any agreement had been registered which gave power for this to be done. The Secretary informed Mr. Rushworth by letter that the shares had been allotted, and afterwards sent him the relative certificates. But Mr. Rushworth did not acknowledge the receipt of them, or take any notice whatever, but held them until the liquidation commenced, when the Liquidator sought to make Mr. Rushworth contribute, on the ground that the shares he held were not paid-up shares, although he believed them to be so.

Mr. SWINFEN EADY, who appeared for the respondents, was not called upon.

Lord Justice LINDLEY, in giving judgment, said the Court must decline to interfere with Mr. Justice Kekewich's decision, which would be affirmed, on the ground that Mr. Rushworth never had applied for any shares, and did nothing to acknowledge the shares said to have been allotted him. The fact was, his Lordship said, the shares were issued too soon; they were intended to be issued as fully paid. The Company found out their mistake, and corrected it by cancelling this allotment in October, 1889. Mr. Rushworth, however, was not informed of the cancellation; and the Liquidator contended that he had acquiesced in becoming the holder of only partly-paid shares, and was therefore liable.

The appeal was refused, with costs.

COUNTY OF LONDON ASSESSMENT SESSIONS.

Sessions House, Clerkenwell, E.C.—Wednesday, March 23.

(Before Sir P. H. EDLIN, Q.C., Chairman, and a Bench of Magistrates.)

The Gaslight and Coke Company's Assessment Appeals.

To-day the decision of the Court was given on the points left unsettled on the previous occasion (*ante*, p. 541.)

The CHAIRMAN: The allocations of rateable value according to the judgments delivered in these appeals are such as to require alteration of several of the present assessments; and the figures I am about to state have been agreed upon between the various parties. I will refer separately to the parishes in the City of London Union. With regard to the parishes in the Strand Union, there will be a reduction of £406 in the rateable value in St. Clement's Danes, of £1225 in St. Martin-in-the-Fields, of £298 in St. Mary-le-Strand, of £165 in St. Paul, Covent Garden, and of £18 in the Liberty of the Rolls. In the Precincts of the Savoy, the present assessment is less than the value assigned; and there will therefore be no alteration. In the St. George's Union, the Committee's assessment of the mains in St. Margaret and St. John, Westminster, was £749 less than the proper amount; but in St. George's, Hanover Square, there will be a reduction of £2227. In the Hackney Union, the reduction in the parish of St. John will be £3336, and £417 in Stoke Newington. In St. Mary, Islington, the reduction will be £25,617; in St. Mary Abbots, Kensington, £1049; in St. Marylebone, £4617; in Paddington, £352; in St. Pancras, £4836; and in St. Leonard's, Shoreditch, £3023. The respective valuation lists will be altered in accordance with these figures. We have now to deal with the costs of these appeals. We are told that the sum total of the expenses incurred in this extensive litigation will be not less than £30,000. It is obvious, therefore, that here are questions of great importance; and a very careful consideration of the facts and circumstances has been necessary for an equitable determination of them. The principles governing the assessment of property of this kind and the distribution and allocation of rateable values in just relative proportions necessitated a valuation of the whole hereditament—that is to say, of the Company's stations, works, mains, and pipes throughout the entire system; and we cannot make a fair apportionment of the costs of this laborious investigation without having

regard to the general result, and the comparative claims and counter-claims of the litigant parties. A sum of £378,000, or (say) three-fifths of the rateable value of the whole, falls to the respondent parishes in these appeals; and the appellants' demands for reduction in these parishes alone would have diminished the value assigned to them by £210,000. After giving credit for the reductions we have awarded in some of them, it is £210,000. There are other arithmetical results of the apportionment to be observed. The total value assigned to these respondent unions and parishes exceeds by £168,000 the rateable values ascribed to them by the appellants in the statements of their demands; but the judgment operates so as to entitle them to reductions amounting altogether to £48,500 in fifteen of the unions and parishes—the calculation as to the remaining eight showing that they were under-assessed therein to the amount of £8000. The Court having no power upon these appeals to raise the values, the latter sums will, of course, stand as they now appear in the respective valuation lists. The position of the City of London Union with regard to the claims for costs is peculiar, and has led to much discussion. There are 114 parishes in this Union; and as to the valuations in five of them, the appellants did not raise any objection. The other parishes were represented by the same Solicitor and the same Counsel, and, with the consent of the appellants, all the assessments in these parishes were dealt with as forming the subject of one appeal; and it was agreed that the subdivision of the total amount assignable to the Union should be adjusted afterwards. The sum total of the rateable values assigned to this Union is £56,696. But the assessments by the respondent Committee amounted to only £51,817; and the appellants required that this sum should be reduced by £34,251—that is to say, that the proper rateable value should be fixed at £15,566. As I have already said, it stands, according to our judgment, at £56,696. Now, it was seemingly upon the aforesaid understanding that, in the tabular statement of the particulars required by the Court—the particulars required for considering the question of costs—the appellants presented only the sums total above mentioned; thus not dealing with the parishes separately, but in union. But as it appeared from the parochial apportionment that they are entitled to a certain reduction in as many as 68 of the parishes, although, upon the whole, they are shown to have been largely under-assessed in the Union, regarding the parishes as constituting one union (it was on Saturday when we came to consider the whole question), the appellants afterwards produced a subdivisional table as the basis of a claim by them to as many distinct orders for costs against those 68 parishes. It will be observed that, for the reasons stated, the appellants avoid the payment of rates on the several amounts in which they are under-assessed in the 41 other parishes; and inasmuch as those under-assessments exceed by nearly £5000 the reductions allowed in the other parishes, which amount to only £10,617, the appellants, while benefiting from these reductions, are exempt from rateability in respect of upwards of £15,000 assigned rateable value in this Union. Upon the actual result we make an order that the appellants pay so much of the general costs of the Assessment Committee as represents the proportion between the rateable value of the parishes in which no reduction will be made, and the total rateable value assigned to the Union; and, save as afterwards appears, we make no order with regard to the general costs relating to the other parishes in this Union. As to each of the parishes included in the Strand Union, excepting the Precincts of the Savoy, we direct that the respondents pay such a proportion of the appellants' general costs as may be determined to be properly chargeable against those parishes respectively. With respect to St. John, Hackney, Stoke Newington, Islington, St. Marylebone, St. Pancras, and Shoreditch, we direct that the respective respondent Committees pay the appellants such a proportion of their general costs as may be determined to be properly chargeable to the Union or parish respectively. In these and in each of the other cases in which the appellants are awarded an order for costs, there will be the set-off against them of the respondents' costs of the first case and the first day's hearing. In the following six appeals, the Company must pay the costs of the respective Assessment Committees: St. Matthew's, Bethnal Green; Bloomsbury; St. Luke's, Chelsea; Hampstead; St. George's, Southwark; and St. James's, Westminster. In St. George's Union, a reduction is ordered in one of the parishes; whereas in the other (St. Margaret and St. John), the valuation was below the proper amount. As to the latter parish, there will be an order to the respondents for their costs in the proper proportion; but as to the former (St. George's, Hanover Square), the Committee will pay such proportion of the appellants' general costs as may be determined to be properly ascribable to this parish, excluding therefrom for this purpose the Company's separate valuation of their works, stations, and indirectly-productive mains situate in this parish. With regard to Kensington, it is to be observed that a reduction of £18,995 was demanded, or £17,946 more than the proper reduction of £1049 resulting from the judgment; and as to Paddington, the value assigned by the Company was less than one-third of the just amount. Here again there are wide divergencies; and, in view of all the circumstances, we shall make no order as to the general costs in either of these appeals. In the latter case—that is, as to Paddington—the appellants must pay the respondents' costs up to and including the first case and the first day's hearing. We make the same order with regard to the Precincts of the Savoy in the Strand Union. We think the costs of the shorthand writer's notes should be equally divided between the appellants and the respondents generally; and that the half falling on the latter should be apportioned according to the relative rateable values. Where no payment has yet been made to the appellants (I am assuming that the costs have been paid by the appellants), or where the payment for copies supplied to any union or parish has already been made in excess of such proportion, the proportion or difference would properly form an item for allowance or set-off in the bill of costs as the case may be; the appellants refunding any surplus excess in the payment already made. If desired, although it is a long list, I will read a statement of the reductions to be made in the City of London Union. [By agreement between learned Counsel, the list was taken as read.] Having regard to cases of this kind, I think I should say this—that as there can be no final order made until the actual figures are ascertained, the several appeals will be respited until this is done;

but, if the parties desire it, the lists can be altered to those figures at once.

It was agreed that the costs should be taxed out of Session, and that the Court should have power to deal with any questions arising on the taxation.

The SOLICITOR-GENERAL, on behalf of the parishes, and Mr. CASTLE, for the appellants, thanked his Lordship for the personal courtesy Counsel had received during this long investigation.

NEWCASTLE ASSIZES.—Friday, March 11.

(Before Mr. Justice WRIGHT and a Jury.)

Mayor and Corporation of Tynemouth v. North Shields Water-Works Company.

This was an action brought against the North Shields Water Company, by the Mayor and Corporation of Tynemouth, for having, as alleged by the plaintiffs, supplied impure water to the borough. It may be remembered that a few weeks ago, as already reported in the JOURNAL (*ante*, p. 446), the Corporation sought, in a Queen's Bench Divisional Court, an injunction to restrain the Company from drawing their water from what were stated to be dangerous sources of supply; but it was refused—the matters in dispute being ordered to go to trial in the usual way. Hence the present proceedings.

Mr. E. TINDAL ATKINSON, Q.C., Mr. STRACHAN, and Mr. T. W. CHITTY appeared for the plaintiffs; Mr. J. LAWSON WALTON, Q.C., and Mr. W. S. ROBSON, Q.C., for the defendants.

Mr. ATKINSON, in opening the case, said the plaintiffs claimed damages and an injunction, and also a *mandamus*, in reference to the character of the water supply of the borough. Their allegation was that for a long time past the water sent out by the defendants had been entirely unfit for drinking or for other domestic purposes. The Company were incorporated under an Act of 1786, empowering certain persons to enter upon land belonging to the Duke of Northumberland, and search for springs of water, and to convey water from such springs and streams to the district which they were authorized to supply; the water being described as fresh water, and provision being made for the price at which the water should be sold. In 1857 the district was placed under a Local Board; and in 1866 the Tynemouth Improvement Act was passed. In that Act were a number of provisions with regard to the supply of water; the Company being bound to provide water for domestic purposes. Since 1786 the Company had had a monopoly of the supply of water within the district of the Tynemouth Corporation; and for many years it had been bad in quantity and quality, and complaints had been made extending from 1883 down to the present time, consistently and frequently, to the Company. In 1883, the defendants, having made arrangements with the Newcastle and Gateshead Water Company for a supply of water from Newcastle, proceeded to intercept some water which was pumped from the Shiremoor Colliery. At that time the colliery was being partially worked; and a large quantity of water, amounting to about 600,000 gallons per day, was pumped out. The supply of the Company not being sufficient for the requirements of the district which they were bound to serve, they proceeded to erect a dam in the course of the water, so as to intercept it, and sent it down pipes which they constructed; carrying the water to their reservoirs, where it was mixed with the rest, and sent to the consumers. The water was utterly unfit for domestic purposes. When the pit was working, it was bound to be contaminated by human sewage and the excrement of horses; and it was of a distinctly yellow colour, owing to the presence of peroxide of iron. In addition to this, there was in it a large quantity of alkaline sulphates, including sulphate of magnesia. The total daily supply of water to the borough was 700,000 gallons. Of this quantity 440,000 gallons came from the Newcastle supply, 120,000 gallons from the Whitley reservoir, and 120,000 gallons from the Shiremoor pit. The Company thought so little of the Shiremoor water that they used it only when the rest was not sufficient for the purposes of the borough. There were three sets of reservoirs; and the water was contaminated by the Shiremoor water, of which since November last they had abandoned the use. It would also be contended that the water was contaminated by the sewage of the fields through which it passed.

The following evidence was then given:—

Mr. D. Balfour, C.E., said he had inspected the course of the waterway from the Shiremoor Colliery to the dam, and also the three Ridges reservoirs. The distance from the Shiremoor pumping-station to the reservoirs was 2½ miles. The water as delivered from the pump at Shiremoor was of a light reddish opaque colour. It ran through fields; part of its course being through a valley, the fields on either side of which had manure upon them.

Mr. WALTON said this was the first time it had been suggested that there was any contamination except that from the colliery.

Justice WRIGHT: Nor is there anything more likely to be fatal to the plaintiffs' case, if the contamination is as suggested. What the plaintiffs had to do was to show the quality of the water when it was pumped from the colliery, and its quality when it left the reservoirs.

Dr. J. E. Goston, Medical Officer of Health for Tynemouth, said that since 1883 he had given special attention to the water supply of Tynemouth, and had made reports thereon to the Corporation. He had taken samples of the water, and had given them to the Sanitary Inspector to be conveyed to Mr. Pattinson, the Analyst. Mr. Pattinson made his reports of the analyses. Mr. Pattinson considered the samples unsuitable for domestic purposes; and witness said his opinion was that the water was quite unfit for a town supply.

In answer to an observation by Mr. Walton,

Justice WRIGHT said he should tell the jury that water pumped from a colliery was not, to his mind, capable of being considered by them either as a stream or a spring; and if the Company obtained water from the Red Burn, which at the best of times was half fed, and sometimes much more than half, by water from the colliery, he should say this was exceeding substantially their parliamentary powers.

Mr. WALTON said the Company had most of their water from Newcastle; and the Newcastle Company procured theirs from every conceivable source.

Justice WRIGHT said the rule was that, unless there was harm done, no injunction would be granted. But if there was any case of the water being impure, that would be enough to support an injunction. Supposing that, when the power was given, the Corporation came forward as opponents, he could not think that the Company would have been allowed to pump this water into their reservoirs if the analyses had been known. Unless there was some objection to the quality of the water, he could not interfere.

Mr. A. Wynter Blyth, Medical Officer of Health for Marylebone, said he agreed substantially with Mr. Pattinson's analyses.

Mr. H. Clark, Secretary to the Company, said he remembered a well disappearing some years ago; it was near to the Shiremoor Colliery, and it ceased owing to the pumping operations of the Shiremoor Colliery Company. It was arranged with that Company that they should allow water to flow into an old culvert, and in that way reach the Red Burn—an old stream—and the culvert was partly an artificial culvert.

Mr. Addison Potter said he was Engineer of the Shiremoor Colliery, from its commencement, in 1871, up to September, 1891. The pumping shaft was sunk to take the water out of the High Main seam, which had been there for 100 years, so that the water would not percolate into the Bensham seam. The quantity pumped was 500 gallons per minute; and the depth from which it was drawn was 44 fathoms.

Mr. A. L. Forster said he was formerly Engineer of the defendant Company, having been appointed in March, 1883. At that time, pumping had commenced at the colliery. The Company made an arrangement by which they gave the colliery Newcastle water in consideration of the colliery keeping their boiler water out of the Water Company's shaft. The latter Company were then pumping water from the Red Burn. He was not with the Company when the well supply ceased; but he surmised that the quantity of water lost to the Ridges reservoirs, independently of the Whitley reservoir, was about 130,000 or 140,000 gallons per day when the well ceased giving out water. They took the water for the purpose of making up the supply, and not permanently.

Justice WRIGHT repeated that he should so construe the Act of 1786 as to hold that the water in question was neither a stream nor a spring within the meaning of the section.

Mr. WALTON said in that case he should have to ask his Lordship to suspend the operation of any injunction.

Mr. ATKINSON asked that the defendants should give an undertaking not to use the water until the appeal was heard. They were not using it at the present time, nor had they been doing so since November. The appeal would be heard long before the necessity arose to tap the source of supply in question.

Mr. WALTON gave an undertaking that the water should not be used except in case of necessity, pending the appeal.

His LORDSHIP then formally decided that the water was not properly capable of being regarded as a spring or a stream, and was not, therefore, within the power of the Company; also that there were sufficient objections in substance to the supply to justify interference by injunction.

By direction, the jury gave a verdict for the plaintiffs for 1s. beyond the 40s. paid into Court.

Bangor (Co. Down) Water and Gas Supply.—The Bangor (Co. Down) Town Commissioners have received the sanction of the Local Government Board for Ireland to a loan of £1300 for water, gas, and sewerage extensions.

New Water-Works for Bude and Stratton.—An inquiry was held last Wednesday, at Bude, by Mr. S. J. Smith, C.E., one of the Inspectors of the Local Government Board, into an application by the Stratton Sanitary Authority, to borrow £3600 for the purpose of constructing water-works for Bude and Stratton. The scheme was explained by Mr. Anson, C.E., who stated that it was proposed to take the water from the reservoir of the Bude Canal Company, which was about eight miles from Bude, and contained nearly 80 acres of water. There was no opposition.

Sheppy Gas Company.—The annual general meeting of this Company was held at Sheerness on the 16th inst.—Mr. C. B. Shrubsole in the chair. The Secretary (Mr. A. W. Marks) read the Directors' report, which was noticed in the JOURNAL for the 15th inst.; and the accounts were taken as read. In moving the adoption of the report, the Chairman called attention to the exceptional increase in the consumption of gas which had taken place in the past twelve months. He stated that 30 years since the quantity of gas consumed in one year, including the Dockyard and Garrison, was 10 million cubic feet; while the quantity of gas sent out last year was 46 millions. In 1861 the price of gas was 5s. per 1000 cubic feet (it having just previously been 7s. 6d.); now it was only 3s. 3d. Some time ago the consumption experienced a temporary check, caused by some consumers using oil. But this only affected them for one year; and he was glad to say that nearly all had now reverted to gas. The loss through leakage had gone up from 78 feet per 1000 in 1890 to 100 feet per 1000 in 1891. This represented upwards of a million cubic feet of gas, or at least 100 tons of coal, besides labour—a loss of about £80 to the Company. He hoped that the time was not far distant when the Local Board would use a light steam-roller on the roads. Having alluded with satisfaction to the fact that the financial position of the Company justified the Directors in recommending the payment of full dividends, the Chairman intimated that it would be necessary to make a call on the "C" shares to meet the expenses of necessary extensions. Mr. Blackman seconded the motion, and it was carried. The dividends recommended having been declared, and the retiring Directors and Auditor re-elected, a vote of thanks was accorded to Mr. Marks and to the Manager (Mr. W. T. Carpenter) for their excellent management of the business of their respective departments. In the course of Mr. Carpenter's reply, he stated that the works were quite equal to producing double the quantity of gas now sent out. A vote of thanks was then accorded to the Chairman and Directors, and the proceedings closed.

MISCELLANEOUS NEWS.

COMMERCIAL GAS COMPANY.

The following is the report of the Directors of this Company, which, with the accounts for the half year ending Dec. 31 last, will be presented at the ordinary general meeting of the proprietors to be held on Friday next:—

The Directors submit the accounts for the half year ended Dec. 31, 1891. The revenue account shows a net profit for the half year of £27,666 5s., making, with £742 3s. 8d. received for interest, £28,408 8s. 8d. This, added to the amount brought forward from previous half years, makes £65,239 os. 9d. Deducting therefrom £2925 for interest on debenture stock, there remains standing to the credit of the net revenue account a balance of £62,314 os. 9d., of which, having regard to the sliding scale and the price of gas charged during the half year, £48,266 is available for dividend. The Directors recommend the payment of dividends at the rates of £13 per cent. per annum upon the old stock of the Company, and of £10 per cent. per annum upon the new stock, both less income-tax. The balance of the net revenue—£18,494 4s. 9d.—will be carried forward to the next half year. To meet the requirements of the Company, further capital is necessary; and the Directors have resolved to issue the £35,000 debenture stock authorized to be raised by resolution passed at the ordinary general meeting in April, 1891. Letters of allotment will be addressed to the proprietors in May; and the amounts payable on accepted allotments will be due on the 20th of June. The Directors have resolved to increase the price of gas to private consumers from 2s. 4d. to 2s. 6d. per 1000 cubic feet after the taking of the Lady-day indices. The following Directors—Sir J. C. R. Colomb, M.P., and Mr. J. G. Pilcher—retire by rotation, and, being eligible, offer themselves for re-election. Mr. G. Ilsley, one of the Auditors, will also go out of office by rotation, and, being eligible, offers himself for re-election.

The accounts accompanying the report consist of the usual statements. The statement of capital stock (No. 1) shows that £715,000 has been paid up, out of a total of £830,000 authorized. The statement of loan capital (No. 2) stands as at the close of the previous six months—£130,000 raised out of £300,000 authorized. The capital account (No. 3) shows a total expenditure of £845,243, of which £11,591 was spent during the past six months. The latter figure is reduced to £8089 by the premium of £3502 realized by the sale of stock. The receipts on capital account at the close of the year amounting, as shown above, to only £845,000, there was a debit balance of £243. The other statements in the accounts are reproduced in full on the opposite page.

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

The half-yearly meeting of this Company will be held on Thursday, when the Directors will submit a report which shows that the gross receipts resulting from the six months' working amount to £139,699, and the expenditure to £100,555; leaving £39,144 to be carried to the credit of the profit and loss account. After the payment of £5070 interest on debenture stock, there is a net profit of £34,167, which includes £92 interest derived from other accounts. This sum, with £24 brought forward from the previous accounts, leaves a gross sum available for dividend of £34,191. The Directors recommend the payment of dividends at the rate of 10½ and 7½ per cent. per annum on the respective shares, the payment of which will absorb £33,857, leaving a balance of £334 to be carried to the next accounts. There has been added to the reserve fund invested a sum of £1146 (being the half-year's interest thereon); making the amount standing to the credit of that fund, £61,670. The Directors further report that the additional facilities offered to users of gas-engines under the hire-purchase system, as well as a rebate on the cost price of the engines, have resulted in a large number being put into operation; and they expect, when these liberal allowances are better understood, that gas-engines will be still more extensively used. There has been a considerable increase in the sale of gas cooking-stoves and appliances for heating by gas. The new ball-fuel fires, with patent cowl to prevent down-draughts, they say are a great success. The Directors have decided on opening an exhibition of gas apparatus early next month. The great success which attended the cooking lessons given last year has induced them to employ a lady, who holds a diploma from the South Kensington School of Cookery, to give a three months' course of lectures. With regard to the manufacturing results, the statements referring thereto show that 54,101 tons of coal and 9701 tons of cannel were carbonized. From this there were produced 646,532,000 cubic feet of gas (599,372,000 feet being accounted for); 77,501 chaldrons of coke; 4305 chaldrons of breeze; 679,679 gallons of tar; and 1,302,250 gallons of ammoniacal liquor.

OTTOMAN GAS COMPANY, LIMITED.

The Ordinary Meeting of this Company was held last Tuesday, at the London Offices, 9, Queen Street Place, E.C.—Mr. EDWARD HORNER in the chair.

Mr. T. GUYATT, in the absence of the Secretary (Mr. A. J. King), read the notice convening the meeting; and it was agreed to take as read the report and accounts, which were referred to in last week's issue (p. 544).

The CHAIRMAN said, before moving the adoption of the report and accounts, he should like to make a few remarks upon them. He hoped the shareholders would consider, with the Directors, that the net result of the half-year's operations had been most satisfactory. Taking the revenue account first, the quantity of coal carbonized had been 177 tons more than in the corresponding period of 1890; but the cost had been about £58 less. The salaries and office expenses at Smyrna were higher, arising from an exceptional item of £231. Exchange had also

ACCOUNTS OF THE COMMERCIAL GAS COMPANY FOR THE HALF YEAR ENDING DEC. 31, 1891.

No. 4.—REVENUE ACCOUNT.

To Manufacture of gas—		By Sale of gas—	
Coals, including dues, carriage, unloading, and trimming (see account No. 8)	£84,997 19 9	Common gas, per meter, at 2s. 4d. per 1000 cubic feet.	£115,636 7 10
Salaries of Engineers, Superintendents, and other Officers at works	2,082 0 0	Public lighting and under contracts, common gas. (See statement No. 10.)	9,310 11 1
Wages (carbonizing)	20,160 10 0	Meter-rental	£1,933 3 5
Purification, including £1876 9s. 8d. for labour .	4,139 13 1	Stove-rental.	713 16 10
Repairs and maintenance of plant and works, materials and labour (less £211 received for old materials)	13,752 13 6	Residual products—	
Distribution of gas—	£125,132 16 4	Coke, less £3759 4s. 3d. for labour	£26 323 15 1
Salaries and wages of Officers (including Rental Clerks)	£2,317 19 9	Tar	10,084 7 8
Repairs, maintenance, and renewal of mains, service-pipes, and fittings, including labour .	2,072 12 10	Ammoniacal liquor and sulphato	9,636 9 5
Repairs and renewals of meters and stoves . .	2,133 14 3		£46,053 12 2
Public lamps—		Less loss on breeze, after deducting £575 7s. 3d. for wages.	155 2 1
Lighting and repairing.	6,524 6 10		45,898 10 1
Rent, rates, and taxes	2,326 1 5	Miscellaneous receipts—	
Management—	5,674 7 11	Rents	£149 12 3
Directors' allowance	£1,250 0 0	Transfer fees	26 0 0
Company's Auditors	75 0 0		175 12 3
Salaries of Secretary, Accountant, and Clerks .	1,089 8 0		
Collectors' salaries and commission	1,470 5 0		
Stationery and printing	412 1 5		
General charges	423 17 6		
	4,720 11 11		
Bad debts	794 14 0		
Law charges	99 10 7		
Superannuations	658 16 0		
Official Officers	70 11 6		
	£146,001 16 6		
Balance carried to profit and loss, net revenue account (No. 5) .	27,636 5 0		
	£173,668 1 6		£173,668 1 6

No. 5.—PROFIT AND LOSS (NET REVENUE ACCOUNT).

Interest on debenture stock	£2,925 0 0	Balance, June 30, 1891.	£81,634 12 1
Balance available for dividend, carried to balance-sheet.	62,314 0 9	Less amount of dividend paid for half year ending June 30, 1891; and £4 forfeiture for defective illuminating power	44,804 0 0
			£36,830 12 1
		Balance from revenue account (No. 4)	27,666 5 0
		Dividends and interest balance	742 3 8
			£65,239 0 9
	£65,239 0 9		

No. 6.—RESERVE FUND.

Balance on Dec. 31, 1891	£44,379 5 1	Balance on June 30, 1891	£44,379 5 1
	£44,379 5 1		£44,379 5 1

No. 7.—INSURANCE FUND.

Coals lost by the wreck of the s.s. "Wapping".	£372 12 5	Balance on June 30, 1891	£34,000 0 0
Balance on June 30, 1891.	33,627 7 7		
	£34,000 0 0		£34,000 0 0

No. 8.—STATEMENT OF COALS.

Description of Coal.	In Store, June 30, 1891.	Received during the Half Year.	Carbonized during the Half Year.	In Store, Dec. 31, 1891.
	Tons.	Tons.	Tons.	Tons.
Common.	19,451	119,222	111,255	27,418
Cannel	1,163	5,016	3,877	2,392
	20,614	124,238	115,132	29,720

No. 9.—STATEMENT OF RESIDUAL PRODUCTS.

	In Store, June 30, 1891.	Made during the Half Year.	Used during the Half Year.	Sold during the Half Year.	In Store, Dec. 31, 1891.
Coke—chaldrons of 36 bushels*	27,328	150,924	39,196	107,545	31,511
Breeze do. do.	3,666	16,185	4,000	11,745	4,106
Tar—gallons	271,600	1,153,935	—	1,654,135	371,400
Ammon. liq.—butts of 108 gals.	8,070	37,883	32,018	—	13,935
Sulphate of ammonia—tons	321	1,070	—	700	691

* Under "Weights and Measures Act, 1878."

No. 10.—STATEMENT OF GAS MADE, SOLD, Etc.

Description of Gas.	Quantity Made. Meter Register.	QUANTITY SOLD.			Quantity used on Works, &c.	Total Quantity accounted for.	Quantity not accounted for.	Number of Public Lights.
		Public Lights and under Contracts (estimated).	Private Lights (per Meter).	Total Quantity Sold.				
	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	
Common	1,140,256	58,754	991,169	1,049,923	14,253	1,064,176	76,080	5,343

BALANCE-SHEET.

To Net Revenue—		By Capital—For balance, per account No. 3	
For balance, per account No. 5	£62,314 0 9	Cash at Bankers	£243 0 8
Reserve Fund—		Cash in hand for current expenditure.	3,846 16 11
For balance, per account No. 6	44,379 5 1	Amount invested in Consols	2,600 0 0
Insurance Fund—		Stores in hand—	78,379 5 1
For balance, per account No. 7	33,627 7 7	Coals	£22,561 0 0
Unclaimed dividends	1,926 6 8	Coke	7,877 13 4
Deposits	9,356 6 7	Ammoniacal liquor and tar	13,895 0 0
Interest on debenture stock	164 8 2	Sundries	5,986 17 2
Sundry tradesmen and others, for amount due for coals, stores, and sundries	22,558 11 7		50,320 10 6
Loan from Bankers	48,000 0 0	Accounts due to the Company—	
		Gas-rental, quarter ending Dec. 31, 1891 . .	£75,597 19 8
		Arrears outstanding	424 16 0
			76,022 15 8
		For coke and other residual products . . .	£10,655 0 3
		Sundries	258 17 4
			10,913 17 7
	£222,326 6 5		£222,326 6 5

increased; but this was owing to the remittances having been larger. The item of depreciation, renewals, and repairs, had increased by the charge for the first time of £374 written off investment; being at the rate of 1 per cent. per annum. Bad debts had advanced by the writing off of some old accounts for fittings. The other items on the debit side of the account did not call for special remark. But on the credit side, it would be noticed that there was the gratifying increase in the gas receipts of £452; in products, of £97; and in fittings, meter-rental, &c., of £518—in all £1068. The make of gas had been good; and the unaccounted-for gas was the same as in the December half of 1890. In consequence of this satisfactory state of affairs, the Directors were able to recommend the shareholders to transfer £1000 to the reserve fund, to accept a dividend at the rate of 7 per cent. per annum, and to carry forward £375. The expenditure on capital account had been £1671, for completing 100 new public lamps, and for the laying of a new 10-inch main in Smyrna, from which both the Company and the inhabitants would derive benefit. The Chairman concluded by moving—"That the report and accounts now presented be received and adopted."

Mr. A. J. DOVE seconded the motion.

Mr. BEARD remarked that he considered the report was a very satisfactory one. He had been a shareholder since the concern was first established; and he remembered the time when they were only getting 2 or 3 per cent. Regarding the question of coal, he asked whether the increased price would affect the Company in the future.

The CHAIRMAN replied that it would not very materially.

The motion was then carried unanimously.

On the proposition of the CHAIRMAN, seconded by Mr. DOVE, resolutions were passed carrying £1000 to the reserve fund (making it £3000), and declaring a dividend, on both classes of shares, at the rate of 7 per cent. per annum.

The retiring Directors (Mr. E. Horner and Mr. J. Orwell Phillips)

were re-elected on the motion of Mr. DOVE, seconded by Mr. CHARLES GANDON; and the Auditors (Mr. C. K. Butt and Mr. T. Guyatt) were re-appointed on the proposition of Mr. W. H. HARDY, seconded by Mr. BEARD.

The CHAIRMAN then moved, and Mr. STEPHENSON R. CLARKE seconded, a vote of thanks to the Consulting Engineer (Mr. H. W. Andrews), the Engineer (Mr. John Gandon), and the staff for their efficient services.

This was passed; and a similar compliment was paid to the Chairman and Directors, on the motion of Mr. R. L. ANDREWS, seconded by Mr. R. LAIDLAW.

The proceedings then terminated.

COLONIAL GAS UNDERTAKINGS.

Having practically closed our account of the progress of the various provincial gas companies during the latter half of last year, attention may now be directed to a few colonial gas undertakings, reports respecting which have lately come to hand.

The working of the Australian Gaslight Company in the half year ending Dec. 31 last resulted in a net profit of £52,844. Adding to this the balance brought forward—£2527—there was a sum of £55,371 available for distribution. Out of this the Directors recommended the payment of a dividend for the six months of 9s. per share on those fully paid, and 6s. per share on the new ones. This would absorb £49,635, and leave £5736 to be carried over. The Company are about to undertake the supply of electric light; and they have accordingly promoted a Bill to obtain the necessary statutory authority. The measure has already passed the Upper House; and at the time of our last advices, it was before the Assembly. With regard to the Company's plant and works, which are under the supervision of their Engineer (Mr. T. J. Bush), they are reported to be in good order. As the accounts accompanying the report consist merely of the profit and loss account and the general balance-sheet, only a few particulars can be furnished as to the working. The sale of gas produced £198,095; and the manufacturing expenses were £125,731. The total expenditure (including £669 placed to the cooker suspense account) was £145,252.

The Brisbane Gas Company had not a very satisfactory half-year's working, for, notwithstanding extensions of mains in the suburbs, there was an actual decrease in the quantity of gas sold, as compared with the six months ending Dec. 31, 1890, owing to continued general depression. The sale of gas produced £19,875; its manufacture costing £7974. After paying all expenses and writing £1111 off plant, there was left a balance of £13,296. A dividend of 6 per cent. was recommended.

The South Brisbane Gas Company made a profit of £1929 on the working in the latter half of last year. This, added to the balance brought forward—£952—made a sum of £2881 available for distribution. The Directors disposed of it as follows: In further liquidation of debenture expenses, £100; special appropriation for the renewal of retorts, £100; dividend at the rate of 7 per cent., £1613; dividend-tax, £80—leaving £986 to be carried forward. The sale of gas and residuals realized £6246; and the expenses of manufacture came to £3400. As mentioned in the JOURNAL last week, the Directors have lost their Engineer and Manager, Mr. J. Davies, by death; and the appointment has been conferred upon his son, Mr. G. A. Davies.

The Directors of the Maryborough (Queensland) Gas Company, in their half-yearly report, express regret that, notwithstanding great reductions made in the working expenses during the past year, the profits realized are below anticipations, owing, as in the case of Brisbane, to the continued depression in trade. The profit for the six months ending Dec. 31 last, with the balance brought forward, was £1196, from which £50 had to be deducted for the dividend tax; leaving £1146 available for distribution. Of this, £1000 was employed in the payment of an 8 per cent. dividend; and the remainder was carried forward. The Engineer and Manager (Mr. J. Henderson, C.E.), in his report to the Directors, expressed regret at the depression in the town causing a reduction in the consumption of gas by existing customers. There were, however, a good many new services put on, although their effect was not felt. The works are in excellent order; but the rebuilding of two beds of retorts is to be undertaken.

During the half year ending Dec. 31, last, the business of the Launceston (Tasmania) Gas Company increased to the extent of 12 per cent., as compared with the corresponding period of 1890. The Company secured the contract for supplying gas to the Tasmanian Exhibition; and the lighting of the buildings has been admitted to be excellent, while the cost has been below the estimate given. The number of consumers is steadily increasing; and the use of gas for cooking and heating purposes is growing in public favour. The net price of gas is to be further reduced 5d. per 1000 cubic feet (to 6s. 8d.) as from the 1st prox.—a concession to the consumers which will amount to £1000 a year. The Directors confidently hope this will soon be compensated for by a more extended use of gas. The total receipts in the six months under review were £11,521; the expenses, £6785—of which £2685 was for salaries and wages, and £3232 for coals. The amount carried to the profit and loss account was £4736; the balance of which account at the close of the year was £4312. A dividend at the rate of 12 per cent. per annum has been declared. The coal carbonized was 3008 tons; the quantity of gas produced being 30,125,800 cubic feet, or 10,014 cubic feet per ton. The illuminating power, as tested by a Sugg No. 1 Argand burner, was 18.93 candles. The gas unaccounted for, taking the entire year, was 3.05 per cent. The increased make of gas last year, as compared with 1890, was 7.88 per cent.; and the actual make for the year was slightly more than double that of 1883. These figures show the healthiness of the concern, the working management of which is under the supervision of Mr. T. S. Clemminshaw, the Company's Engineer.

The last accounts to hand of the Rockhampton (Queensland) Gas and Coke Company, Limited, cover a period of seven months ending Dec. 31 last. In the report accompanying them, the Directors express their pleasure at being able to state that the business of the Company is in a prosperous condition. Although the liberal reduc-

tion granted in the price of gas made a difference of fully £200 in the revenue, the profit for the above-named period was £1766, which was brought up, by the addition of the balance carried forward, to £1851. The latter was the amount standing to the credit of the profit and loss account at the close of the year; and from it the Directors recommended the declaration of a dividend of 10 per cent. per annum—leaving £16 to the good. The Company have taken a definite step in the matter of electric lighting. The Directors instructed their London agents to invite applications for the position of Electrical Engineer to the Company; and Mr. A. E. Neal, formerly of Birmingham, was selected. He has reported on the systems most suitable for Rockhampton; and the Directors have decided to proceed without delay, believing that the early introduction of the electric light will be advantageous. A suitable site has been secured for the works, and upon the frontage general offices and show-rooms will be erected for carrying on both sections of the Company's business. The gas-mains have been extended to North Rockhampton—a step which promises to yield a good return on the capital invested. The reduction in the price of gas used for other than lighting purposes has had the effect of creating a large demand for gas-stoves; and there is little doubt that the increased consumption of gas for culinary operations will amply repay the Company for the concession they have made to their customers. The receipts arising from the sale of gas amounted to £5291; the coal costing £1318, and the manufacturing expenses being £704.

The Directors of the Wellington (New Zealand) Gas Company report a substantial increase in the consumption of gas during the past year; and consequently the working shows a decided improvement. The Directors, therefore, in view of these favourable circumstances, decided to abolish meter-rents and reduce the price of gas as from the commencement of the year (making it 8s. 4d. gross and 7s. 1d. net per 1000 cubic feet). They hoped that by so doing the use of gas, especially for cooking and heating purposes, would be stimulated. The receipts for gas amounted to £27,906; the cost of coal, wages, &c., less coal in stock, came to £12,829. The balance to the credit of the profit and loss account was £7050; and a dividend of 6 per cent. has been paid—making 12 per cent. for the year. The whole of the plant, which is under the supervision of Mr. H. P. Higginson, M. Inst. C. E., has been maintained in good condition.

THE DURHAM MINERS' STRIKE AND THE SUPPLY OF GAS COAL TO LONDON.

In view of the strike of miners in Durham, a good deal of public interest has been manifested in the gas supply of London; and some doubts have arisen in the minds of nervous people as to the Companies being able to ensure their supplies of raw material. A notice posted up at the London Coal Exchange last Tuesday, stating that among the cargoes arriving or due were "two steamers with German coal for the South Metropolitan Gas Company," indicated that at all events one Company was turning its attention to "fresh fields." According to one of the London evening papers, the members of the Exchange were pleased with this challenge to the Unions, who, it was stated, would bring up all their forces to prevent the coal from being unloaded. The announcement of what the Company had done caused some excitement; and the Chief Engineer (Mr. Frank Livesey) was "interviewed" on the matter. He stated that his Company, in common with all others, preferred Durham coal; but the strike in the Tyne district had forced them to look about for other sources of supply. Some time ago, promises of assistance in case of difficulty were received from various foreign gas companies; and he had been recommended to try some of the Westphalian coal, which was highly esteemed in Germany for its gas-making properties. So far, the exportation was only an experiment; and he did not think it would be at all necessary to buy largely from abroad. The best Yorkshire coal made even better gas than that from Durham; but as it was sent by rail to Hull, and then shipped, it was more expensive. As to the effects of the strike and stoppage, Mr. Livesey said that if the Durham men remained out for two or three months, and all the London Gas Companies went to Yorkshire for their supply, prices would necessarily rise; but he did not think the cost of gas would be increased to the consumers. Notwithstanding all the efforts of the miners, there could be no doubt that the price of coal was declining. The Gas Companies had offers of coal at a lower figure than the present contract prices. The action of the Coal Porters' Union in promising the Federation Board that they would not unload any coal coming from abroad did not affect his Company in any way, as the cargoes would be brought alongside their own depôts and unloaded by their own men.

In addition to the importation of foreign coal, large quantities have been obtained from the Fifeshire mines. Two ships laden with Scotch coal reached the Regent's Canal Dock during the week; the bulk, if not the whole, of the cargo being destined for the Commercial Gas-Works. Referring to this matter last Friday, the *Evening Standard* confirmed the statement made above that the Durham coal-owners are resolved to fight on to the bitter end. At the same time, there is not much fear that the Gas Companies will hold their ground now and prospectively. Apart from the Yorkshire fields alluded to by Mr. Livesey in his interview, there are the Midlands, the coals from which district might be utilized for gas-making purposes.

The "Electric Fires" in Liverpool.—It will be remembered that a short time since fires occurred in several of the boxes containing the electric wires underneath the paving of certain streets in Liverpool. Major Cardew was recently sent down by the Board of Trade to make an examination; and a copy of his report to the Board on the subject was submitted to the Watch Committee of the Corporation yesterday week. This provoked a great deal of discussion. Ultimately the City Engineer was instructed to make an inspection of the street boxes, and present a report to the Committee.

THE STOKE-UPON-TRENT GAS UNDERTAKING.

The Finances of the Gas Department.

A Special Meeting of the Stoke-upon-Trent Town Council was held last Thursday—the MAYOR (Alderman W. Kirkham) in the chair—for the purpose of considering the report of Messrs. Alfred Lass, Wood, and Co., upon the accounts of the Gas Department for the year ended March 31, 1891, a full abstract of which was given in the JOURNAL last week.

Alderman LEASON, Chairman of the Gas Committee, explained that in October last, while the Council were considering the desirability of promoting a Bill in Parliament to empower them to erect new gas-works, he stated that the Committee could deliver at the consumer's meter at a cost of 1s. 10d. per 1000 cubic feet, as compared with 3½d. per unit for electricity—13 units being required to produce lighting power equal to 1000 cubic feet of gas. This statement was disputed, as well as his contention that the Corporation were making a profit out of the gas supplied to the North Staffordshire Railway Company. In consequence of this difference of opinion, it was decided to have the assistance of an independent Accountant to report upon the two points. Mr. Lass was accordingly called in; and he contended that this gentleman's report fully maintained, if it did not more than maintain, the position of the Committee. In his report, Mr. Lass referred to two subsidiary questions, which, however, were of considerable importance. They were of such a nature that, in his opinion, they ought to have been considered in Committee, and a report thereon submitted to the Council. Other members, however, held a different opinion; and therefore the questions would have to be discussed with the other points contained in the report. The first of these subsidiary matters was that of the sinking fund; and no doubt it was a surprise to the Council to be told that there was a deficiency of £800. At the time the gas-works were purchased by the Corporation, some difficulty was experienced in raising the amount of the purchase-money. They could not obtain this in a lump sum, and for the period allowed by the Act, but were compelled to raise it in several amounts, at different prices, and for various periods. Their Act gave them four years before making preparation for a sinking fund; and acting upon the suggestion of the late Alderman Turner, the Committee decided, instead of paying annual instalments upon the whole of their loans, to take the largest loan and pay it off by such annual instalments as would be equivalent to paying instalments upon the whole of their liabilities. The Local Government Board pointed out that this was not in accordance with the provisions of the Act. But the late Alderman Keary advised them that they were perfectly right in the course they were pursuing; and a deputation from the Council waited upon the Local Government Board to discuss the matter with them. The Board agreed that their mode of repaying their loans was an advantage to the borough; but they maintained that it was against the spirit of the Act, and that it would be necessary for them to obtain a Provisional Order to legalize the principle upon which they were acting. The Order was obtained; and the Committee were under the impression that they had made a good bargain. But, unfortunately, the figures upon which they were acting, and which they submitted to the Board, were not incorporated in that Order. This led Mr. Lass to suggest means of making up a supposed deficiency in the sinking fund; and it was for the Council to decide what action should be taken if a mistake had been made. [Mr. SANT: There has been no mistake.] Another question raised by Mr. Lass was that of the reserve fund, which he said only amounted to £2775, instead of £5000, as provided by the Act. It was the opinion of the Committee that future generations should bear their share of the burdens of the gas undertaking, and that therefore there was no necessity for filling up the reserve fund hurriedly. They were forming the fund slowly, but surely; and in course of time, they would reach the limit of £5000 specified in the Act. Mr. Lass suggested that there was a question whether the reserve fund was invested according to law. The Committee had lent the money to the Corporation upon security of the sewage farm; and they were advised that this was a legal investment.

Mr. GEEN pointed out that Mr. Lass, in his report, put down the cost of gas at the consumer's door at 19'02d.; but in his working statement, he showed that, when all the items "chargeable" were taken into account, it amounted to 28'86d. With regard to the supply of gas to the Railway Company, he was also supported by Messrs. Wade, Guthrie, and Co. in his contention that such a sum for interest and depreciation should be included in the cost as would be required to renew all apparatus and fittings used in the manufacture of the gas, and that therefore the charge of 2s. 3d. per 1000 cubic feet to the Company resulted in an annual loss of £33 12s. 9d., instead of a profit of £265, as shown in Mr. Lass's report. Further than this, he submitted that, as the net profit from the gas undertaking last year was £2475, or equal to 8½d. in the pound on the district rate, the Railway Company, being rated at £4789, received by way of reduced rates out of the net profit, to which they did not contribute, the sum of £164 12s. 10d. This he did not consider fair treatment to the other gas consumers. With regard to the alleged deficiencies in the sinking fund and reserve fund, he suggested that some definite statement should be submitted by the Committee as to how they proposed to set these matters right.

After a long discussion, in the course of which the report and Mr. Geen's reply thereto were freely criticized, it was decided that the Committee be requested to consider and state to the Council, in view of Mr. Lass's report, at what price gas ought to be sold to the Railway Company, also as to what course they recommended the Council to adopt with regard to the sinking and reserve funds, and generally to make recommendations upon the report.

Gas in Japan.—According to the statement of accounts presented at the last half-yearly meeting of the Tokio Gas Company, the total income for the six months ending Dec. 31 was £9400; and the expenditure, £5546—leaving a profit of £3854. A dividend at the rate of 8 per cent. per annum was declared.

THE TAUNTON TOWN COUNCIL AND ELECTRIC LIGHTING.

Our readers are aware that the Taunton Town Council have had lately under consideration the questions of purchasing the gas and electric light undertakings. With respect to the gas-works, the terms asked by the Directors of the Company—viz., 22½ years' purchase—were regarded as too high, as the acquisition of the concern on these conditions would burden the rates to the extent of £200 a year. This matter, therefore, was allowed to drop; and attention was concentrated upon the Electric Light Company's undertaking. It is unnecessary now to comment upon this decision; the matter being done with. All that need be said is that the Corporation let slip a business that was certainly paying its way, and had every prospect of continuing to do so. This, judging from recent events, is more than can be said for its rival; for, as stated in the JOURNAL last week, there was so serious a deficit on last year's working that the shareholders have given the Directors *carte blanche* to do the best they can for them. This serious position of affairs could scarcely have been unknown to the townspeople; yet their representatives could not keep their eyes off the electric light undertaking, and they accordingly gave instructions to the Finance and General Purposes Committee to report to them on the subject of purchase. The Town Clerk also put himself in communication with the Board of Trade and the Local Government Board on the matter, and had a personal interview with one of the officials of the former department. The Committee's report, embodying all the information obtained, was submitted to the Council at a special meeting held on Tuesday last. In it they suggested that, in the event of the Corporation deciding to purchase, a Licence, which could be granted by August next, should be obtained for a limited period—say, three years—and that the Local Government Board be asked to hold an inquiry in the autumn of the present year, and give their sanction for a loan, to be repaid in three years if the Council do not obtain a Provisional Order, and for 30 years if they did. The Council could then, they said, take over the works, and carry on the business until the Order could be obtained, which would probably be in August, 1893; and until that time it would be impossible to borrow to repay the purchase-money. The Board of Trade should also be asked to allow the Council three years before they should be required to carry the wires underground. Accompanying the Committee's report was one by the Borough Surveyor (Mr. J. H. Smith) on the buildings and plant of the Electric Lighting Company. He gave the cost of the former (with land) as £3092 2s. 3d., deducting 5 per cent. for depreciation, although, with few exceptions, the works are comparatively new. The plant on which he allowed 10 per cent. for depreciation, he put at £7354 15s. 4d.; making together a total of £10,446 17s. 7d., brought up to £10,497 17s. 7d. by a few miscellaneous items. After making some observations upon the plant generally, and offering certain suggestions for its more efficient working, Mr. Smith went on to say that the vertical high-speed engines were working at much below their proper load with the 515 incandescent lamps wired, and that 785 lamps more could be supplied with the same power—thus adding £500 per annum to the revenue. The profits derived from the supply of electricity to private consumers would, he said, increase rapidly with the extension of the demand, as the staff and other expenses would be sufficient to work a much larger number of lamps than those enumerated. The charge of 6d. per Board of Trade unit for private lighting would be equivalent to 3s. 6d. per 1000 cubic feet of coal gas; and in some towns it was considered that an 8-candle power incandescent lamp would light interiors equally as well as, if not better than, gas-jets with the illuminating power of 14 candles. The prices varied somewhat in different towns, but the average charge per annum was as follows: 8-candle power lamps, suitable for bed-rooms, 8s.; 10-candle power lamps, suitable for sitting-rooms, 14s.; similar lamps for passage and hall, 16s.; 1200-candle power arc lamps (2000 hours), £23 15s.; 16-candle power incandescent lamps (3250 hours), £6 15s.; 32-candle power ditto, £9 18s. Mr. Smith said it was not possible to give an exact estimate of the cost of extending the supply to a larger area than the one now served; but it might be taken roughly at £50 for each arc light and lamp complete, and £10 for each 32-candle power incandescent lamp. He pointed out that electricity and electric lighting were being rapidly cheapened; so that incandescent lamps which now cost 3s. 6d. would, as from next year, be sold at 1s. 6d. each. He found that one indicated horse power might be taken to produce 140 candles in incandescent lamps; the same power would be equal to 860 candles of arc light. Consequently, the arc system of lighting was by far the best for all main thoroughfares. At the same time, some towns were using incandescent lamps in the side streets, by placing them in old gas-lanterns, which was found to be economical. Therefore 32-candle power lamps would have to be used in main streets, so that there would be 196 of these lamps available; and this would mean as many gas-jets shut off at £2 8s. per annum. He calculated that the saving on coal would be at least £100; on oil and waste, £50; and on water, £35—making a total of £185. On the subject of measuring the supply, he expressed the opinion that the introduction of recording meters would be satisfactory to the consumers as well as to the suppliers of electricity. Accompanying the report were four statements, setting out the present income and expenditure of the Company, the probable increase in the income by the adoption of the meter system, the capacity of the works for extension, and a similar statement based on the charge for light being at a lower rate. The first statement showed the income for the past year to have been £1521; and the various payments and liabilities, £2267—leaving a deficit of £746. According to the second statement, the estimated income under the supply by meter, at 6d. per unit, would be £2098, or £2148 with the addition of the meter-rent. With the working expenses, &c., as before, *plus* the instalment in liquidation of the amount borrowed for the meters—in all £2293—the deficit would be only £145. Utilized up to their full capacity, however, the works were shown to be equal to realizing a profit of £1235; or supposing a lower rate were charged for the light, one of £560.

The electric light question has naturally been the subject of much newspaper correspondence which cannot be dealt with here. One letter, however, from a writer who appropriately adopted the *nom de*

plume of "Querist," from the very pertinent questions he raised in the course of his communication, must not be passed over. He began by pointing out that, in the second statement, £2098 was estimated to be the income of the works if the present output were charged at 6d. per unit—equal to 83,920 units at 6d. The actual working expenses for the past year were £1947 2s. 9d., which works out to 5'45d. (say, 5½d.) per unit, without any allowance for depreciation, interest, or sinking fund, and with many other deficiencies. He then proceeded as follows: "The estimate of savings to be effected over the working of a Company with a brand new plant, working for dear life, are about as reliable as those which have been regularly circulated at the end of each year of the Company's existence, and as regularly falsified by events in the year succeeding their publication. The original cost of the plant was £13,086 19s. 7d. The sum entered in all the estimates for repairs and renewals is £225 os. 7d.; being 1'72d. (say, 1¾d.) per cent. on the original cost. Preposterous! Nothing is entered for depreciation, although the Borough Surveyor himself reports that at least 10 per cent. per annum should be deducted for depreciation. The amounts are thus incorrect to the extent of £1300 a year on each statement. The Board of Trade require the wires to be put underground in a reasonably short time—say, three years, as suggested by the Committee. The town is to pay £1588 for these wires, posts, &c., which are to be taken down and sold for what they will fetch, and underground wires substituted at a cost of about £4000. Nothing is entered in either statement for capital nor the charge for sinking fund thereon, amounting to over £200 a year. In the third statement, 18 arc lamps are to be run (25 per cent. additional), and nothing is entered for carbons or attendance—say, £35 a year. Also £500 expended for meters and £1100 on extension. Nothing whatever is entered for repairs or depreciation on these new items; this would cost at least another £200 a year. The income from it is entered. The Borough Surveyor says 6d. per unit equals 3s. 6d. per 1000 cubic feet for gas. The Company have been supplying current at 2½d. a unit, which, on a relative calculation, equals 1s. 6d. per 1000 cubic feet for gas. Does he not think that, if the supposed comparison were true, everybody would have taken the new light years ago? Here are the comparative costs, allowing for a renewal of one electric lamp for each 500 hours, and 1s. per lamp per year for the use of the meter:—

Electric Light at 6d. per Unit.					Gas at 3s. 9d. per 1000 Cubic Feet.				
Burning till	9.00 p.m.	16 c. p.	£1	18 8	..	6 c. ft. per hour	£1	5 2	
"	11.30	" 16 "	3	8 6	..	6	"	1 18 6	
"	9.00	" 32 "	3	12 6	..	12	"	2 10 0	
"	11.30	" 32 "	6	6 0	..	12	"	3 15 0	

Now, 16-candle lamps are at present charged not exceeding £1 1s. a year, including renewals of lamps; and 32-candle lamps, under £2. How many customers of the Company will pay the charges, especially those who need the lamps till 11 o'clock p.m.? It is possible to purchase new plant, which will do the work more economically than that now in use, for less money than the estimated present value of the latter. Ought we not to have correct—that is to say, complete and accurate, instead of grossly incomplete and inaccurate accounts submitted to us before being asked to vote? Ought not the Council to investigate, so as to ascertain if it has the power to charge, and all the consumers the will and the ability to pay, the increased (doubled or trebled) charges which are necessary to make the business approach a paying point? Having these queries answered, ought we not to have (say) three months to consider the figures? and, if so, why are folks trying to rush us into an unprofitable speculation?" With this string of questions, the writer closed his letter.

The whole subject was considered at a numerously attended public meeting held on Monday evening last week, under the presidency of the Mayor (Alderman Chapman). The proceedings were throughout somewhat lively; and in the end the following motion, submitted by Alderman Standfast—"That it is not advisable at the present time that the Town Council purchase the works of the Electric Light Company"—was carried by a small majority. A special meeting of the Town Council was held the following morning to discuss the matter. The report of the Committee, summarized above, was presented, as was also the Borough Surveyor's report; and their adoption was moved by the Mayor, and seconded by Alderman Van Trump. A sharp debate ensued; and eventually Alderman Spiller proposed that the matter should be adjourned for a month, and the Committee empowered in the meantime to employ an expert, at a cost not exceeding 50 guineas, to prepare a report upon the suitability of the present buildings and plant for the lighting of the town by electricity. Alderman Farrant seconded the motion; and, after considerable discussion, it was agreed to. It was also decided that another special meeting of the Council should be held on the 21st prox. A motion of Alderman Standfast, that the books of the Company should be submitted to the Council for inspection, was lost.

THE PUBLIC LIGHTING AND ROADS OF KENSINGTON.

At a Meeting of the Incorporated Association of Municipal and County Engineers held at the Town Hall, Kensington, on the 12th inst., Mr. W. WEAVER, M. Inst. C. E., the Surveyor to the Vestry, read a paper dealing with the various matters under his supervision.

With regard to the lighting of the parish, the author explained that it is all within the area supplied by The Gaslight and Coke Company. There are 4329 public lamps in the streets, of which number 32 are refuge-lamps, with 50 or 100 candle power burners. The lamps are lighted on the average meter system—a meter being fixed to about every 20 lamps. The lamps are fixed, lighted, extinguished, cleaned and repaired by the Vestry's own staff of 42 lamplighters and 8 supernumeraries, 1 foreman, and 4 workmen; the whole being under the direction of Mr. Monson, the Lighting Engineer. The lamp governors are regulated to pass 4'5 cubic feet of gas per hour; the price charged for gas at Lady-day, 1891, was 2s. 2d. per 1000 cubic feet. The cost per lamp was £2 14s. 1d.; and the lighting rate 1¾d. in the pound. The working of the average meter system commenced in 1877; and its economy and advantages over the old system of a fixed annual payment, amounting to £3 8s. 2d. per lamp, will be seen by taking three

years of the old, and three of the new system. In 1873 under the old system, and the burners regulated to consume 3 cubic feet of gas per hour, the lighting rate was 3½d. in the pound; in 1874, it was 3½d.; and in 1875, it was 3½d. In 1877, under the new average meter system, the Vestry having the control of the lighting and repairs, and paying only for the actual quantity of gas consumed, with the burners regulated to pass 4'5 cubic feet per hour, and giving upwards of 50 per cent. more light, the rate was 1¾d. in the pound; in 1888, it was 2d.; and in 1889, it was 1¾d. Not any of the public street-lamps are permanently lighted by electricity, although some of the refuge-lamps have been so lighted experimentally. With regard to the Electric Lighting Act, the author advised the Vestry to make an application for a Provisional Order and undertake the work themselves. Looking to the enormous amount which would have to be raised, and the probable discontent of residents in districts outside the first areas lighted, the Vestry deemed it preferable to divide the parish into six areas, which have been allotted to five Companies—viz., the London Electric Supply Corporation, Limited; the Notting Hill Electric Lighting Company, Limited; Kensington and Knightsbridge Electric Lighting Company, Limited; the Chelsea Electricity Supply Company, Limited; the House-to-House Electric Light Supply Company, Limited. The last-mentioned Company undertake the lighting of two areas. The system of supply adopted by the whole of the Companies (except the House-to-House Company) is arranged on the low-tension system. The House-to-House Company's system is an alternating current transformer high-pressure supply, with high-pressure service lines from distributing mains, and transformers on the consumers' premises. The Provisional Order granted to this Company contains a condition that, so soon as the amount of supply in the district appears to warrant it, the Company may be called upon by the Board of Trade to establish distributing stations and lay mains worked at a low pressure. About 15 miles of roads and footpaths have been opened up for the purpose of laying electric mains in the parish. In some cases the conductors have been placed in brick or concrete culverts; in other places, bitumen tubes or iron pipes have been used. In some streets it has been a matter of extreme difficulty to find space in which to lay the mains; and the author expressed the opinion that all the principal roads, at any rate, should have a subway. Stoneware pipes for the reception of the gas and water services and electric wires could be laid from the subway to vaults; and if these pipes were laid in the drain trenches, the cost of the stoneware pipes would be the only extra expense beyond the subway. The author thought that, if the cost of such subway works were defrayed by a loan spread over 50 years, the various companies could be charged a rent which it would be economical for them to pay, and sufficient to return a profit on the outlay. At the same time the appearance of the roads and footpaths would, he considered, be vastly improved, and the comfort and safety of the public enhanced.

Dealing with the subject of the roads in the parish (of which, at Ladyday last year, there were 82½ miles under the charge of the Vestry), the author referred to the use of steam-rollers for consolidating the surface. He said that two 10-ton steam-rollers are now employed; the 15-ton roller formerly used having been taken off, and utilized as a stationary engine for working a circular saw, and cutting wood paving blocks and timber for wheelwright's work. He explained that the stoppage of that roller on outside work was ordered, upon The Gaslight and Coke Company obtaining an injunction, restraining the Vestry from using steam-rollers to the damage of the Company's mains and services. The Court of Appeal subsequently somewhat modified the injunction, by limiting the liability for damage to mains, &c., properly laid. The author made the following remarks on this matter: "The present state of the law, therefore, is that every authority using a steam-roller is liable for all damage to mains and pipes, unless it can be proved that they were not properly laid. The actual cost of repairing a damaged main is of very little moment, compared with the incidental compensation which may arise from a consequent explosion and loss of life. As the result of a conference of Metropolitan Vestries held at Kensington, the London County Council last year inserted a clause in their Various Powers Bill, legalizing the use of rollers not exceeding 10 tons in weight without liability for damage to mains, if laid at a less depth than 2 feet. The Committee of the House, however, rejected the clause. This result, in the author's opinion, was mainly brought about by the evidence of Sir Frederick Bramwell, who appeared on behalf of the Gas Company. When asked for his opinion on the clause, Sir F. Bramwell replied that it was 'perfectly absurd, as it sought to exempt from liability the only persons who could cause the damage.' No attempt was made by the London County Council to refute this evidence, by producing witnesses to testify to fractures prior to steam-rollers being used, or to trollies traversing the streets, conveying weights giving double and treble the pressure per inch of tyre as compared with steam-rollers." The author went on to say that he had dealt somewhat fully with the subject of steam-rolling, as at the present moment every road surveyor in the country occupies a very unsafe position. An explosion arising from a fractured gas-main may happen any day; causing loss of life and damage to property, involving heavy compensation. If a steam-roller has been recently working on the adjacent road, the authority using the roller will only escape liability for the entire consequences by proving that the fractured main was not properly laid; and such proof was, he said, extremely difficult of demonstration.

Thirsk Gas Company.—The profits of this Company on last year's working amounted to £656, which was a slight increase over 1890. The figure would have been still larger had there not been exceptional expenditure in renewing and fixing new services, consequent on the reduction in the price of gas and in the rental of meters. At the recent annual meeting, a dividend was declared, which, with the interim payment, made 5½ per cent. for the year.

New Joint-Stock Company.—The Common Petroleum Engine Syndicate, Limited, has been registered with a capital of £20,000, in £1 shares, to carry into effect an agreement made between Spiel's Patent Petroleum Engine Company, Limited, of the one part, and J. Elsner, on behalf of the Syndicate, of the other part, for the acquisition and working of certain patents relating to improvements in gas, petroleum, and other hydrocarbon motors.

METROPOLIS WATER SUPPLY.**The Quality of the Water in February.**

The returns furnished to the Registrar-General by the London Water Companies as to the water supply of the Metropolis during the past month, show that the average daily supply was 180,123,530 gallons, as compared with 180,491,255 gallons in the corresponding month of 1891; being at the rate of 29.5 gallons per head of the population. Of the entire bulk of water sent out, 90,749,666 gallons were drawn from the Thames, and 89,373,864 gallons from the Lea and other sources. Reporting upon the quality of the supply, Dr. E. Frankland said: "Taking the average amount of organic impurity contained in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies and by the Tottenham Local Board of Health was: Kent, 0.9; Tottenham, 1.0; New River, 1.9; Colne Valley, 2.1; East London (deep-well), 2.2; East London (river supply), 2.8; Southwark, 3.2; West Middlesex and Grand Junction, 3.4; Chelsea, 3.5; and Lambeth, 3.6. The water abstracted from the Thames by the Chelsea, West Middlesex, Southwark, Grand Junction, and Lambeth Companies was of much better average quality in February than in the previous month. It was efficiently filtered in all cases. The water taken chiefly from the Lea by the New River Company had returned to its usual degree of purity; while that taken from the same river by the East London Company was superior to the best Thames-derived waters. Both waters were efficiently filtered. The deep-well waters of the Kent, Colne Valley, and East London Companies, and of the Tottenham Local Board of Health, were of good quality for dietetic use; those of the Kent Company and the Tottenham Board of Health being especially distinguished for their excellence. The Colne Valley Company's water, having been softened before delivery, was rendered suitable for washing. All these waters were clear and bright without filtration. Seen through a stratum 2 feet deep, the Kent, Colne Valley, and Tottenham waters were clear and colourless; the East London (deep well) clear and nearly colourless; and the remaining waters clear and very pale yellow. The bacteriological examination by Dr. Koch's process of gelatine plate culture, gave the following results: One cubic centimetre of each water, collected on the same days as the samples for chemical analysis, developed the following numbers of colonies of microbes: West Middlesex, 16; Kent, 24; New River, 36; Lambeth, 38; Grand Junction, 46; Chelsea, 60; East London (river supply), 126; and Southwark, 348."

Messrs. Crookes, Odling, and (the late) Dr. Tidy, in the course of their report to the Official Water Examiner for the Metropolis (General A. de Courcy Scott) on the quality of the water supplied by the London Water Companies during the past month, as shown by samples taken daily for analysis, say: "The whole of the 175 samples examined were found to be clear, bright, and efficiently filtered. In other respects, also, the condition of the water supply during February was throughout entirely satisfactory. In the case of the Lea-derived water supplied by the East London Company, the mean amount of organic carbon was found to be only 0.125 part, and the maximum amount 0.157 part, in 100,000 parts of the water. In the case of the Thames-derived supply, the mean amount of organic carbon was only 0.137 part, and the maximum, in any single sample examined, 0.151 part in 100,000 parts of the water; as against a mean of 0.158 part, and maxima of 0.189 and 0.204 part, in the previous month's supply." A novelty in connection with the report of the above-named analysts for the past month is the inclusion therein of an additional table giving the results of tests of samples of the Companies' waters taken from the works on various days. This allows of a comparison being made between its condition there and at the places whence the samples are usually drawn from the mains.

LIVERPOOL CORPORATION WATER SUPPLY.**Completion of the Boring of the Mersey Tunnel.**

The interesting news was received at Liverpool last Tuesday that the tunnel under the Mersey, through which water from the Vyrnwy Lake is to flow, had been successfully bored through from shaft to shaft. The work was commenced in March, 1888, by Messrs. Monk and Newell; and since the abandonment of the contract by them, it has been carried on, on behalf of the Corporation, by Messrs. J. Cochrane and Sons, of London. The former contractors had sunk a shaft on each bank of the Mersey, and had driven a tunnel 57 ft. 6 in. long from the Cheshire side, at a very low level. Messrs. Cochrane introduced more expensive machinery, including four new air-pressers, several 40-horse power boilers, portable engines, a new boring shield, and substituted electric light for candles. They sunk a new shaft on the Cheshire bank; and, utilizing the top portion of the existing Lancashire shaft, proceeded to drive a new tunnel across at a much higher level and with a greatly reduced air pressure. Generally speaking, the new apparatus has proved a success all along. Owing to the sandy water-bearing strata traversed, the boring had to be done by the aid of compressed air, which served to keep the loose earth in check; and in spite of the water having burst through on several occasions, causing considerable delays, the work has proceeded with phenomenal rapidity, until last Tuesday the whole length of 805 feet from centre to centre was accomplished. The tunnel and shafts are being lined with cast-iron segments, each ring of which measures 18 inches in length 11 inches in thickness, and 6 inches at the flanges, and weighs 2 tons 4 cwt. The diameter of the tunnel inside the flanges is 9 feet; so that there will be room for more than the two pipes which are at present intended to carry the water through at a pressure of 180 lbs. per square inch. A great deal of work has yet to be done before the completion of the tunnel and shafts; a quantity of earth having to be removed and the cast-iron lining finished. The fixing of the pipes to conduct the water through will form a separate contract; and when this shall have been accomplished, nothing will remain but to divert the water from the temporary pipe-line into the aqueducts under both the Ship Canal and the Mersey, and thence into the pipes leading into the Prescott reservoir.

PLYMOUTH CORPORATION WATER SUPPLY.**A New Storage Reservoir—Water Power for Electrical Purposes.**

It will be remembered that, after the blizzard of 1891, there was a good deal of controversy at Plymouth as to what ought to be done to protect the leat, so as to prevent a stoppage in the supply of water. Some members of the Council were in favour of piping; others advocated a plan for roofing it with concrete; and the idea of a storage reservoir was also mooted. It was generally felt, however, that it would be unwise to commit the Council to a large expenditure on any definite scheme until after the new Water Engineer (Mr. Sandeman) had been able to give them the benefit of his advice. One of his first tasks, therefore, was to investigate the general condition of the water supply, and to report upon what he considered desirable to be done in view of the present and future requirements of the town. His report has now been published; and the result of his investigation is that he proposes the construction of a storage reservoir at Burrator, and the laying of a direct line of pipes from the proposed reservoir to the Roborough reservoir. The Burrator site, said Mr. Sandeman, is, by its configuration, naturally adapted for the formation of a reservoir; and here one could be formed, with a capacity of 422 million gallons, for, it is estimated, £96,000, including the dams, overflow, gauge, weir, road diversion, valves, &c., but not the cost of the land. The reservoir could be designed so that, when requisite, its storage capacity could be increased (at small cost) by 350 million gallons by raising the dams 10 feet higher; making the total storage capacity 800 million gallons. The cost of the pipe-line to Roborough is estimated at £24,000; and the leat will remain as a duplicate means of supply between Burrator and Roborough. Later on in the report, Mr. Sandeman deals with the question of water power. He says, assuming the town to be in possession of storage capacity sufficient to ensure a daily supply of 6 million gallons, the energy available by utilizing the fall from one reservoir to another would be as follows: Roborough to Hartley, 260-horse power; Hartley to Drake's Place (by a new main), 78-horse power; by enlarging the main from Burrator to Roborough to 30 inches, in order to reduce the friction in the pipes, 126-horse power. This gives a total gross horse power of 464; and after deducting the friction in the pipes, turbines, &c., a net horse power of 175. It should be remembered, observes the Engineer, that this power is continuous through the twenty-four hours; and if it be found advisable at some future time to introduce into the town the system of supplying water power at high pressures (600 or 700 lbs. per square inch), for the use of small traders and manufacturers in place of steam power, the means of producing hydraulic power by day and electric light by night are here present. Appendices to the report give analyses of the water by Mr. R. H. Harland, F.I.C., F.C.S., Analyst to the Greenwich Board of Works; and he pronounces the samples to be "excellent waters for drinking and domestic purposes." A report on the scheme by Mr. James Mansergh, C.E., is also given; and his opinion is altogether in favour of it.

Tynemouth Gas Company.—The annual report of the Directors of this Company, to be submitted to the shareholders at their meeting to-day, states that the revenue for the past year amounted to £28,663, and the expenditure to £23,204. After writing off £510 for depreciation of meters, stoves, &c., and charging £715 (the cost of two new boilers) to revenue account, there is a balance of net profit of £5,459. An interim dividend of 5 per cent. on the original capital and 3½ per cent. on the new share capital was paid on Sept. 4 last, amounting in all to £2859; and the Directors propose to make a like payment for the half year ending Dec. 31 last. The two payments will amount to the statutory dividend for the year. The Directors state that they have found it necessary, on the advice of their Engineer (Mr. W. Hardie, jun.) to replace two boilers, which had been in constant use since the new works were erected in 1872, by two patent Galloway boilers of steel, at a cost of £715. They are fitted with Meldrum's patent dust-fuel furnaces, so as to consume the refuse from the coke; and this will in future effect a considerable saving in the consumption of coke on the works. Owing to the increased consumption of gas, it will also be requisite to lay down several new mains of a larger size during the present year. The great increase in the cost of coal has been a cause of much anxiety; but there is every prospect of securing a more favourable contract on the expiration of the old one. A new show-room has been completed; and a great variety of the latest appliances for cooking, heating, &c., are now on view. There are 205 cooking-stoves let out on hire; and the Directors have every reason to be satisfied with this new departure.

Bristol Water Company.—The report presented by the Directors of this Company at the forty-sixth annual meeting last Saturday stated that the revenue from water-rates for the past year was £92,607; being an increase of £3548. The sum shown by the revenue account to be applicable for dividend was £18,986; and the Directors recommended that dividends of 3½ per cent. on the ordinary £25, £20, £6, and £4 10s. shares, and of £2 12s. 6d. per cent. on the 7 per cent. maximum ordinary stock, be declared; making, with the intermediate dividends, 7½ per cent. on the ordinary shares and 5½ per cent. on the 7 per cent. maximum ordinary stock for the year, and leaving £849 to be carried forward. The Sanitary Authority having expressed a desire that the Company should take steps to prevent, so far as possible, the necessity for breaking up the surface of roads newly laid with wood pavement, the Directors mentioned that they had with that object laid new mains in several important streets; and the exceptional expense so incurred and charged to revenue was £904. The interest on the capital expended on the Barrow new reservoir had been charged to revenue from Jan. 1, 1891; and to this fact was attributable the reduction of the dividend compared with that paid for 1890. The total quantity of water now stored in the three Barrow reservoirs was 715 million gallons, of which 370 millions were stored in the new reservoir. The additional storage capacity afforded by the new reservoir would, it was believed, enable the Directors this year to effect a considerable saving in the expenditure on pumping at Chelvey. The works in the Yeo Valley were being proceeded with. The capital expended during the year was £57,216; and the length of service mains laid was about 6½ miles.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

The Custodiers of the Wallace Monument at Stirling had before them on Monday an application by Mr. Carlow, of Arbroath, on behalf of the North British Association of Gas Managers, for leave to place the bust of Wm. Murdoch in the Monument, as resolved upon at the meeting in Edinburgh last July. The application asked that it be placed in a suitable place in the monument. Provost Kinross, of Stirling, who presided, said they had all received a somewhat lengthy account of the history of Murdoch; and he moved that they accept the offer of a bust, and instruct a Committee to make arrangements for its reception. He had been consulted, he said, as to whether a bronze or a marble bust should be given; and he had replied that he had not a good impression of the bronze bust of Carlyle, and that he would prefer a marble bust on a pedestal. I think it requires very little reading between the lines to perceive that, although Mr. Carlow laid before each of the Custodiers a full narrative of what Murdoch did, they had not all read it. I cannot otherwise account for a show of opposition which was offered, not to the acceptance of the bust, but to the placing of it in the hall where the other existing busts are. No one surely who had taken the trouble to make himself acquainted with Murdoch's work, could doubt that he is as much entitled to the highest honour which can be bestowed as any Scotchman whose name might be mentioned. His invention is quite on a level with that of Watt, the inventor of the steam-engine; and it has been of more consequence to the world, I do not hesitate to say, than have the writings of Carlyle. Yet I find a Mr. Thomson saying "he thought they should not cheapen the Monument in any way;" and that "it was the intention at first, when the bust idea was entertained, that they ought to admit to the chief room of the Monument only those Scotchmen who had a distinct claim to be admitted, and though Murdoch's bust was worthy to be received, yet they should take up the question as to whether it should not be placed in another hall in the building." Another member of the Board, Treasurer Ronald, dissented against the placing of the bust of Murdoch in the hall along with the others. Happily these two stood alone; and the bust was accepted on the same conditions as the others—viz., that the Custodiers have power to shift it if it should be necessary. The presentation of it will take place at the annual meeting of the North British Association in July.

On account of their not having been able to submit the Committee minutes for the month at their annual meeting last week, the Edinburgh and Leith Gas Commissioners are to hold their ordinary monthly meeting on Monday, contrary to the resolutions they had arrived at. I understand the chief business before them will be a recommendation that the present price of gas—4s. 6d. per 1000 cubic feet—should be continued till after the autumn reading of the meters. By that time, they will have ascertained the results of the working for this year, and will have entered into their contracts for the year which will be then current. It is most probable there will be a reduction in the price of gas.

It is announced that the Dundee Gas Commissioners will probably be in a position, at the end of this year, to reduce the price of gas. The increase in the output, to which I referred last week, is now stated to amount to 34,750,000 cubic feet over the estimate. This has been attained in spite of the starting of several installations of electric light; and it shows the business of the Gas Commission to be in a very healthy condition. An unusual source of saving, for it cannot be called revenue, has arisen in connection with the new contracts for coal, which were entered into on the original contracts being cancelled as not fulfilling the guarantee. The question for the Commissioners is whether they will materially reduce the price of gas or apply the surplus which is expected in strengthening the contingent fund, which is regarded by some as not being in a satisfactory position. Probably they will be able to do both to some extent.

The members of the Aberdeen Town Council on Tuesday inspected the stoking and coal-breaking machinery which was erected in their works over a year ago by Mr. John West, and agreed to take the plant off Mr. West's hands. Bailie M'Kenzie, the Convener of the Committee, stated that the machinery had given every satisfaction; and as they were that day to pass Mr. West's account for payment, it was thought desirable that the members of the Council should be taken to see it. The machinery was inspected at work; and everyone appeared to be satisfied with it. A general inspection of the gas-works was made at the same time; a thing which, considering how ill-informed many members of corporations are upon gas matters, might be done with advantage in other places. The Gas Committee met on the following day; and it was reported to them that the gas had been tested twice during the past month, and had been found to be of 22.34 and 23.5 candle power. The consumption of gas showed an increase over the corresponding month of last year of about 5 million cubic feet.

At the meeting of the Stirling Town Council already alluded to, a letter was submitted which had been received by the Lighting Committee from the Secretary of the Gas Company, announcing the reduction in the price of gas mentioned in last week's "Notes." The minutes stated that the Committee had instructed the Town Clerk to write to the Gas Company, expressing their pleasure at the reduction, and to ascertain what reduction would be made on the price charged for gas used in the public lamps; and that a reply had been received to the effect that the gas consumed in the public lamps would be charged on the reduced scale. At the same meeting, the question of the advisability of the Town Council taking over the gas-works for the benefit of the town came up in an indirect way. The question was brought before the Council on the motion of Mr. Dougall last November, and remitted to the Lighting Committee for inquiry and report; that gentleman being added to the Committee to assist in the deliberations. In the report which the Committee submitted last Monday, they said that they had considered the motion as to the proposed purchase, and continued the matter for further consideration. Mr. Lawson moved the approval of the minute; and pointed out that Mr. Dougall was no longer a member of Council. After some talk, it was agreed to continue the remit to the Lighting Committee. Mr. Dougall told the Council in November that there was no middle course, and that the issue was

either acquisition or opposition. A local journal says that acquiescence in the present state of things is more likely to be the solution of the question; and that the laughter with which the motion to continue the remit was received, showed that the Council as a whole entertained a similar belief. The fact of three months having elapsed without the Lighting Committee being able to report, was either a testimony to difficulties having turned up that were not expected, or to there being a desire to allow the matter gradually to drop out of sight.

At the last monthly meeting of the Paisley Town Council, the allocation of last year's gas surplus was trotted out, with the result that the grasping disposition of those Councillors who think it is not improper to seize the gas profits for the improvement of the town, met with complete discomfiture. The ringleader was again ex-Provost Cochran, who moved that of the surplus of £8238, the sum of £4238 be devoted to defray the debts of the Gas Trust, and the balance of £4000 be given to improve the town. In support of his motion, the ex-Provost pointed to the extensive improvements which had been carried out by means of the gas surpluses, remarking that they had spent fully £30,000 in that direction. The burden of this was borne, he said, by householders paying rents of £10 and upwards, the poorer classes paying only one-sixth. That was one of his principal reasons for asking a continuance of the system. There were many things, such as repairs and improvements on their town, which they could not tax the community for, and these the surpluses enabled them to carry out. If they did not continue the utilization of the surpluses for town improvements, they would have to impose a tax of 4d. in the £1. He hoped that the Council would show their good sense, and do what they had done for a great many years. The motion was seconded by ex-Bailie Andrews, who remarked that he concurred in the views of ex-Provost Cochran. Sympathy with those views was also expressed by ex-Provost Clark, who wished, however, to know for his guidance if the Gas Act did not require that the Trust should first wipe away their deficit before they could say that they had a balance to dispose of for public improvements. The Clerk (Mr. Martin) stated that, construing the Act strictly, they must first of all apply the money towards the payment of the debt incurred for extension and improvement of the works and mains, before they could give anything towards improving the town. They had now exceeded their borrowing powers; but as soon as they had paid off the excess, they would be able again to spend the surplus on improvements. The Convener of the Gas Committee then formally moved that the surplus be applied, in terms of the Act, to pay off the debt. This was seconded and agreed to.

The failure of John Dobbie, Sons, and Co. is giving the Arbroath Gas Corporation some trouble. Messrs. Chiene and Tait, of Edinburgh, have made up a statement regarding the estate, which shows the liabilities of the firm to amount to £18,079 7s. 6d., and the assets to £17,103 10s. 4d.; leaving a deficiency of £975 17s. 2d. The Committee of Management of the Arbroath Gas Corporation have resolved to take action in the Sheriff Court to compel the Messrs. Dobbie and their cautioner to take delivery of the residuals.

Messrs. Leslie and Reid, of Edinburgh, have been appointed Engineers to the Falkirk and District Water Trust, in connection with the re-construction of the embankment of Earl's Burn Reservoir under the arbitration proceedings between the Trust and the contractors. They propose that the work should be begun early in May.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, March 26.

Sulphate of Ammonia.—There is nothing fresh to be reported. The market is steady, and the demand apparently sufficient to prevent an increase of stocks; and as parcels are not pressed for sale, prices are entirely unchanged. East coast buyers will, as a rule, not exceed £10 3s. 9d.; but the bulk of the business is nevertheless at £10 5s., and £10 2s. 6d. has been realized at Liverpool, though lower quotations are floating about. Nitrate is still very quiet, and is now offering at 9s. 1½d.; but there is a steadier feeling at the close.

LONDON, March 26.

Tar Products.—Business is very dull; and buyers are few and far between. The transactions that have been noted are at low and unprofitable prices. Pitch is the only product which seems to interest buyers; but business in this article can only be done at a very considerable reduction on to-day's quotation. Both tar and oils are now being largely burnt as fuel; and, taking into account the prices offered for products, this seems at the moment the best outlet for them. Prices: Tar, 12s. 6d. Pitch, 28s. 6d. Benzol, 90 per cent., 2s.; 50 per cent., 1s. 6d. Toluol, 1s. 4d. Solvent naphtha, 1s. 3d. Crude benzol naphtha, 30 per cent., 10½d. Creosote, ¾d. Naphthalene salts, 20s.; pressed, 45s. Carbolic crude, 60's., 1s.; 70's., 1s. 4d.; crystals, 4½d. Cresol, 8d. Anthracene, 30 per cent. "A" quality, 11d.; "B," 8d.

Sulphate of Ammonia.—A better feeling has come over this market; and sales are not so difficult. Considerable business is being done at prices ranging from £10 to £10 5s. less 3½ per cent. It is believed that the bottom of this article has been reached; and that, with the advent of spring, better prices will obtain. Gas liquor (10 oz.) is quoted at 5s. 6d. to 7s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—During the past week there has been a more or less general stagnation of demand throughout the Lancashire district; and with the resumption of work at the collieries (which with very few exceptions was restarted on the 21st), the output has been considerably in excess of present requirements. In the place of the previous needless anxiety on the part of merchants and consumers to get in extra supplies, colliery owners have had more coal to offer than they could dispose of; and although here and there an attempt has been made to hold on to some portion of the recent advance, it has been quite unsuccessful, and prices have promptly receded to old rates. For the present it is scarcely possible to form any really accurate

estimate as to the real condition of trade, as merchants and consumers in many cases are still holders of considerable stocks; and until these are worked off, only a limited demand can be looked for. Round coals, at the pit's mouth, do not average more than 12s. 6d. per ton for the best Wigan Arley, 10s. 6d. to 11s. for Pemberton four-feet and second qualities of Arley, and 9s. to 9s. 6d. for common round coals. Engine classes of fuel, upon which the advance was the greatest, are now the most plentiful in the market. Burgy is readily obtainable at 6s. to 7s. per ton; best qualities of slack, 5s. 6d.; and the common sorts, at 3s. 6d. to 4s. per ton, at the pit. In the shipping trade, there has been very little doing; and with plentiful supplies offering at the ports on the Mersey, for which it has been impossible to find buyers, prices have quickly gone back to about 10s. to 10s. 6d. per ton, for good ordinary qualities of steam coal delivered at the Garston Docks, or at the High Level, Liverpool.

Northern Coal Trade.—The effects of the strike in the Durham coal trade are now fully manifest; indeed, in some degree they are being overcome. Coal is being brought into the county from Scotland, Yorkshire, and Northumberland; so that, with the stoppage of many blast-furnaces and works, the difficulty is being removed, as far as absolute present needs are concerned. Northumbrian steam coal has fallen in price to something more like its normal rate; and it is now from 10s. 6d. to 11s. per ton, free on board, for best qualities. Second qualities are about 1s. per ton lower. Small steam coals are more abundant, at about 5s. per ton. In gas coals there is a lessened demand from London, which seems to be obtaining its supplies from other sources; and the high prices that were asked by a few of the Tyneside colliery-owners who can supply this kind of coal, have fallen. Still, from 13s. to 14s. per ton, free on board, is the current price. The demand being easier, lower rates may be anticipated soon. Bunker coals are slow; so many steamships lying idle just now. Manufacturing coals are quiet, with a very limited demand. Household coals are flat, with an abundant supply. Coke for blast-furnaces is, of course, extremely scarce, and commands about 20s. per ton at the ovens; but so many furnaces are out of use that the consumption is very small. Gas coke has been raised in price for retail sale; but it is the usual increase that takes place when the production is falling off. The strike in the coal trade shows some signs of settlement; more especially because the resources of the men are being rapidly drawn upon, and the funds of the Societies are small for the number of men (nearly 60,000) who are dependent upon them.

West of Scotland.—The coal trade in this district is reported rather easier. Shippers are still, however, engaged in working off old orders. The mild weather is telling upon the demand for household coal, which is materially reduced. There is a falling off in the trade to Ireland. Little or nothing continues to be done for the Continent except in nuts, of which foreigners are taking fair deliveries. For forward delivery there is but little inquiry, buyers holding off in the expectation of even a lower level of prices than prevailed before the recent spurt set in. Quotations, as it is, are down very considerably from what they were. Ell coal is offering at 8s. 9d. to 9s.; main, at 8s.; splint, at about 9s.; and steam, at 10s. 3d. to 10s. 6d. The shipments of Scotch coal for the week amounted to 147,200 tons, an increase over the preceding week of 18,713 tons. For the year to date, the shipments have reached 1,234,058 tons; as against 1,027,500 tons for the same period of last year—an increase of 206,558 tons.

Steam-Rollers and Gas-Mains.—Through an explosion of gas last Wednesday week, a house in South Street, Wilton, was wrecked, and a young man injured. It seems that shortly before the occurrence, a steam-roller had been used in the street; and it is conjectured that this fractured the gas-main, and the gas escaped into the sewer-pipe, and thence into the house.

Dorking Gas Company.—The half-yearly meeting of this Company was held on Monday last week. The report of the Directors showed a profit on the revenue account of £750, which, with the balance from the previous half year, left £1122 available for dividend. From this the Directors recommended the payment of dividends at the rate of 8 per cent. on the "A" and "B" shares, and 7 per cent. on the £10 per share paid on the "C" shares. The sale of gas was 7½ per cent. above that of the corresponding period of 1890; and this increase the Directors attributed to the extensive use of gas cooking and heating stoves. The report was adopted.

Celebration of the Third Anniversary of the Gas Workers' Union.—A great meeting of members of various Trade Unions was held at Barking last Sunday afternoon, to celebrate the third anniversary of the formation of the Gas Workers' and General Labourers' Union. It was estimated that about 25,000 people were present. There were two platforms provided for the speakers, among whom were Messrs. Burns and Thorne; and the following resolution was put from both: "That this mass meeting of trade unionists and others congratulates the Gas Workers' Union upon their third anniversary, and pledges itself to support no candidate for parliamentary or municipal vacancies who does not pledge himself to support a legal eight-hour day or 48-hours week, with a minimum wage of 6d. per hour." The resolution was carried.

Ammonia Gas Purifying and Alkali Company, Limited.—At the annual general meeting of this Company last Wednesday, the Directors reported that the net revenue for the past year amounted to £1415; being an advance of £431 on the receipts for 1890. There was an available balance of £2191, out of which the Directors recommended the declaration of a dividend of 5 per cent., free of income-tax. This absorbed £1122; and after paying the Directors' fees, there was a balance of £768 to be carried forward. In the previous report, and also at the last general meeting, reference was made to the difficulties experienced with the Company's plant at Belfast. The result of a personal inspection by three of the Directors and the Chemist (Professor Heaton, F.I.C., F.C.S.) was a decision to thoroughly overhaul it. This was accordingly done; and the purification arrangements are now reported to be in complete order. The royalties from the sulphur-recovery process continue to increase; the Halifax Corporation having been added to the Company's licensees during the present year.

Electric Lighting for Cambridge.—The Cambridge Town Council have adopted a recommendation of the Electric Lighting Committee, that the powers contained in their Provisional Order should be transferred to Messrs. Parsons and Co., who have undertaken to commence to light the specified area of supply not later than the beginning of the October term.

Southend Gas Company.—At the annual general meeting of this Company last Thursday—Mr. C. F. Woosnam in the chair—the report of the Directors and the statement of accounts for the past year (briefly noticed in the JOURNAL last week) were taken as read. The Chairman moved the adoption of the report; and the motion was carried unanimously. The statutory dividends were declared; and the proceedings closed with votes of thanks to the Chairman, Directors, and officers of the Company.

The Vyrnwy Water and Lead-Poisoning.—The *Chester Chronicle* says there is grave reason to fear that the Vyrnwy water contains elements very seriously impregnating the water when it comes into contact with lead pipes. At Liverpool, for eleven days in succession, lead was found in the water, although the city is only receiving a moiety of the Vyrnwy water, while Malpas is having its whole supply from that source now; and as the houses are nearly all supplied through lead pipes, our contemporary says it is none too soon to call attention to this serious matter.

Gas Exhibitions.—Under the auspices of the Corporation Gas Department, an interesting exhibition of gas appliances was opened on the 15th inst., at Rochdale, by Messrs. John Wright and Co., Limited, of Birmingham and London, and continued until the 19th. Cookery lectures were delivered twice daily by Mrs. H. M. Young, of Warrington. The same firm held a successful exhibition at Barmouth from the 22nd to the 25th inst., when Mrs. J. Marshall gave lectures and cookery demonstrations. Messrs. Richmond and Co., Limited, of Warrington and London, held exhibitions last week at Richmond (Surrey), Llandudno, and Widnes. Mrs. Bennett lectured at the first-named town; Miss Owen, at Llandudno. At Widnes, Mr. E. W. T. Richmond delivered an address on "Gas as a Domestic Servant."

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.
(For Stock Market Intelligence, see ante, p. 571.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon invest. ment.
£			p. c.					£ s. d.
GAS COMPANIES.								
590,000	10	15 Oct.	10½	Alliance & Dublin 10 p. c.	10	16-17	..	6 3 6
100,000	10	"	7½	Do. 7 p. c.	10	11½-12½	..	6 0 0
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105-107	..	4 13 5
100,000	20	27 Nov.	8	Bahia, Limited	20	12-14	..	11 8 1
200,000	5	12 Nov.	7½	Bombay, Limited	5	6½-6¾	..	5 11 6
40,000	5	"	7½	Do. New	4	4½-5½	..	5 14 1
380,000	Stock	26 Feb.	12½	Brentford Consolidated . .	100	205-215	..	5 14 1
150,000	"	"	9½	Do. New	100	155-160	+2	5 15 8
220,000	"	11 Mar.	11½	Brighton & Hove Original .	20	39-41*	..	5 12 2
888,500	Stock	11 Mar.	5	Bristol	100	95-100*	..	5 0 0
320,000	20	15 Oct.	11½	British	20	43-45	..	5 0 0
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	10	19-20	..	5 15 0
51,510	10	"	8½	Do. 7 p. c.	10	14-15	..	5 13 4
328,750	100	"	—	Buenos Ayres (New) Limited	10	6-7	..	—
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	93-96	..	6 5 0
150,000	20	26 Feb.	8	Cagliari, Limited	20	24-26	..	6 3 1
550,000	Stock	15 Oct.	13a	Commercial, Old Stock . .	100	244-249	..	5 4 5
165,000	"	"	10a	Do. New do.	100	190-195	..	5 2 7
130,000	"	30 Dec.	4½	Do. 4½ p. c. Deb. do.	100	118-123	..	3 13 2
800,000	Stock	30 Dec.	13	Continental Union, Limited.	100	221-226	..	5 15 1
200,000	"	"	10	Do. 7 p. c. Pref.	100	185-195	..	5 2 7
75,000	Stock	16 Sept.	10	Crystal Palace District . .	100	190-200	..	5 0 0
486,090	10	29 Jan.	10	European, Limited	10	19-20	..	5 0 0
354,060	10	"	10	Do. Partly paid	7½	14-15	..	5 0 0
5,470,820	Stock	12 Feb.	12	Gaslight & Coke, A, Ordinary	100	212-217	+1	5 10 7
100,000	"	"	4	Do. B, 4 p. c. max.	100	94-97	..	4 2 5
665,000	"	"	10	Do. C, D, & E, 10 p. c. Pf.	100	244-249	..	4 0 4
30,000	"	"	5	Do. F, 5 p. c. Prf.	100	116-121	..	4 2 9
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	169-174	..	4 6 2
1,300,000	"	"	7	Do. H, 7 p. c. max.	100	150-154	..	4 10 11
463,000	"	"	10	Do. J, 10 p. c. Prf.	100	241-246	..	4 1 3
476,000	"	"	—	Do. K, 6 p. c. Prf.	100	145-150	..	4 0 0
1,061,150	"	11 Dec.	4	Do. 4 p. c. Deb. Stk. . . .	100	113-116	..	3 9 0
294,850	"	"	4½	Do. 4½ p. c. do.	100	118-123	..	3 13 2
908,000	"	"	6	Do. 6 p. c. do	100	163-168	..	3 11 5
3,800,000	Stock	12 Nov.	12	Imperial Continental . . .	100	222-226	+1	5 6 2
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4-4½	..	6 13 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p. c. Deb.	100	108-110	..	4 10 11
541,920	20	27 Nov.	6½	Monte Video, Limited. . .	20	14½-15½	..	8 7 8
150,000	5	27 Nov.	10	Oriental, Limited	5	8½-8¾	..	5 14 3
60,000	5	30 Sept.	7	Ottoman, Limited	5	4-5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited	10	2½-3½	..	—
People's Gas of Chicago—								
420,000	100	3 Nov.	6	1st Mtg. Bds.	100	100-105	..	5 14 3
500,000	100	1 Dec.	6	2nd Do.	100	100-105	..	5 14 3
150,000	10	15 Oct.	10	San Paulo, Limited	10	9-10	..	10 0 0
500,000	Stock	26 Feb.	15½	South Metropolitan, A Stock	100	266-271	..	5 14 5
1,350,000	"	"	12	Do. B do.	100	220-225	..	5 6 8
200,000	"	"	13	Do. C do.	100	235-240	+3	5 8 4
725,000	"	30 Dec.	5	Do. 5 p. c. Deb. Stk. . . .	100	138-143	..	3 10 0
600,000	Stock	11 Mar.	11½	Tottenham & Edm'nton, Orig.	100	—	..	—
WATER COMPANIES.								
729,331	Stock	30 Dec.	10	Chelsea, Ordinary	100	225-235	-5	4 5 1
1,720,560	Stock	15 Oct.	8	East London, Ordinary . .	100	192-197	-½	4 1 3
544,440	"	30 Dec.	4½	Do. 4½ p. c. Deb. Stk. . .	100	136-140	..	3 4 3
700,000	50	11 Dec.	8	Grand Junction	50	92-96	+1½	4 3 4
708,000	Stock	12 Feb.	10½	Kent	100	240-250	-10	4 4 0
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max. . .	100	205-215	-2½	4 8 4
406,200	100	"	7½	Do. 7½ p. c. max.	100	185-190	..	3 19 0
260,000	Stock	30 Sept.	4	Do. 4 p. c. Deb. Stk. . . .	100	120-123	..	3 5 0
500,000	100	12 Feb.	12½	New River, New Shares . .	100	325-335	..	3 2 4
1,000,000	Stock	29 Jan.	4	Do. 4 p. c. Deb. Stk. . . .	100	125-128	..	3 2 6
902,300	Stock	30 Dec.	6½	S'hwk & V'xhall, 10 p. c. max.	100	132-137	-3	4 15 0
126,500	100	"	6½	Do. D 7½ p. c. do.	100	140-145	..	4 9 8
1,155,066	Stock	11 Dec.	10	West Middlesex	100	236-241	-1½	4 3 0

a Next dividends will be at this rate.

Completion of New Water-Works for Padiham.—The new water-works of the Padiham Local Board, at Churn Clough, were formally opened last Wednesday by Mr. E. Ingham, Chairman of the Board. They were commenced in November, 1884; and the total cost is estimated at £70,000.

Water Affairs at Loughborough.—The General Purposes Committee of the Loughborough Town Council, at their meeting yesterday week, decided to accept a tender submitted by Messrs. Oakes and Co., amounting to £1739, for laying a 12-inch auxiliary water-main from Nanpanton, and one from Mr. J. Band, of Peterborough, for executing certain work in connection with the new main for £700. At the same meeting, a statement was presented by the Town Clerk from which it appeared that, after crediting the water-supply account with the sum of £500 per annum for water used for public purposes, there was still a difference of £1136 between the receipts and expenditure; and this had to be provided out of the general district rate. The deficit was occasioned by the water charges being so much under the scale authorized by the Act, and below the charges for water made in other towns. After a protracted discussion, the Finance Committee were

instructed to prepare, and submit to the Council for approval, a scale of charges which would cover the cost of supply.

The Acquisition of the Calverley District Water Company by Local Authorities.—A letter was read at the meeting of the Farsley Local Board yesterday week from the Secretary of the Calverley District Water Company, asking if the Pudsey, Farsley, and Calverley Local Authorities intended taking over the concern on the 1st prox., it being absolutely essential for the Directors to know as early as possible in order to make arrangements for the collection of the book debts; and further if it was the desire of the respective Boards that the Directors should carry on the undertaking for another period. The Directors, the letter stated, deemed it necessary to have this information at once, so as to purchase stock and material to keep the plant in an efficient condition. It was pointed out, on the reading of the letter, that the Board had not yet received the sanction of the Local Government Board to the borrowing of the necessary money. It was therefore resolved that the Clerk should write to them pointing out that there was an arrangement to take over the works on the 1st prox., and ask for a reply saying if they would grant the necessary sanction.

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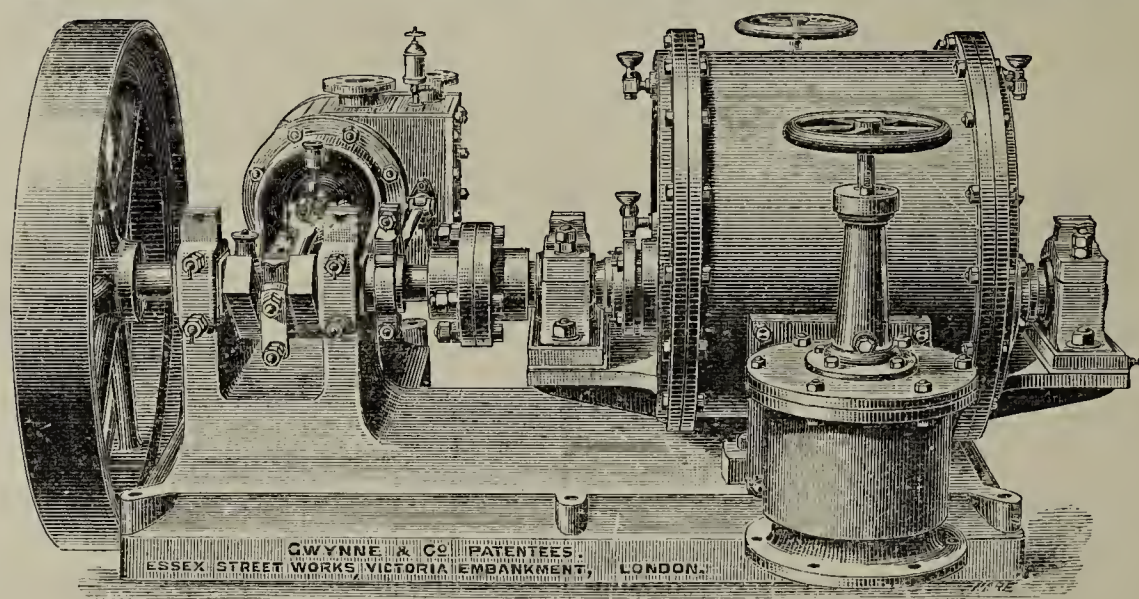
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TO ADVERTISERS.

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THE

JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, APRIL 5, 1892.

The Affairs of the Commercial Gas Company.

THE general meeting of the shareholders of the Commercial Gas Company, held last Friday, may be regarded as ending in a triumphant vindication of the policy of the Directors, if these gentlemen choose so to regard proceedings which lasted but a short half hour, and brought them face to face with no criticism, "irresponsible" or otherwise. For it is a lamentable fact that the able Chairman of the Company (Mr. John Blacket Gill) fell into the error which Colonel Makins, M.P., was wise enough to shake off last February—he began his speech to the proprietors

with a complaint against "irresponsible criticism." Now, Mr. Gill is far too able and well-instructed a man to need reminding of the nature of the function of critics, whether they deal with the affairs of a gas company or the performance of an artist. This was settled long ago, in his most magisterial manner, by Dr. Johnson, when he maintained that it was not necessary for a man to be a working carpenter to qualify for expressing opinions regarding the workmanship of a table. "A man may know when a table is well or ill made," said the Doctor, "without being able to make a better, or even so good a piece of work." And upon the same principle, the sooner Chairmen of Gas Companies put foolish sensitiveness to outside criticism, as such, in their pockets, with their fees, the better they will be enabled to use this criticism as a light for their path. If it is wrongly directed for want of sufficient information, that is hardly the fault of the critic, who has to frame his opinions upon the materials at hand. The great point to be remembered is that the sharper the criticism, provided it is honest, the more salutary it is likely to be; for there is really nothing more poisonous, as well as cloying, than indiscriminating laudation. Who is there to help the administration of a gas undertaking by independent criticism, outside the JOURNAL? Suppose we were to fill our editorial columns week after week with adulation of every director of every gas company in the kingdom, simply because he is a director of a gas company, what conceivable useful purpose would be served thereby? Yet it is according to human nature, we suppose, that no sooner do we call in question, upon common information, the wisdom of a single gas director or public officer, than that individual seizes the first opportunity for declaiming against "irresponsible critics." We had hoped that Mr. Gill was superior to this sort of thing. Now, with regard to Mr. H. E. Jones, the Engineer of the Commercial Gas Company, it is only fair to admit that, whenever he can explain away the point of a published stricture upon his official actions, he generally does so. Referring to the affairs of the Company, we recently took occasion to remark upon the trouble Mr. Jones has had with his coal porters, and inquired why, if the Union hands proved unmanageable, he, as being largely responsible for the supplies of coal to the Commercial works, did not employ others. On Friday, Mr. Jones took, or rather made, an opportunity for explaining that the men whose conduct has been complained of were not under his control, being employed at the Regent's Canal Docks, and not at the gas-works at all. He went on to show, moreover, that these independent members of the coalheaving persuasion were as utterly free from due subjection to their Union officials as to the inferior personages through whom their wages come. This is all very well, so far as it goes. Far be it from us to wantonly throw obstacles in the way of the management of any gas-works, whether in London or elsewhere. We take leave to remind all whom it may concern, however, that the only motive which we can own as governing the comments, favourable or otherwise, upon the conduct of gas undertakings which appear in these columns, is solicitude for the cause of the good management and prosperity of the gas industry as a whole. There are certain gas companies and committees of municipal corporations which just at present appear to us, so inspired, to be in a bad way; and thinking this, for reasons not difficult to be understood, we shall continue to say as much whenever occasion serves. With regard to the Commercial, as in respect of other gas undertakings that could be named, it certainly does appear that the responsible administrators need to have a tighter grip upon the reins. There may not be anything greatly amiss with the property as a whole; but—and we are not now alluding only to the East-end Gas Company—as time goes on and day follows day in strictest routine, there is danger lest at head-quarters the impression should prevail that the concern is able to run itself. In some instances, the prevalence of this impression results in the cutting down of the salaries of principals, the reduction of heads of departments to the status of clerks or foremen, and a general propensity to dispense with brain power in the management. In other cases, the heads emancipate themselves more and more from the care of what they call the details of management, but which are really the bases of commercial prosperity, while they engage in a variety of outside occupations. It is impossible to strictly define the restrictions of good management. But they exist, for all

that ; and in matters of gas administration, as in so many others, it is the on-lookers who see most of the way of the game.

The City Gas Examinership.

THE Corporation of the City of London are to be congratulated upon their wise selection of Professor Vivian B. Lewes to fill the vacant gas examinership. There were many highly eligible candidates for the appointment ; and it is with no desire to disparage any of these gentlemen if we venture to express the conviction that in Professor Lewes the City have secured the best man for the post. We say this without reserve, either for personal or professional qualifications. Professor Lewes is not only a capable gas examiner, well trained in that routine which is so necessary in connection with the regular and rigidly impartial discharge of the duties of a statutory office, and for which the brightest attainments or the most brilliant educational record do not compensate the man who does not possess the habitude of it. He is also an enthusiastic worker in the chemistry of the commercial lighting gases ; and is certain to make his influence felt on the side of progress in the arts of gas manufacture and utilization. He is, moreover, young, and has a reasonable prospect of many years of professional activity. Wherefore, on all counts, the City Corporation are to be commended on the way in which they have exercised this particular bit of patronage. It is by no means easy for a body of this character to correctly gauge the qualifications of candidates for offices involving the discharge of scientific or technical duties. The average town councillor may reasonably feel puzzled when he is constrained to discriminate between the rival claims of a small host of gentlemen, all apparently equally eminent in their own world, which is a sphere that is usually beyond his own system or that of the associates from whom he derives guidance in ordinary municipal business. Consequently, when such a leading office as that of Gas Examiner to the City of London falls vacant, the incumbent of which can be such an important personage in the little technical world to which he belongs, if his heart is in his work, it is a subject of general concern whether the hazard of the choice will turn out happily or the reverse. This time we sincerely believe, having followed Professor Lewes's recent professional career with considerable interest, that in the office to which he has been elected he will approve himself to be, emphatically, "the right man in the right place."

Gas Companies and Subways.

IN our column devoted to "Parliamentary Intelligence" will be found the condensed report of the conclusion arrived at before Mr. Herbert Gladstone's Committee with regard to the Subways Bill of the London County Council. This measure as first drafted contained some provisions which the owners of the pipes, &c., proposed to be put compulsorily into street subways looked upon with much disfavour. It was not that the Gas Companies and others similarly interested in the matter entertained any particular objection to subways ; but what they did not like was the prospect of being saddled with the whole or an unfair proportion of the cost of making these public conveniences, which meanwhile they can very well do without. When the consideration of the Bill was opened in Committee, it speedily appeared that the opposition to its general scope and intent might be composed by arrangement between the parties ; and, after several adjournments, during which there was a good deal of negotiation and consultation on all sides respecting the modification of the clauses, these were finally agreed upon. It is not very clear what amount of benefit the Bill, if it passes in its present form, will confer upon the public ; but we suppose it means at least that the Gas Companies who have withdrawn their opposition to it are not opposed to the idea of putting their mains into subways and paying a reasonable consideration for the accommodation, such as it is. This agreement may also convince the County Council that Gas Companies have no such malignant desire for breaking up newly-made road surfaces as is sometimes alleged of them. They are ready to fall in with any fair arrangement which may be devised for reducing the annoyance of main and service laying. But this is purely a matter of business with them ; and it is only right that, when the placing of gas-mains in street subways is being discussed, it should be clearly understood that these mains and services do

not actually need any such treatment, and that, when subways are constructed in the interests of the public, those who derive the greatest benefit should pay the largest share of the expense. Gas Companies have to look very sharply after these things, or else they might often find themselves the victims of those enthusiastic reformers of local affairs who seek so ardently to do good at the expense of others.

Gas at the Chicago Exhibition.

FROM Mr. Alex. C. Humphreys, a well-known member of the profession of gas engineering in the United States, who approaches us in the awe-inspiring official capacity of "Chairman of the Finance Committee of the World's Fair Gas Industry Council," we have received a letter and a parcel of printed circulars relating to the praiseworthy undertaking of this body to secure fitting representation of the national industry of gas lighting at the Chicago Exhibition of 1893. It appears that, after some trouble, and not a little playing at cross-purposes by those interested in the gas industry and the Exhibition respectively, an allotment of space in the Exhibition grounds has been obtained, whereon it is in contemplation to erect a so-called Gas Building, thereby repeating the example of the Pavilion erected by French Gas Companies at the last Paris Exhibition—of course, with the understanding that the United States are to "go better" in this regard than the Frenchmen. An influential and representative Committee has been formed to take this business in hand, Mr. Eugene Vanderpool being Chairman ; and his colleagues are all well known in the profession, not merely in America but throughout the world. Subscriptions from all Transatlantic Gas Companies are being invited ; and it is stated that a subsidy after the rate of \$4 per million cubic feet of the yearly production of all United States and Canadian Gas Companies would provide the necessary funds. Mr. Humphreys, who is the Secretary of the Permanent Council as well as Chairman of the Finance Committee, has been directed to ask for the co-operation of all the principal Associations of Gas Engineers and Managers in the Old World as well as in the New, with the object of making the Gas Building of Chicago and its contents as complete an exemplification of the gas industry as is possible in the circumstances. And to this end he also bespeaks our good offices. It is with the greatest pleasure that we respond to this appeal. We have too many good friends across the Atlantic to need to be asked twice to say or do anything that is pleasing or helpful in the sight of the duly-accredited representatives of the North American gas industry. We sincerely hope that their participation in their National Exhibition will redound to their credit and to the advantage of the industry ; and we can only regret that distance and other material considerations will prevent our sending a Special Commissioner to see how they succeed in their endeavour. At any rate, we can wish Mr. Vanderpool and his associates well through their rather onerous but honourable task. It is to be feared that while United States politicians of both parties are so fond of indulging in the amusement of "twisting the lion's tail," and while the current economic delusion known as M'Kinleyism embarrasses the commercial relations of the two great English-speaking nations, there will continue to be some difficulty in getting the two peoples to pull together in all matters. In regard to gas engineering, however, there is undoubtedly a bridge of professional sympathy spanning the North Atlantic ; and we have every confidence that British gas engineers will extend to their American brethren every assistance they can legitimately afford towards ensuring the success of the Chicago demonstration. It is not for us a question of dollars, but of aid and countenance in other kinds. We should imagine that the loan of models, specimen apparatus, &c., would be acceptable ; but, of course, details of this kind can be settled later. The main thing at present is to place British gas engineers in sympathy with their American brethren in respect of the efforts now being put forward by the latter to secure fair recognition at Chicago next year ; and to this object we are glad to take the present opportunity of engaging the good offices of all readers of the JOURNAL.

A Trade Union Anniversary.

THE third anniversary of the establishment of the Gas Workers' Union, which was held at Canning Town last

Sunday week, may be regarded as the opening of the Mass-Meeting season of 1892. With the brightening of the days, energetic Trade Union officials furbish up their banners, take their "regalia" out of the safe keeping in which it has reposed through the winter, and inquire after the brassiest of the brass bands which take open-air engagements on Sundays. Poets of a past, and perhaps a more picturesque time, have depicted the effects of Spring, and described how all animate nature responds to the jocund chorus, "Summer is y-comen in!" But it remains for the essentially unpoetical newspaper reporter of this dingy, prosaic age to chronicle how, with the approach of the vernal season, our modern Progressists turn out from the Sunday club-rooms where during the winter they solace themselves with indoor variety entertainments, and make the streets and open spaces of English towns hideous with their tawdry processions. Truly, the reproach of dulness is being fast removed from English Sundays, as observed in many parts of our once Puritanical land. What with our Booths and Burnsers, our Thornes and Tilletts, it really seems as if some of us, at any rate, had begun to learn the lesson of keeping the Seventh Day jolly. Let us hope that those classes of the community who follow the new fashion in Sunday Observance enjoy and profit by it. They do little harm, at any rate, by their processionizing and spouting; and if it is any satisfaction, to a man who labours hard all the week, to bedeck himself on Sundays with a gaudy scarf, and carry a heavy banner in a perspiring crowd of his fellows, along a dusty road—well, there is no accounting for tastes. There is something in the suggestion that the undoubted popularity of the mass-meeting and the stump-oration among the less instructed and slowest thinking orders of working men is really due to the lack of ideas in these men, which is shown by their inability to amuse themselves intelligently, or to occupy their leisure hours in any self-suggested employment. It is stated, and we can quite believe it, that the scene of the recent Gas Workers' meeting, as viewed from the centre platform, was very impressive; there being upwards of 20,000 people present, whose demeanour was quiet and orderly, and their attention to the various speakers worthy of all praise. We are told also that there were as many as 90 bands and banners in the procession; and if this report is heavily discounted, it will still prove that there was plenty of noise and colour to fill the ears and take the eyes of the Barking Road crowd. The New Unionism is, as the American phrase goes, "great on banners." If the Gas Workers' Union officials can show little else for the subscriptions of their supporters, it must be a source of deep satisfaction to the latter to reflect that they are currently reputed to possess the "best banners" of any organization in England. Surely, if any of the strikers who were so completely "sold" by the officials on the many occasions which need not be specified here, were present at the recent meeting, the bands and banners would solace them for their sufferings. Be this as it may, it appears reasonable to regard bands and banners in the light of toys which please the grown-up children who assemble in these gatherings, while the speeches they applaud so rapturously must represent the *pabulum* for such general ideas respecting political and social matters as they are able to assimilate. Truly, the spectacle of such a meeting is an impressive one, in a sense different from that in which the word would be used in a newspaper report. Here may be seen masses of the power-wielding English people, swayed by men like Burns and Thorne as hardly a living priest or statesman could hope to sway them. We have nothing whatever to say in this regard against Burns or Thorne, who doubtless act for the best according to their lights. There is manifestly a wide difference between such men and persons like the notorious Michael Henry, or William H. Ward. But how is it that they can count a following, which takes their crudities of thought for ripened wisdom, their wild assertions for gospel, their lop-sided reasoning for comprehensive instruction respecting all things in heaven and on earth? Primarily, as we take it, men of this stamp attain and keep their position because they speak the language of their hearers, and understand better than the learned the mental limitations and emotional springs of the ignorant. Perhaps in the course of time the demagogue may find his occupation gone, because a generation which has been to school will realize that bands and

banners do not contain the elements of any sufficient remedy for the "ills that flesh is heir to." But for the time being it is quite evident that the leather-lunged street-corner orator is the darling of the mob; and the community has something to be thankful for in the fact that the majority of these men are "indifferent honest."

WATER AND SANITARY AFFAIRS.

THE Royal Commissioners appointed to inquire into the subject of the Metropolitan Water Supply have had two meetings, in order to settle the question of procedure, and to consider the means to be adopted for obtaining the information necessary for the purposes of the inquiry. They come together again to-morrow. As the meetings are a week apart, the apparent rate of advance is not very rapid. The constitution of the Commission seems to have been a little misunderstood by Sir R. Temple, who has asked in Parliament for the addition of one or two Commissioners, who would represent that part of Surrey which suffers—as Sir Richard states—from the circumstance that the River Thames is "being exhausted of all its water" by the Companies. In reply, Mr. Ritchie explained that the Commission had not been formed on the principle of obtaining representatives of the different districts, but of securing the services of gentlemen specially qualified for the important inquiry which the Commission had to undertake. An idea that the Metropolis will demand enough water to drain the whole valley of the Thames, together with that of the Lea, is also represented by a letter which Sir Richard Nicholson has addressed to the London County Council, asking that any new or additional supply should not be taken from within the counties of Hertford, Middlesex, or Surrey, and that any powers granted by Parliament to the Council should be limited accordingly. Mr. H. L. Cripps, the Council's Parliamentary Agent, has discerned a flaw in this proposal, and suggests that, should the Council buy a Water Company's undertaking, payment might have to be made according to the powers possessed by the Company, without reference to the extent to which they were being exercised. If any of these powers were to be subsequently extinguished, who would compensate the Council? It was the conclusion of Mr. Cripps that, pending the report of the Royal Commission, the Councils of the Home Counties should let the matter rest. This statement of the case was embodied in a report laid before the County Council at its meeting last week by the Special Water Committee, and was followed by a trenchant speech from Sir Thomas Farrer, reviewing the position of the Council in reference to the water question. Sir Thomas remarked that the sources of the future water supply of London had not been determined; "and it was obvious that the Home Counties" would have much to say on the subject." In more belligerent tones, the speaker went on to assert that "certain" "assumed rights" of the present Companies would be disputed "to the death." Unluckily for the Council, the Government did not see eye to eye with that body on certain parts of the water question, and had required, as a condition of proceeding with the London Water Bill, that the clause should be struck out which was to empower the Council to examine the Companies' books, and otherwise to inquire into their affairs. Sir T. Farrer thought this action on the part of the Government by no means fair. But we presume Mr. Ritchie's idea was that the Royal Commissioners were the proper parties to exercise these extensive powers of investigation. However, Sir Thomas hopes that the County Council will have everything its own way when a new Parliament is elected; and in the meantime he points exultingly to the result of the recent County Council elections in London. The latter result he interprets as an endorsement of the policy adopted at Spring Gardens on the water question. It may be anything else, for aught we know; and it may happen that, when that policy assumes a more definite shape, the ratepayers will take the alarm.

The Hybrid Committee of the House of Commons appointed to consider the Water Bill of the Birmingham Corporation, held their first meeting last Thursday, Mr. Campbell-Bannerman being elected Chairman. The case for the Corporation was opened by Mr. Pope, Q.C., who pleaded that nothing was further from the truth than the assertion that the Birmingham authorities were seeking

to obtain the Elan and Claerwen watershed because they wished to anticipate other people. The present sources of the Birmingham supply gave a minimum yield of some 17½ million gallons per day, and an average of 21 million gallons; whereas the daily demand last year amounted to 17 million gallons, and Mr. Mansergh calculated that 30 million gallons would be required in 1915, rising to 51½ million gallons in 1940. Coming nearer to the present time, it was reckoned that the present supply would be altogether overtaken in 1900, by which date it was expected that the proposed works would be finished. How long it would take the London County Council to make up its mind where to go for fresh supplies, the learned Counsel did not know; and even when the Council had decided the question for itself, other contingencies would intervene to cause delay. Supposing the Royal Commission reported in a manner agreeable to the aspirations of the County Council, giving an utter condemnation to the river supply, a period of years must yet elapse before the Council could begin to appropriate an entirely new source. In the meantime the wants of Birmingham must be met. Put in this manner, Birmingham would seem to have a strong case; and if this can be proved, we do not exactly see what right London has to stand in the way. Topographically, Birmingham comes before the Metropolis in seeking a supply of water from Mid-Wales. If there is water enough in the district for both Birmingham and London, there is the less reason for the latter to make any objection. Probably the County Council will be satisfied if certain clauses, proposed a short time back, are introduced into the Birmingham Bill, so as to secure a water supply for London from Mid-Wales, should it be required. This is all that need be asked for; and we may presume that the supply will never be wanted. Should a Mid-Wales scheme ever be sanctioned for the Metropolis, the cost will be tremendous. The Birmingham Bill asks for power to raise £6,000,000 of capital; and the probability is that all this will be swallowed up, especially if the proposals of the Board of Trade, that the amount of compensation water should be largely increased, are adopted by the Committee. We may observe that the constitution of the Committee has been slightly altered since the names were given last week; Mr. W. James and Sir Henry Stafford Northcote now appearing in the room of Mr. Bryce and Mr. Wharton. In the House of Commons yesterday, Mr. D. Thomas moved that the number of members on the Committee should be increased from nine to eleven, in order that Wales might be duly represented, as largely interested in the inquiry. The proposal found several supporters in the debate which followed; but, on a division, the motion was lost—120 voting for, and 150 against it.

We can hardly pass by an alarming statement quoted in a *Times* leader on Saturday, concerning the unhealthy condition of the rural sanitary district of Staines. The question is raised by a report from Dr. Blaxall, published in the annual volume just issued by the Medical Department of the Local Government Board. The picture given of the rural district referred to is certainly deplorable; and the state of affairs calls for vigorous and prompt correction. We may observe that this is an old story, and Dr. Blaxall's report dates from 1890. It is suggested that the germs of typhoid fever emanating from this miserable region may possibly become mingled with the London water supply. We can only say that there is no evidence of such a result down to the present time. The villagers have cesspools in the gravelly subsoil, and readily succeed in poisoning the local wells. But the intakes at Sunbury are at a considerable distance; and the objection which we find urged is, that there is an underground flow of water in that direction. Supposing this hypothesis to be correct, some allowance is to be made for the natural filtration produced by the intervening gravel-beds, following which is the powerful effect due to the artificial filtration carried out by the Water Companies. The bacteriological examination of the supply by Dr. Koch's process, demonstrates the efficiency of the filtration which the water undergoes after being taken from the Thames; and the vital statistics of the Metropolis give further assurance of the wholesome character of the supply. At the same time, we endorse all that is said as to the extraordinary neglect of the local authorities who have charge of the rural district of Staines, and we trust some remedy will soon be applied.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 637.)

BUSINESS in the Stock Markets was even quieter last week than it was the week before. The chief thing was the settlement of the long account; and that went through satisfactorily. But, apart from this, transactions were reduced to the lowest level. Nevertheless, making allowance for this lack of support, the tendency was not at all bad, and prices did not suffer anything to speak of. Money is very easy, and many were prepared for a lowering of the Bank rate on Thursday; but nothing was done. However, it seems bound to fall next Thursday. The Gas Market has been so quiet as to be utterly devoid of feature. There was not a single move made in any issue, either up or down—the only variations being merely *ex div.* corrections; and the scanty array of transactions marked scarcely calls for any notice. Gaslight "A" was dealt in once or twice every day, and showed a disposition to firmness, so far as such slight matter can indicate anything. The closing price on Saturday—216—was the best of the week. The debenture and other secured issues also gave some faint evidence of steadiness. The few transactions recorded in South Metropolitan were at about average figures. The same may be said of Commercial. The Company held their general meeting on Friday; and, for the first time in their history, declared a reduced rate of dividend. This is usually a disagreeable ordeal for a Chairman to go through; but Mr. Gill managed to put the meeting so thoroughly in accord with the Board, that the announcement was actually received with applause. However, 13 per cent. is a very good dividend, and one which we are disposed to think should not again be exceeded in future, except in circumstances at present wholly unforeseen. The Suburban and Provincial Companies and the entire array of Foreign undertakings may be dismissed in one word—stagnation. The isolated transactions marked, however, were at good, steady figures. In the earlier part of the week, there was a moderate amount of business done in Water; but it tailed off to next to nothing towards the end. Some issues which would appear to have been overlooked at the time of the general reduction in values—*e.g.*, Lambeth 7½ per cents. and Southwark and Vauxhall "D"—were put down to a level with the rest; and New River also fell back in line with them. On the other hand, Grand Junction and Southwark and Vauxhall ordinary made a moderate recovery; and Lambeth debentures were quoted *ex div.* at an advance of 2. Taking them all round, the stocks appear to have reached the bottom of their fall, unless some new scare should arise.

The daily operations were too insignificant to require any detailed notice.

The Secretaryship of the Bristol Gas Company has become vacant by the relinquishment by Mr. J. V. Green of the position to which he was appointed on the retirement of Mr. H. H. Townsend early in 1887.

The Gas Referees' Summer Instructions, which have just been issued, contain the notification, usual at this season, that the maximum quantity of sulphur allowable in gas will, until further notice, be 17 grains per 100 cubic feet. Beyond this there is a slight addition to the instructions as to the times and mode of testing gas for illuminating power. In the paragraph in which the candles are described, it is now specified that two candles, "or two of the half candles formed by cutting one of these candles in two," shall be used together; and the three testings conducted on one day are to be made with "three different pairs of candles or half candles." The Instructions bear the name of Arthur W. Rücker (who, as already mentioned in the JOURNAL, has taken Dr. Tyndall's place as one of the Referees), in conjunction with those of Professor A. Vernon Harcourt and Dr. Pole.

South-West of England District Association of Gas Managers.

—The next half-yearly meeting of this Association will be held at the offices of the Bristol Gas Company on Tuesday next, under the presidency of Mr. D. Irving. We learn from the notice issued to the members by the Honorary Secretary (Mr. Norton H. Humphrys, Assoc. M. Inst. C.E., F.C.S.) that the following matters will engage attention. After the introductory business has been disposed of, the gentlemen here named will be proposed for election: Mr. W. J. Fuller, Bournemouth; Mr. F. W. Johnston, Stapleton, Bristol; Mr. W. Sainsbury, Salisbury; Mr. S. B. Darwin, Portsea; Mr. G. B. Irons, Gosport. The President will then deliver his Inaugural Address. Three papers are promised for the occasion: (1) "The Construction of the Severn Tunnel," by Mr. C. Richardson, M. Inst. C.E., of Bristol; (2) "The Development of Gas Lighting in Railway Trains," by Mr. E. C. Riley, of Swindon; (3) "The Enrichment of Gas in Bulk by means of Carburettors," by Mr. Frank W. Clark, of London. There will be discussions on these; and one on "The Supply of Gas by Prepayment Meters, or Short-Period Collections, as a means of Increasing Consumption," will be opened by Mr. Geo. J. Gough, of Calne. After the meeting the members and friends will dine at the Royal Hotel; and on the following day a party will visit the Severn Tunnel, by the kind permission of W. Dean, Esq.

ELECTRIC LIGHTING MEMORANDA.**A Popular Statement of the Electric Lighting Question—The Lane-Fox Patent Litigation—The Grosvenor Gallery Station of the Electric Supply Corporation.**

A VALUABLE, because reliable series of articles descriptive of the public electric lighting arrangements of London, is being published in the *St. James's Gazette*. It is hardly possible to say anything new about the affairs and prospects of the different Metropolitan Electric Lighting Companies; but the point respecting which public interest is still as keen as ever is the cost of this method of lighting, and how this compares with gas and oil. The *St. James's* articles are not signed; but their author evidently knows what he is writing about, and is equally alive to the circumstances of the consumers' position. In his third article, therefore, he explains in simple language how the price of electric lighting is reckoned. He says: "Just as gas is charged at so much per 1000 cubic feet, so current for electric lighting is charged at so much per Board of Trade unit, or B.T.U. A current of 1 ampère at a pressure of 1 volt is called a watt, and one hour's consumption of such a current is called a watt-hour. The Board of Trade unit is 1000 watt-hours; and its price varies at present from 6d. to 8d." It is explained that the different companies supplying London charge various rates. The maximum permitted by the Board of Trade is 8d. per unit, which is the general price; but the St. Pancras Vestry are trying what can be done at 6d. The writer next gives a statement of the cost of electricity as compared with other sources of light, which will be found in full in another column. These figures are described as resulting from "careful experiments carried out under ordinary household conditions;" and it is remarked of them that they are not likely to "please everybody." This is true, seeing that incandescent electric lamps are shown to cost, for a given amount of lighting, 245s., as compared with 93s. for gas at 3s. per 1000 cubic feet consumed in Argand burners, or 41s. in Wenham lamps, or 30s. in Welsbach incandescent burners. Mineral oil at 7d. per gallon works out, upon the same basis, at from 44s. to 58s., according to the type of lamp employed. We have nothing to complain of in connection with this statement, which errs, if at all, on the side of leniency to the electric light; but we do protest against the writer's conclusion, in another part of his last article, that the public are "well protected" against any danger to life or property from electric light wires. This assertion must have been written before the Chatham catastrophe.

One of those heavy patent cases which are at once the glory of lawyers and the reproach of the legal system of the country, was recently heard by Mr. Justice A. L. Smith, sitting for Mr. Justice Romer. This was the suit of Mr. Lane-Fox, the well-known pioneer of electric lighting, against the Kensington and Knightsbridge Electric Lighting Company, for an alleged infringement of his patent No. 3988 of 1878, which was asserted to cover the idea of utilizing secondary batteries, then newly brought out by Planté, for the purpose of equalizing the supply of current from a central lighting station. The hearing occupied the Court for fifteen days, during which period the unhappy Judge was lectured by all the electrical talent of the country, duly marshalled for the purpose of flatly contradicting one another, and of confusing the Court when they could not succeed in making good their own views. If the plaintiff could have sustained his claim, he would have succeeded to the enviable position of holder of a master patent applying to an important method of electrical distribution; but the event was ordered otherwise. In a judgment, which must be esteemed a marvel of lucidity, especially considering the conflict of evidence from which it was deduced, the learned Judge pronounced the patent cited to be bad, "upon the ground that the complete specification does not conform to the provisional; upon the ground that the invention as described cannot be made to work; and also upon the ground that, if it could, no sufficient information is given as to how it was to be made to work." Perhaps it is not too much to say that this decision may be interpreted in popular language as declaring Mr. Lane-Fox's patent to be a purely speculative one. The patentee seems to have "hit upon an idea," as the phrase goes, which he forthwith proceeded to patent, and which he appears to have believed sufficiently to the point to give him the control over everything that could be done afterwards in this line of invention. This, we may be permitted to observe, is the popularly received notion of "how to make money by patents." The lucky man has his inspiration, for which he obtains protection; and thereafter he is enabled to levy tribute to his heart's content upon the meaner horde of working people who are engaged in making and selling things. It is therefore as well to spread far and wide the correction of such illusions which judgments like this of Mr. Justice A. L. Smith supply. If Chancery proceedings in patent cases teach any general lesson at all, it is that patents for inventions that can be classified in the order of "lucky hits" are rarely of any good in point of law.

It has been reported in the *JOURNAL* how a firm of tradesmen carrying on business in Bond Street succeeded in obtaining an injunction against the London Electric Supply Corporation, restraining them from using their Grosvenor Gallery premises as a sub-station for receiving and converting high-pressure

current from Deptford for use in lighting the district. What the tradesmen in question particularly objected to was the collection, upon premises adjoining their own, of "a large number of electric cables and step-down transformers, which were of a highly inflammatory and combustible nature." That there was good reason for the objection appeared from the fact that there had been two fires upon the premises of the Corporation, the later one being of a very serious character. After the injunction had been obtained, an appeal was entered upon, which naturally led to a settlement, the terms of which are, upon the whole, fair for both parties. With the termination of this litigation, one of the many troubles that beset the path of the Deptford undertaking disappears. It is to be feared, however, that the Corporation have other and more serious obstacles in their course.

The City Gas Examinership.—At the meeting of the Court of Common Council last Thursday, the names of the two gentlemen—Professor Vivian B. Lewes and Dr. Rideal—selected by the Committee from the list of candidates for the appointment of Gas Examiner to the Corporation, were submitted to the Council, and Professor Lewes was elected.

Retort-Scurfing Blocks.—In the course of the second article on "Coal Gas: Its Manufacture, Distribution, and Consumption," which appeared in the *JOURNAL* for the 22nd ult. (p. 531), reference was made to a plan of scurfing retorts by the aid of fire-clay blocks cut a little smaller than the area of the retort. We learn that this system was introduced into the Shrewsbury Gas-Works by Mr. C. B. Newton, of Sheffield, who was formerly Assistant-Manager at those works.

Death of Mr. J. P. Kennedy.—Mr. John P. Kennedy, who died recently in New York City, at the age of 72, was a constructing engineer who had given much attention to the erection of gas-works. In 1861 he put up works for the Metropolitan Gaslight Company of New York, and others in Brooklyn and Detroit. In 1870 he built the works of the New York Mutual Gaslight Company, of which he was Managing Director until 1877, when he was elected President. At the time of his death he was a Director of the Hudson County Gaslight Company.

The Informal Meeting of Scottish Gas Managers.—This meeting will be held in the Victoria Hotel, West George Street, Glasgow, on the 14th inst. As our readers are aware, this is a kind of friendly gathering of members of the former West of Scotland Association; no papers being presented. Mr. James M'Gilchrist, of Dumbarton, is the Convener; and the President this year will be Mr. T. D. Hall, of Montrose, who will deliver an address which will open up discussion, and probably bring out views which may be generally serviceable to the gas industry. The meeting will close, as usual, with a dinner.

The Murdoch Centenary.—Reference has been already made in the *JOURNAL* to the steps which the North British Association of Gas Managers have taken to celebrate the centenary of William Murdoch, by placing a bust of him in the Wallace Monument at Stirling. At the request of the Memorial Committee of the Association, Mr. A. Murdoch, of Pollokshields, Glasgow, has prepared a sketch of the life and work of his namesake, written in a popular style, with the object of making his genius and achievements more generally known. The book will shortly be ready; and it will be issued at a figure which should ensure its wide circulation among all who are in any way concerned with the gas industry. It will have as a frontispiece a photogravure of Murdoch. Reference to the Murdoch Memorial enables us to correct an error which inadvertently crept into the first paragraph of our "Notes from Scotland" last week. It was on the application of Mr. James M'Gilchrist, of Dumbarton, the Secretary and Treasurer of the Murdoch Memorial Committee of the North British Association (not of Mr. Carlow, the Secretary of the Association), who has from the first taken a very warm interest in the movement, that permission was obtained for placing the bust in the Wallace Monument.

Walker's "Health" Water-Pipe.—Readers of the *JOURNAL* who are specially interested in the portions of its contents dealing with questions of water supply do not need reminding of the many cases of contamination which have occurred in consequence of water containing properties which make its conveyance through the ordinary lead service-pipes a source of danger to health and life. Attempts have been made to obviate this by special filtration, or by the use of wrought or galvanized iron pipes. These, however, do not exactly meet the requirements, as they are frequently affected by the water, which then deteriorates in value for certain manufacturing operations. With a tin-lined pipe, there is no danger of internal corrosion; and consequently water can be delivered absolutely pure to the consumers. Piping of this kind is now being produced by Messrs. E. Walker and Co., of Mirfield and Heckmondwike; and it is meeting with very favourable consideration in England and abroad. Judging by the sample we have examined, this piping is made of such strength as to stand any pressure without risk of leakage; while a burst would appear to be impossible. Pipes of this kind are made of any required length or diameter; and they are fixed together by tin-lined unions, without the use of lead or other solder.

COMMUNICATED ARTICLE.

COAL GAS: ITS MANUFACTURE, DISTRIBUTION, AND CONSUMPTION.

A Series of Articles for Gas Students.

(Continued from p. 532.)

One of the advantages mentioned in the preceding article as being attendant on the adoption of gaseous firing for retorts is the considerable saving of fuel effected thereby. In other words, a gaseous furnace will do the same work as an ordinary furnace, or even more, with (say) from 25 to 30 per cent. less fuel. This is largely due to the fact that the heat which attends the combustion or oxidation of carbon monoxide into carbon dioxide, and which is the heating agent employed in the former class of furnace, is much more intense than that which is derived from the ordinary combustion of coke, and utilized in heating the ordinary settings. In the latter class of furnace, if any carbonic oxide be produced, it is carried forward with other products of combustion, owing to the absence of any secondary air supply; and it may be seen burning with its characteristic pale blue flame at the top of the chimney stack. The heat thus emitted is wholly lost, instead of being conserved and utilized as by the new system.

The construction of generator furnaces has, in the light of recent experiences of practical work, been much simplified of late; and in many works the furnaces are being put up at a cost which, considering the economy and general advantages to be derived from their adoption, will compare most favourably with that of the older form of furnace. It has been authoritatively stated that, where this system is in use, the retorts constructed of fire bricks and tiles do not answer so well as the ordinary moulded retorts, as they are more liable to become deformed by the intense heat acting upon them. To this statement, however, the writer must take exception; holding, as he does, quite the contrary opinion. Nor can it be supported by many managers who are now using well-designed ovens of brick retorts heated by gaseous fuel. The retorts are found to stand the heat well; and the heavy expense that is entailed in the renewal of a setting as compared with the new form of furnace, renders the advantages already claimed for brick retorts (see *ante*, p. 531) even more applicable to settings heated by generator furnaces.

To meet the ever-increasing demand for the minimization of labour in the retort-house, the various applications of machinery, and sundry modern constructive improvements, gas managers are putting in larger retorts than heretofore. We may now consider 16 inches diameter for the circular retort (where it is not displaced by the much more popular \square section), and 21 in. by 15 in. for the latter, as the most economical sizes. Mr. West, however, prefers \square retorts 22 in. by 16 in. where his stoking machinery is to be worked.

Before leaving this subject, the reader should study the remarks of Mr. A. Dougall on the generator furnaces in use at Tunbridge Wells, as given in his Inaugural Address to the Southern District Association of Gas Engineers and Managers at their recent annual meeting (*ante*, p. 484).

CHARGING RETORTS.—FITTINGS AND CONNECTIONS.

In the majority of gas-works, the charging and drawing of the retorts are done by hand; the former operation being performed by means of the shovel or scoop, the latter with the stoker's rake. The scoop, which is usually worked by three men, deposits half of the charge on one side of the retort first, is then withdrawn, and returned with the second half; the whole being evenly placed over the full length of the retort.

Considerable importance must be attached to the manner in which the charge of coal is laid in the retort, whether by the shovel or the scoop. If the coal be irregularly placed—thin in some parts of the retorts, thick and heavy in others—the rich gases will be driven off from the light portion before the proper time, and gases of low illuminating power that should have been left in the coke will be evolved, to the detriment of the quality of the general bulk of gas. On the other hand, the heavily-laid portion of the charge is not properly spent in the period allowed for distillation; quantities of the illuminating gases remaining in the coke. Moreover, the continued presence of the “uncooked” mass tends to considerably reduce the heat of the retort. Thus much trouble may ensue, both as regards the quality and quantity of the gas obtained, by unskilful or careless charging.

Mechanical Stoking.

Drawing and charging operations should always be carried on as expeditiously as possible. For many years past attempts have been made to economically and satisfactorily substitute machinery—in great part—for hand labour in the retort-house, and many systems of mechanical stoking have been devised and put into practical work with more or less success. The mechanical stokers introduced by Mr. West and Mr. Foulis are those which are best known and most used in England. Mention should also be made of the ingenious invention of Captain Ross, of Cincinnati (U.S.A.).

The system devised by Mr. West commences in the coal-stores adjoining the retort-house. There the coal is reduced by a mechanical breaker to the size best fitted for charging. It is raised by an endless chain of buckets (similar in appearance to the grain-raisers used on board ship in the Baltic grain trade) to a fixed hopper placed at a suitable altitude, immediately above

the front of the retort-bench. The charging apparatus consists primarily of a rectangular frame mounted on wheels, which run on tram-rails laid the full length of the retort-house floor. It is readily propelled by a hand wheel or by power to any desired position—either immediately underneath the fixed hopper first referred to, or in front of any of the retorts. At the top of the frame is a smaller hopper, which, when the apparatus is in the right position, can readily be filled with coal from the large stationary one. The discharge at the bottom of this hopper is provided with a spiked spindle, which ensures an even delivery of the coal to the scoops below. Beneath the hopper is a sliding scoop-carrier, which may be raised or lowered at will—a condition of course necessary to meet the several levels of the retorts. The carrier contains twin scoops, and is constructed to run on wheels into the retorts. When there, the scoops are turned over by means of a handle or wheel affixed on the carrier. The whole is then withdrawn, and the retorts are closed. The operation of turning the scoops is similar to that with the hand-worked scoops, except that here, there being two, they are by a train of wheels simultaneously turned over, and the charge is placed by *one* operation instead of by two. The arrangement is an ingenious and a pretty one. The drawing apparatus consists of a kind of light crane, also travelling on wheels on the before-mentioned tram-rails. This carries a rake of somewhat similar pattern to the ordinary hand rake, and supported by a chain and winch fixed to the crane. The rake can be raised, lowered, driven into the retort, and withdrawn by power or by hand as desired.

Power for carrying on the whole of the various operations just described—*i.e.*, preparing and raising the coal, delivering it into the scoops ready for charging, propelling the charging and drawing frames, and manipulating as desired the scoops and rakes—can now, by Mr. West's system, be applied either in part or to all the work. It can be communicated either by a wire rope or other means from a central motor, or by compressed air. The whole of the work done by the West system is simplified to an extent that the early inventors of mechanical stoking would certainly have considered impossible of attainment.

The Foulis system is characterized by the application of hydraulic power to the work of charging and drawing retorts. The power is obtained from an accumulator erected in any convenient position of the works, and fed by pumping-engines of the needful horse power. The accumulator consists essentially of a strongly-built cylinder, in which works a piston, having at its upper end a vessel or other medium for carrying a load that shall give to the piston the pressure required. Through a pipe of small diameter, the cylinder is supplied with water by a pumping-engine. From the cylinder the water is conveyed at the desired pressure to the various positions on the works as needed. The following particulars of his system have been kindly supplied by Mr. Foulis; and they apply to the charging apparatus as well as to the drawing arrangement.

The drawing appliance consists of a steel bar of **I** section, suspended near its centre to a framework of **L** iron. On this bar there slides a carriage, which is moved backwards and forwards by two hydraulic cylinders. The rake-rod is attached to this carriage. The bar, together with its hydraulic cylinders, rake-rod, levers, &c., is raised and lowered, to suit the various heights of the retorts, by means of a hydraulic cylinder fixed to the framework. A rope or chain attached to the suspending rope or chain passes upwards and downwards over the pulleys, the end being fixed to a frame. This frame is connected to the rake-bar by a short crank; and to the same shaft that carries the crank is attached a crank which actuates the valve for moving the rake backwards and forwards, and also the handle for traversing the machine. The effect of this arrangement is, first to maintain the rake-bar at the same horizontal level in all positions; and, secondly, to enable the movement for opening the valve, so as to send the rake into the retort, to depress the back end of the **I**-bar, and so elevate the rake that it passes over the coke—the reverse movement depressing the rake, and withdrawing it from the retort. On the top of the framework is fixed a joint so constructed that the flexible supply-pipes may be speedily connected thereto without either screw or bolts. From this joint $\frac{1}{2}$ -inch pipes are led to the hydraulic cylinders; the connections being made by means of a flexible tube, to admit of the rake being raised or lowered. The whole apparatus is controlled from a platform fixed to the back of the machine. The exhaust-pipe is perforated at the front end, in order to discharge some of the water on the rake-rod, and so tend to keep it cool. At the front end of the **I**-bar is attached a plate, to prevent the coke from being scattered over the floor. Where the bottom retorts are so low that there is not room for this plate, when drawing these retorts it is raised automatically by means of levers and rods actuated by a pulley moving between the **L** iron bars fixed to the machine. The latter is moved from one retort to another by hand, by means of bevel-wheels and pinions. The quantity of water used is small; the cylinder only being some $1\frac{1}{2}$ inches in diameter. The time occupied in drawing a retort is only 35 seconds. At Glasgow the retorts are set in beds of eight; and the time occupied in drawing the whole bed, including all movements of raising and lowering the rake-bar and moving the machine from one retort to another, is not more than from six to eight minutes.

Within the past year or two the application of the force of gravitation to the operations of charging and drawing retorts has

received a great impetus owing to the improvements which have been introduced in the setting of inclined retorts by M. Coze. We say "improvements introduced," because the idea of placing retorts at an inclination is not a new one; but it remained for M. Coze to successfully apply the principle to every-day practical use. His system, which is now worked in combination with further improvements under patents of Messrs. Morris and Van Vestrant, has evidently found much favour among some of the leading English gas engineers. It consists essentially of setting the retorts at an angle of 30 degrees, which is found to be the one at which the automatic charging by gravitation can be best obtained. The retorts, set in ovens built back to back, are fed from a central hopper fixed at the top of the bench; and the coal is expeditiously and evenly laid immediately the communication therefrom with the retort is opened. At the lower end of the retort is fixed a screen, against which rests the foremost portion of the charge just run down. The passage of the charge being thus arrested, the coal itself acts as a stop to that above it; and thus the whole charge is quietly brought to rest without a single lump being displaced. At the end of the period of distillation, the lower door is opened, the screen removed, the lower portion of the stratum of coke gently eased off the face of the retort with a chiselled bar, and the spent charge allowed to quietly fall down—the retort being then ready for a fresh charge.

The respective merits of these three systems for dispensing with hand labour cannot be dealt with here. The advantages claimed for all are, however: (1) A higher yield of gas per ton and per mouthpiece; (2) reduction of wear and tear of carbonizing plant; (3) reduction of cost of labour (allowing for wear and tear of machinery); (4) less dependence on hand labour.

Mouthpieces.

The ordinary retort door is a wrought-iron plate, cut to the shape of the retort, and provided with lugs by which to support it on the mouthpiece. The cement or "luting" by which to make the joint tight is put on the door with a trowel, and consists usually of about one part of lime (spent lime from the purifiers will answer very well) and two parts of sand or clay. The door is placed in position, and tightened up by means of a cross-bar and screw fastener. It is an advantage to have the cross-bar hinged on to the mouthpiece, to obviate removing and re-fixing it when a retort is charged and the door put on.

Several good self-sealing retort-lids are in use. Amongst these are Morton's lid with Holman's eccentric fastener, Grice's, Tassie's, Somerville's, and Ruscoe's. Morton's lid, cast to the shape of the mouthpiece, is faced and planed, as is also the latter where the two surfaces will be brought into contact. It is not removable from the retort, but swivels round on opening. It is secured by a catch on the side opposite the swivel hinge, and is tightened up by an eccentric fastening introduced by Mr. Holman. In Grice's lid, the device for self-sealing consists of a groove east round the edges of the mouthpiece, and a corresponding projection round the lid; both groove and projection being turned in a lathe. Tassie's arrangement is rendered gas tight by a steel ring of circular section, turned true in a lathe, and let into the face of the mouthpiece, against which the lid, which is also faced, is fastened. Both Grice's and Tassie's lids are secured by a screw and cross-bar; and in order to ensure a tight joint, they are made to revolve with the screw. The inventions are thus adapted to circular mouthpieces only.

The mouthpiece is usually secured to the retort by bolts and nuts; the bolts being inserted in the head of the retort prior to the latter being built in. A good cement for ensuring an effective joint with the retort is one-third of iron cement (with excess of sal ammoniac) and two-thirds of fire-clay, well kneaded together to the consistency of dough. (King's "Treatise on Coal Gas.") The bolt-and-nut system of securing mouthpieces is open to serious objection. In the first place, there is the liability of some of the bolts to burn off, thus bringing down the mouthpiece altogether, or throwing an undue and uneven strain on the retort. Secondly, there is the liability of the retorts to give way under the stress of the weight of the mouthpiece and ascension-pipe, unless excessive support be provided to meet this contingency. This difficulty is increased by the introduction of the self-sealing retort-lids and mouthpieces, which, being of a more permanent nature than the older pattern, are also very much heavier. A very good plan, and quite free from any of the objections named, is to brace up the mouthpiece by cross-girders, which are themselves bolted to, and kept in position by, the buckstays, holding together the bench.

Illustrations of mouthpieces, and the auxiliary appliances of the retort-bench, will be found in King's "Treatise on Coal Gas," Vol. I., and in Newbigging's "Handbook" (fifth edition).

Temperature of Coal under Distillation.

Although the coal is distilled at a temperature ranging from 1800° to 1900° Fahr., the gas does not issue from it at this temperature; on the contrary, it is seldom hotter than about 130° Fahr. (Clegg). This is due to the fact that, when solid bodies are converted into the gaseous form, very great absorption of heat occurs. Take, for instance, the conversion of liquid carbonic acid or ammonia into the normal gases. The atmosphere around is so robbed of its heat as to bring the temperature to below zero. The heat of the retorts has thus been absorbed in resolving the solid coal into its gaseous constituents; and these pass off at about the temperature named.

(To be continued.)

TECHNICAL RECORD.

NEW ENGLAND ASSOCIATION OF GAS MANAGERS.

The Annual Meeting at Boston.

(Continued from p. 577.)

At the close of the proceedings following the presentation of the Committee's report on the subject of the representation of the gas industry at the Chicago Exhibition,

Dr. R. Amory (Brookline) gave a description of the new gas and electric light plant recently erected by the Brookline Gas-light Company, which comprises entirely new works built upon marshy ground on the bank of Charles River. The soil consists of mud to an average depth of 30 feet, resting on a quicksand, so that it was necessary to support the whole on piles. The first thing was to erect a retaining-wall along the line of the bank of the river. Piles were driven, connected with cross beams, which support a plank cribbing, on which a stone wall was erected. Outside this wall is a wharf supported on oak piles, fitted with a crane for hoisting coal from vessels alongside, and an automatic railway leading to the coal and lime stores. Piles were next driven for the buildings, tanks, &c.; their tops connected with cross beams and stringers, on which the plank cribbing to receive the stone foundations was placed. The level of the cribbing was so fixed as to allow all the woodwork to be immersed in water for an hour and a half at each tide, and free ingress and egress of the tide water was allowed in all parts. A cellar floor was arranged in all the buildings, at a height of 6 feet above high-water mark, and the working floors were laid at a level of about 17 feet. The intermediate space was utilized for carrying all the gas-pipes and connections. A sufficient number of connecting bridges between the buildings, and also stairways, were erected, to allow of ready and quick access to all parts of the works. Hydraulic elevators were erected for lifting the coal, lime, &c., to the working floors. The coal is raised direct from the lighter into a hopper at the top of a tower, from which it is allowed to fall by gravity into automatic cars, which discharge it into the coal-shed, after passing over a platform weighing-machine. At the lowest part of the coal-shed is a small scale-house, where the coal as required for use can be delivered into hand cars. In these it is transferred, by means of lines of rails and the elevators, direct to the mouths of the retorts. The retort-house is 90 ft. by 63 ft. 6 in., and contains at present six double beds of six retorts in each, or 72 retorts in all, set on half-depth Flemming regenerator furnaces. The working floor forms the stage, and the lower one the coke-cellar; and there is plenty of room for whole-depth regenerators, if it should be found desirable to use them at any future time. There is also a space left sufficient for four more beds, or for a water-gas plant. The coke can be drawn direct into the furnace from the retorts; and the remainder is carried into the boiler-house by means of an endless chain of buckets. A large building, about 120 ft. by 60 ft., contains the whole of the condensing and purifying plant, with annexes forming the meter and governor houses. The plant at present in use at the old station is to be utilized at the new one. From the retort-house the gas is conveyed to the exhausters, then through two condensers, a Walker tar extractor and carbonic acid purifying apparatus, and a "Standard" washer-scrubber, to the purifiers. When complete, there will be eight purifiers, each 18 ft. by 20 ft. In addition to the storage space for lime, there is a revivifying floor for oxide. The gasholder connections are arranged with bye-passes, admitting of the whole being shut off, or of either inlet or outlet being laid off for cleaning; the other pipe answering both purposes meanwhile. Only one gasholder has been erected; but there is room for two more. Bases have also been left for additional condensers, scrubber, exhauster, and meter. At the present rate of increase, this will provide for the requirements of the next 20 years. The gasholder-tank is constructed of wrought iron. It is supported upon 858 piles, cut off below mean low-water mark, cross timbered, and covered with a double plank floor. On this is a bed of concrete 10 inches thick, upon which was laid an outer ring of concrete 6 feet wide, and on that the iron tank was erected. The centre part was filled up with fine gravel and sand; and after the holder was put in, fine Portland cement was forced into this space by pressure, so as to form a uniform bed of concrete for the support of the tank and holder. The tank is 88 feet in diameter and 22 ft. 3 in. high; and the holder has two lifts. Some difficulty was experienced with the tar and liquor tank, on account of the sea water. Altogether, 165 piles were driven, cut off 4 feet above mean low-water level, cross timbered, and a floor of 3 in. by 10 in. spruce planking laid, as was done for the other buildings. A concrete bed 9 inches thick was put down, and three courses of brickwork in Portland cement, with a cement rendering on the top. A circular brick wall 45 ft. 4 in. in diameter, 7 feet deep, and 2 feet thick, was built on this, also an inner wall 20 feet in diameter and 16 inches thick; the two rings being connected by four radial cross walls. The whole forms one inner tank for tar of 13,000 gallons capacity, and two semi-annular outer tanks, each of 17,000 gallons capacity, for liquor. It was at first attempted to use a cement rendering on the concrete bed; but the tide broke through, and therefore the three courses of brick were added. The electric light plant is contained in a large one-

storey building, 95 ft. by 107 ft., and includes a boiler-room with accommodation for eight nominal 125-horse power boilers. In the engine-room there is space for one 100, one 150, and two 500 horse power engines. The main driving-shaft, to which either or all of the engines can be coupled as required, is supported from an independent foundation. Provision is made for eight 50-light arc dynamos and three 1000-light incandescent dynamos; but this can be extended, if needed, to take two more machines of each kind. Every possible modern improvement has been introduced throughout. The roof is of iron, covered with slate; and to prevent the accumulation of moisture on the iron trusses, &c., they were painted with ground cork and lead paint, laid on to a thickness of $\frac{3}{8}$ inch. The ground cork forms a rough surface, something like sand paper, on which water will not condense.

After some questions and conversation on Dr. Amory's paper, the Association proceeded to consider a communication from the Society of Gas Lighting, consisting of a proposition for uniformity in castings. It was read by Mr. Slater. A Committee had been appointed by the Society to devise standard sizes for flanges, sockets, and other connecting parts of gas-pipes, to be used throughout the country, with a view of obviating the inconvenience caused by each maker using special sizes; and the communication, which was illustrated with drawings, set forth the results of their labours. Mr. Harbison proposed that a small Committee should be appointed by the Association, to co-operate with other Associations in getting the recommendations adopted throughout the country. In doing so, he alluded to the advantages which had followed upon the adoption of a similar course in respect to meter couplings a few years since. The proposition was agreed to; and a Committee was appointed to confer with other Associations, and report at the next meeting.

Mr. H. H. Kelly (Waltham, Mass.) read a paper entitled "Wrinkles." The first of these referred to the use of oil as an enricher. A piece of 3-inch wrought-iron pipe, 4 feet long, was filled with broken coke, and two quarts of oil poured into it. One of these cartridges was put into each of two retorts of a bed of six, one hour before drawing. This was found to give time for the gasification of the oil, without exposing the pipe to unnecessary burning. The second "wrinkle" was the use of the best lard oil for the exhauster, which would prevent the formation of pitch. The third recommended the test-cock being fitted on the outlet-pipe rather than on the lid of a purifier; and the fourth, the use of a steel brush $2\frac{1}{2}$ in. by 8 in., as used in foundries for cleaning purifier grids and castings. The fifth "wrinkle" described the use of lime for thawing frozen ground over a gas-main; two bushels of good lime being spread over the place, well wetted and covered with straw and sacking. In a few hours the thaw would penetrate a depth of 18 inches or more. The last "wrinkle" related to soldering meter connections and repairing broken mains. Some discussion followed on the method of thawing frozen ground. Mr. Harbison preferred a fire-basket containing burning coke, as cheaper and quicker in action. Mr. Lamson and Mr. A. C. Humphreys preferred the lime; considering it quite as efficient as coke, while avoiding danger of fire or explosion. Other speakers testified to the superiority of lime for the purpose; and Mr. W. A. Learned described a plan of utilizing steam. He said a small portable boiler was brought up to the spot, some holes drilled into the ground, and steam introduced into them.

The contents of the "question-box" were next considered. The first question asked whether, in the event of a mile of 6-inch main having to be put down, cast or wrought pipe would be used. Mr. F. Egner said it depended on the soil. In a good clay soil, he would lay wrought-iron pipe with screw joints, but in a mixed soil, cast pipes with cement joints, and one lead joint at about every six lengths. He would not trust wrought pipe if ashes were abundant. The wrought pipes could be laid absolutely gas-tight. The services were connected by a band round the main. Mr. A. C. Humphreys said he was not a great believer in wrought pipe, and thought that, by careful working, the leakage from cast pipe could be brought very low. Mr. Harbison said that the duration must be considered. In mixed soil he found that wrought pipes would not last more than 25 years. Mr. Lamson said that wrought-iron pipes might do for outlying districts, but the soil in cities was quite unsuited to them. In reply to an inquiry as to the average yield of tar per ton of coal, 14, 15, 16, 17, and 18 gallons were respectively given by various speakers, as figures based upon a year or more of practical working. Discussing a question about coke, Mr. Egner said that Youghiogheny coal yielded 38 bushels of coke to the ton, and a bushel of the dry coke would weigh 35 to 36 lbs. Some coals yielded as much as 45 bushels, and others as little as 32 bushels per ton. The President said he had made 42 bushels of coke, weighing 38 lbs. to the bushel, per ton of coal carbonized.

A paper entitled "A Gas-Works as a Heat-Engine" was read by Mr. W. E. McKay, of Boston. It was based upon observations taken at the Calf Pasture station of the Bay State Gas Company, where carburetted water gas is manufactured by the Flannery process. Attention having been directed to the effect of temperature on the bulk of gas as stored in the holder, the author stated that during September and October last year, 175 million cubic feet of gas were manufactured. The quantity of carbon used in the generator, as shown by the coal introduced

minus ashes withdrawn, averaged 23.9 lbs. per 1000 cubic feet of gas made. There were 4.8 gallons of naphtha, having a composition of 84 parts of carbon and 16 parts of hydrogen by weight, used for each 1000 cubic feet; and this represented 23.5 lbs. of carbon and 4.5 lbs. of hydrogen. The total carbon used was therefore 47.4 lbs. per 1000 cubic feet of gas made. The gas was 26 $\frac{1}{4}$ -candle power, and the analysis of it gave the following figures:—

	By Volume.	By Weight.
Carbonic acid	3.2	7.2
Illuminants	14.8	33.3
Carbonic oxide	25.8	36.9
Methane	17.2	14.1
Hydrogen	35.6	3.6
Nitrogen	3.4	4.9
	100.0	100.0

This represents 30 lbs. of carbon, 13.6 lbs. of oxygen, 5.7 lbs. of hydrogen, and 2.5 lbs. of nitrogen in each 1000 cubic feet. According to experiments extended over December and January last, the yield of tar was 0.72 lb. per 1000 cubic feet, which may be taken as 0.6 lb. of carbon and 0.1 lb. of hydrogen. The quantity of steam absorbed is deduced from the oxygen found to be in the gas; 13.6 lbs. of oxygen would represent 15.3 lbs. of steam, and leave 1.7 lbs. of hydrogen to be added to that supplied from the oil. Comparing the weights of carbon and hydrogen supplied with those obtained in the gas tar, there is a deficit of 16.83 lbs. of carbon and 0.41 lb. hydrogen, which represents that burned by the blast in heating up. The carbonic oxide and carbonic acid in the gas contain 9.2 lbs of carbon, which is assumed to come from the coal; and this would leave 14.7 lbs. of carbon to be consumed in the blast. The difference —2.13 lbs.—and the hydrogen, is furnished by the oil; and from this it was calculated that 9.2 per cent. of the oil supplied was used by the blast. Analyses of the blast gases showed a composition of 25.4 parts of carbonic acid, 2.5 parts of carbonic oxide, and 72.1 parts of nitrogen by weight, from which it was shown that all the hydrogen was accounted for, but only 8 lbs. of carbon. The deficit of carbon is deposited in the superheater. The structure of this vessel was considered at length, in regard to the arranging of the brick packing so as to furnish the greatest possible extent of surface for the hot gases from the generator to play upon, and thus retain as much heat as possible. At first using, no secondary supply of air is necessary beyond that in the blast; but afterwards it is desirable to allow a small excess, to burn the carbon off the surface of the bricks. The practical question of the frequency of renewal depended upon the cost of the bricks, as compared with the extent of depreciation they had undergone. At the Calf Pasture works, more than 150 million cubic feet of gas had been passed through a packing of 2600 bricks. The quantity of steam actually supplied to the generator was 31.5 lbs. per 1000 cubic feet of gas, or 16.2 lbs. in excess of that actually used. The temperature of the gas at the superheater outlet was 1616°; at the hydraulic outlet, 192°; at the scrubber inlet, 182°; and after passing the scrubbers, condensers, and a second set of scrubbers, 94°. Reasons were next given for supposing that at the outlet of the superheater there would be 5310 cubic feet of gas, vapour of water, and tar, &c., and 2350 cubic feet at the hydraulic outlet, for every 1000 cubic feet of gas in the holder. By means of full and elaborate calculations, it was shown that the heat lost in cooling and condensation was 56,780 units, of which 45,000 were represented by the water heated in the condensing apparatus; leaving 11,780 units removed by air. There is a copious appendix to the paper, consisting of tables illustrating the various data referred to.

In the course of the discussion, Mr. A. C. Humphreys alluded at length to the importance of properly packing the superheater, so as to get as much baffling of the current as possible; and he also said that the carbon deposit might be reduced or burnt off by leaving the apparatus under natural draught during idle hours. Speaking of water-gas tar, he claimed that if it was properly separated from the water it was more valuable than coal-gas tar. It was found that this was greatly facilitated when water-gas and coal-gas tar were mixed in the same well. Mr. Harbison said he could easily dispose of water-gas tar, and found it very efficient for use as asphalt, or as a paint.

Mr. McKay replied at some length; first explaining the difference in the arrangement for packing the superheater, as at present done, and that in the original apparatus. The latter was of a very open character, and was devised at a time when large deposits of carbon had to be dealt with. His tar was of nearly the same specific gravity as water; and when the latter would not separate, the mixture was run into a large tank, holding 16,000 gallons, and heated by a powerful steam coil at the bottom, to nearly the same temperature as the steam. After long heating and thorough cooling, the tar separated out, and there was also a layer of light oil on the surface of the water. The vapours given off during heating could be admitted into the scrubber if desired. The practical advantages of the natural draught for clearing the superheater were very marked; but some care was necessary in adjusting it. The carbon deposit he referred to was not on the surface, but in the substance of the brick itself. The oil he used was a light naphtha (sp. gr. 70 Baumé). He did not state the actual quantity of coal used, because nearly sufficient boiler fuel for the whole of his requirements was obtained from the screenings of the ashes.

(To be continued.)

REGISTER OF PATENTS.

Roasting Shelves for Gas-Ovens.—Carr, M. A. St. J., of Old Bond Street, London. No. 18,206; Oct. 23, 1891.

This "invention" consists in making the bars of the grating which supports the meat in a gas-oven while being roasted curve downward at their centres, so that the dripping always runs down to the centre of the bars, where it drops into a dripping-pan placed beneath.

Manufacture of Gas from Hydrocarbon Oils.—Lake, H. H.; communicated from C. H. Wilder, of Boston, U.S.A. No. 18,498; Oct. 27, 1891.

This invention relates to the manufacture of gas for illuminating and heating purposes, by vaporizing oil in a retort, and mixing it with heated atmospheric air in an air and vapour mixing retort. The object of the invention is: (1) To provide a novel method or process of feeding oil, or any hydrocarbon liquid, to the vaporizing retort, whereby sediment and other foreign matter contained in the oil is precipitated or deposited prior to the entrance of the oil into the vaporizing retort. (2) To provide a novel method of cleaning or purifying the oil, and subsequently feeding it uniformly to the vaporizing retort, whereby Lima oil can be practically utilized in the manufacture of gas for illuminating and heating purposes, without the residuum in the retorts of offensive odours from the oil-vapour, while obtaining a larger proportion of gas from a given quantity of oil. (3) To provide novel means for feeding the oil to the vaporizing retort, through the medium of hydrostatic pressure on a body of heated water, whereby the oil is not only fed uniformly to the retort, but sediment and other foreign matter is deposited before the oil enters it. (4) To provide a novel apparatus for manufacturing gas by commingling vaporized oil with air.

Self-Closing Gas-Valve and Regulator.—Spratt, C., of New Cross. No. 261; Jan. 6, 1891.

This automatically closing gas-valve consists essentially of a cap dropping over the gas-inlet when the supply is withdrawn, and re-admitting the gas only when acted upon by an exterior pin, lever, or other agent. The means for regulating the amount of gas supplied to the burner, either above or below the self-closing cap, consist of an indented cover fitted on to a similarly indented casing in combination with a ring closing the apertures formed by these indents.

Effecting the Complete Mixture of Inflammable Gas or Vapour with Air.—Vickers, W. E., of Surbiton, and Everett, G. A., of Lincoln's Inn Fields, London. No. 965; Jan. 18, 1892.

This invention relates to apparatus in which ordinary coal gas, or other inflammable gas or vapour, is mixed in such proportions with air that the mixture is permanent and can be used for heating, lighting, and other purposes.

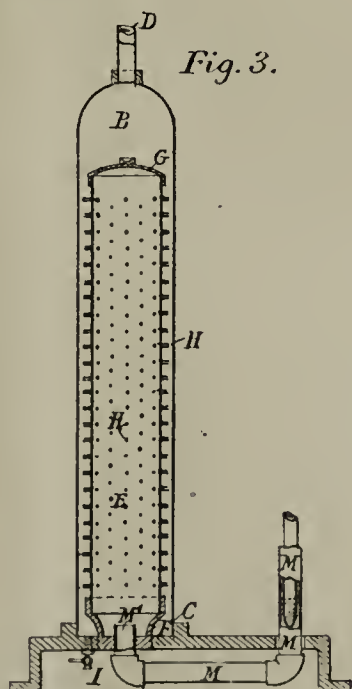
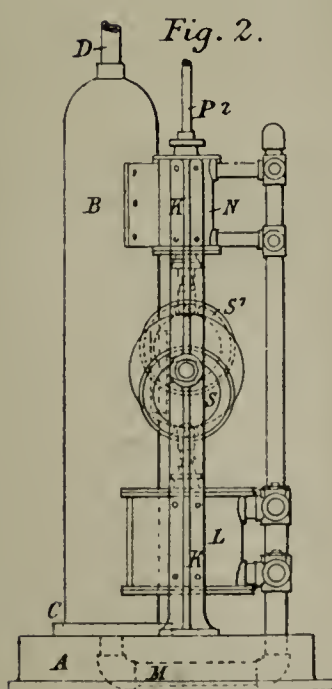
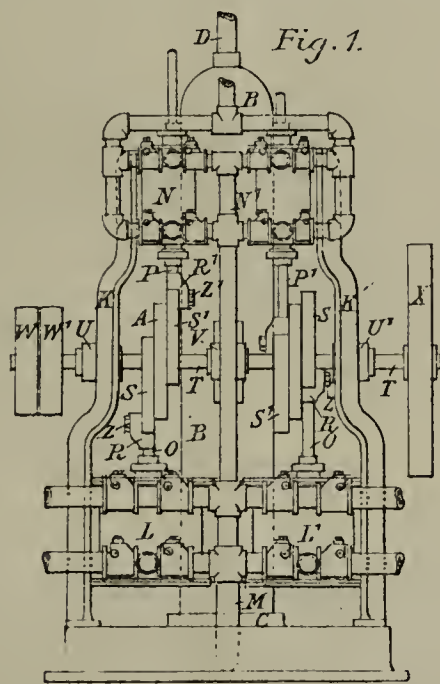


Fig. 1 is a front view of the entire apparatus; fig. 2 is a side view; fig. 3 is a vertical section through the mixing chamber or vessels.

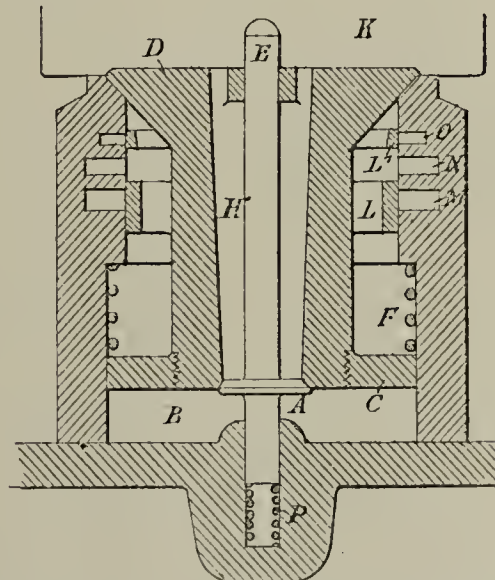
On the base-plate of the apparatus is a tubular chamber B, referably

of wrought iron or steel, the lower end of which is fixed upon the base-plate at C. D is a discharge-pipe from the upper end of the chamber B, through which the inflammable mixture is conveyed away to be utilized as may be desired. E is a similar internal chamber or tube of less diameter than, but concentric with B, and carried by a support G, fixed to the base, and having its upper end closed by the cover G. Round the outer circumference of the inner chamber E, are a large number of radial jets H, the outer ends of which approach nearly to the inner side of the outer chamber. These jets are made hollow; their outer closed ends being perforated with small holes directed towards one another, so that the issuing mixture of gas or vapour and air are more thoroughly mixed as they escape. Frames K of cast iron or other suitable material are fixed upon the base, and carry near their lower ends cylinders L L', containing pistons by which air is forced into the pipe M, and near their upper ends cylinders N (preferably of smaller size), by which gas or inflammable vapour is also forced into the same pipe. The four cylinders L L', and N N', are also attached to the outer chamber B. The piston-rods O O' pass upward through stuffing-boxes in covers of cylinders L L'; and the piston-rods P P', similarly pass downward through stuffing-boxes in the bottoms of the cylinders N N'. The outer ends of these four piston-rods are provided with brackets R R', fitting against the edges and sides of the four eccentrics S S', fitted upon the driving-shaft T, which revolves in bearings U U', in the frames K, and in a central bearing V, carried by the chamber B. The shaft is driven by fast or loose pulleys W W', or other ordinary devices. The cylinders L L' are provided with suction-valves and delivery-valves, and also passages by which air is drawn in through a suction-pipe, and delivered into the pipe M; and the cylinders N N' are similarly provided with suction-valves and delivery-valves, by which the gas or inflammable vapour is drawn in through a suction-pipe, and delivered into the gas-delivery pipe. This gas-delivery pipe is of smaller diameter than the pipe M, and passes centrally into the latter through an air-tight junction, and the lower end of the pipe is perforated with a number of small holes (fig. 3), through which the gas is discharged into and mixed with the air delivered into the pipe M from the cylinders L L', as already described. The mixture is discharged from the pipe M, into the lower end of the inner chamber E, through the opening M' (fig. 3), which may also be provided with a number of perforations, or with wire gauze, instead of having a single opening.

The operation of the apparatus is as follows: The shaft T being set in revolution, the eccentrics S S', which have previously been adjusted to the required eccentricity, also revolve; and the pistons in the four cylinders are made to reciprocate with strokes dependent upon the eccentricity of the eccentrics. Air is accordingly forced into the pipe M, and simultaneously gas or inflammable vapour is forced through the perforations in the gas-delivery pipe into the pipe M. The gas and air become mixed in the pipe, and are then delivered through M', into the lower end of the inner chamber E; and the mixture is then forced out through the jets H, becoming further mixed, and striking the inner sides of the chamber B, the mixture (which is then permanent) finally passing out through the delivery-pipe D, and being led away for consumption.

Gas-Engine Valves.—Southall, J., of Worcester. No. 1203; Jan. 21, 1892.

This invention relates to valves for the supply of a suitable mixture of air and inflammable gas or vapour, to the cylinder of a gas-engine, and for the discharge of the products of combustion therefrom.



A central section is shown of a valve arrangement suited for both supply and discharge. K is part of the combustion space of the cylinder, into which opens the valve D. This valve has attached to it at C a collar forming a piston; and at L L', rings forming a slide-valve governing three annular ports—M, the exhaust-port, communicating with a discharge-pipe; N, the air-supply port, communicating with the open air; and O, the port for the supply of gas or oil vapour. The valve D, when seated as shown, and subjected to the presence of a helical spring F, has beyond it a space B from which a passage H extends through the body of the valve. This passage is closed by a check-valve A, the stem E of which extends beyond the valve D into the cylinder space K.

The operation is as follows: When the working piston of the engine is making its outstroke for charging, the valve D lifts enough to allow a passage of air and gas or vapour from the ports N and O, but not enough to uncover the exhaust-port M. When the piston makes its instroke, compressing the charge, the valve D is closed; the valve A being also kept closed by a spring P. The charge being then ignited, the pressure produced in the cylinder causes the valve A to open, and charge the space B with high-pressure fluid. As the piston approaches the end of its outstroke, the pressure in the cylinder is so far reduced that the pressure of the fluid in the space B overcomes the force of the spring F, opens the valve D, and allows the contents of the cylinder to

be discharged by the exhaust-port M; the ports N and O being then covered by L. As the piston approaches the end of its instroke, it (or a part projecting from it meeting the end of the stem E) opens the valve A, and allows the escape of the fluid from the space B; thus permitting the spring F to close the valve D. The space B may communicate with the exhaust-pipe by a passage provided with a valve, which is opened by the governor when the speed of the engine is excessive; thus reducing the pressure in B, and so preventing the valve D from being opened for exhaust until the speed is moderated. The spring P may be so adjusted that the valve A is opened by the pressure of the compressed charge in the cylinder; the space B thus becoming charged with combustible mixture. This being ignited, communicates ignition to the cylinder charge; the valve A being at that time held open by the piston bearing on its stem E.

Shadowless Gas-Lamps.—Hudders, T., of Shaw, Lancs. No. 4508; March 13, 1891.

This invention (designed to prevent the casting of shadows) consists in supporting the top cover or reflector portion of the lamp by small metal bars from the base. These wire supports are secured to the base ring, and extend, at the same time diverging outwards to a convenient height, where they are secured to the top ring, which receives the reflector proper. The inverted cone thus formed by the wire supports, is filled in on the outer diameter by glass segments, so cut and divided as to fit evenly side by side, but not tight, so as to allow for expansion of the glass. The glass segments are held in place as usual by tabs, at the top and bottom. An opening is provided for a ventilator or air cowl.

Treating the Discharge Gases from Gas-Engine Cylinders.—Key, W., of Glasgow. No. 6949; April 22, 1891.

This invention refers to a method of rendering innocuous and inodorous and silencing the explosive discharge and exhaust gases from gas-engine cylinders, by passing them through calcium hydrate or equivalent porous earths or chemical agents within a box or vessel.

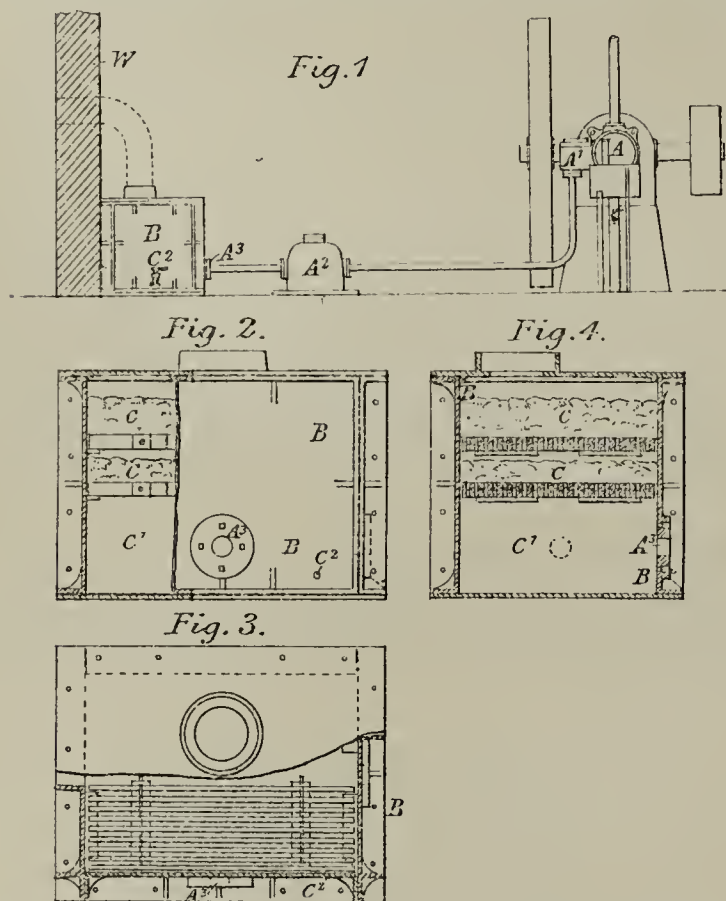


Fig. 1 is an elevation of one arrangement of the complete appliances by which these improvements may be carried into practice; fig. 2 is a side view of one construction of the exhaust purifying vessel; fig. 3 is a plan view corresponding to fig. 2; and fig. 4 is a transverse section at right angles to fig. 2.

The improvements consist in leading the discharged gases from the exhaust-port A¹ of the cylinder A of a gas-engine, preferably first through one or more of the usual metallic exhaust-boxes or hollow chambers A², and then taking them by another pipe A³ to, and passing them through, a purifying and noise-silencing box or vessel B, or it may be a tank or chamber. This vessel B is preferably constructed of square or rectangular shape of cast iron or other metal as shown, or of stone, brickwork, cement, or wood; and for a nominal 4-horse power gas-engine might be 2½ feet long by 2 feet broad, and 2 feet high, and be fitted with a portable or removable lid or cover on top, preferably of cast iron, stone, or wood. Horizontal perforated grids or sieves are fitted at distances apart across the chamber B, preferably made of spars of wood, set on edge and resting on projecting flanges or bricks from the inner walls of the vessel, and connected together by transverse bolts and separating collars. The sieves would have filled over them layers C of calcium hydrate of a moist consistency, or equivalent porous earths or chemical agents, to absorb carbonic acid, sulphur, or other impurities from the waste gases passing through them, as well as deadening any sound of explosion. After passing through the material C, they may be discharged through a port or hole in the lid into the engine-room freed from all noxious odours; or the gases thus rendered innocuous and inodorous may be led by a fire-clay or other pipe (shown in dotted lines in fig. 1) through the wall W of the building, and discharged into the outer atmosphere. A series of baffle-bricks, cast-iron grids, or other projections, may be built or fitted with open spaces between them in the lower part C¹ of the interior of the vessel B below the bottom sieve, against which the waste gases or products of combustion would first impinge. Any excess of moisture deposited in the lower part C¹ of the exhaust silencing and purifying vessel B would be discharged by a tap at C².

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

Regulating the Seal in, and Drawing the Tar from, Hydraulic Mains.

SIR,—May I again request the favour of a little space for reply to your correspondents "J. H." and Mr. Ellery on the above subject, in your issues of the 22nd and 29th ult.? The former very persistently maintains that the arrangement described in the JOURNAL of Dec. 16, 1879, and mine are identical; and at this I must once more express my surprise, even after a careful examination of the drawings to which he refers. I do not doubt that the arrangement accomplishes the object intended—i.e., the regulation of the seal and the emptying of the hydraulic main; but these are effected by a very roundabout and expensive means. To regulate the seal of itself is nothing new; and to empty the main by means of an ordinary stop, as is done in the case to which "J. H." refers, is as certainly without novelty. But to regulate the seal, empty the main, and completely shut off communication between the hydraulic main and the run-off pipes by the operation of one and the same screw, and without the use of any stopcock whatever, is most certainly new. This is what I claim, and what is clearly set forth in the specification; and I challenge anyone to prove to me that a vessel accomplishing this threefold object is anywhere in existence.

As to Mr. Ellery's arrangement, a sketch of which he has kindly furnished to me by request, and which he contends is the same as mine "even to some small details," how he could ever come to such a conclusion I fail to make out, as it also is nothing more than a seal-regulator with the addition of a separate stop to empty the main. In the case to which "J. H." refers, the tar is run from the cock into an elevated tank, erected for the purpose of supplying the retort furnaces with tar; while Mr. Ellery has no such arrangement. Now, in my experience, such stopcocks are useless, as they set fast, and cannot be turned when wanted. Hence my device to obviate their use altogether; and if your correspondents will take the trouble to candidly consider the nature and capabilities of their arrangements with mine, I think they will, or should, come to the conclusion that they are wrong, and that their rush into print has been altogether premature.

Paisley, April 1, 1892.

GEO. R. HISLOP.

The Yield of English and American Gas Coals.

SIR,—In reading the article on "Coal Gas: Its Manufacture, Distribution, and Consumption," published in the JOURNAL for the 8th inst., I am somewhat struck with the statement made in relation to the yield obtained from a ton of Newcastle coal. I have never before this time had an opportunity of knowing what an average Newcastle ton would do; and I confess I am somewhat surprised at the small results obtained. Many of your readers, especially those who are interested in South American and Mediterranean gas-works, may like to know what the coal mined by the Westmoreland Coal Company will do. Some time ago I compiled an average working result from the reports of eleven different large companies, and the yield per ton of 2240 lbs. was 10,864 cubic feet of 17·01-candle gas; the average weight of coke produced being 1596 lbs., and the quantity of tar 13 gallons.

In the article above referred to, it is stated: "Many managers, however, are now constantly getting considerably higher results than the averages just quoted." I should be very glad if you would request the author of the article in question to enlarge upon that point, so that I may have an opportunity of making a fair comparison between the average results produced from American and English gas coals. I have been told that Pelaw Main is a standard coal; and if any of your readers could give me the results produced therefrom, I should esteem it a favour.

E. H. M'CULLOUGH,

President, Westmoreland Coal Company.

Philadelphia (Penn.), March 22, 1892.

Stoking Machinery for the Halifax Gas-Works.—The Gas Committee of the Halifax Corporation are proposing to erect stoking machines at the works under their charge before next winter.

A Water Scheme for Standish.—On behalf of the Local Government Board, Major-General H. D. Crozier, R.E., held an inquiry at Standish last Thursday week, into an application by the Local Board for sanction to borrow £9955 for constructing works for the purpose of obtaining a supply of water from the Chorley reservoir of the Liverpool Corporation. There was no opposition.

Electric Lighting for Leeds.—According to a Leeds contemporary, there is good hope for belief that a public installation of the electric light will be available in the borough in a few months. A Company have been formed under the title of the Yorkshire House-to-House Electricity Company, Limited; and in addition to providing the requisite electric supply for Leeds, they will have, if necessary, the power to supply other parts of the county. At present, however, the Company's enterprise is to be restricted to Leeds. The necessary Provisional Order having been confirmed by Parliament, the Company are raising £50,000 capital in order to lay down works, in connection with which 20,000 lights can be fixed, and mains laid in the most important thoroughfares of the borough. Terms of purchase have been agreed upon in the event of the Corporation wishing to take over the Company's business—the bargain being that the former have power to purchase on giving (roughly) £80,000 in Leeds Corporation 3 per cent. stock for every £50,000 invested in the enterprise. It is estimated that the central supply station will cost (excluding land) £37,500. It will contain three 100,000 watt plants for night working, and one 50,000 watt plant for the day supply. The capacity of the works is calculated to be such as to permit of the wiring for 20,000 8-candle power incandescent lamps, which, on the basis of 11s. per lamp per annum, will, it is expected, bring in a gross revenue to the Company, when the plant is fully employed, of £11,000. Of this amount, the Directors anticipate that fully one-half, or £5500, will be profit.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress was made with Bills last week :—

Bill read the first time : East Grinstead Gas and Water Bill.

Opposition withdrawn : Newport Corporation Bill.

Preamble not proved : Llanbradach District and Aber Valley Water Bill.

Bills reported : Oxford Gas Bill ; Rhymney Valley Gas and Water Bill ; Southborough Local Board (Gas) Bill ; Tredegar Local Board Water Bill.

Bills read the third time and passed : Bradford Corporation Water Bill ; Liverpool United Gas Bill.

HOUSE OF COMMONS.

The following progress was made with Bills last week :—

Petition presented for London Water (No. 1) Bill, and Bill subsequently brought in by Sir R. Hanson, Sir C. Hall, Sir J. Lubbock, and Mr. J. Stuart.

Bills read the first time : Barrow-in-Furness Corporation Water Bill ; Cleator Moor Local Board (Gas) Bill ; London Water (No. 1) Bill.

Bill read a second time and committed : Rhyl District Water Bill.

Bills reported : Brynmawr and Abertillery Gas and Water Bill ; Lanarkshire (Middle Ward District) Water Bill ; London County Council (Subways) Bill ; Ormskirk Gas Bill ; Southend Gas Bill.

Bill read the third time and passed : East Grinstead Gas and Water Bill.

Petitions against the following Bills were presented :—

Birmingham Corporation Water Bill, from the Commons Preservation Society, Owners, &c., of Lands in Llansaintffraid Cwm-dawddwr and other places, Edward Thomas and others, and Samuel Charles Evans Williams.

London Water (No. 1) Bill, from the County of Middlesex, the Bromley Local Board and the Bromley Rural Sanitary Authority, the East Ham Local Board, and the Conservators of the River Thames.

Petition withdrawn : Stamford Corporation against the Stamford Gas Bill.

HOUSE OF LORDS COMMITTEE.

Friday, March 18.

(Before Earl RAVENSWORTH, Chairman ; Viscount BANGOR, Lord WINDSOR, Lord ZOUCH OF HARYNGWORTH, and Lord SHUTE.)

SWINTON AND PENDLEBURY LOCAL BOARD BILL.

This Bill, under which the Swinton and Pendlebury Local Board seek power to acquire the portion of the gas undertaking of the Salford Corporation situated within the Board's district, as well as in several other places in the outskirts of Salford, under a clause inserted in the Provisional Order obtained by the Corporation last session, came today before the above-named Select Committee.

Mr. BIDDER, Q.C., Mr. SAUNDERS, Q.C., and Mr. FREEMAN appeared for the promoters. The Bill was opposed by the Corporation of Salford, for whom Mr. BALFOUR BROWNE, Q.C., and Mr. HANS HAMILTON appeared ; by the Barton-upon-Irwell Rural Sanitary Authority, represented by Mr. PEMBROKE STEPHENS, Q.C., and Mr. J. D. FITZGERALD ; the Little Hulton Local Board, by Mr. J. BATTEN ; and the Barton, Eccles, Winton, and Monton Local Board, by Mr. LITTLER, Q.C., and Mr. RAM. There were other petitioners against the Bill ; but no Counsel were in attendance on their behalf.

Mr. BIDDER, in opening the case for the promoters, said the Bill was the outcome of the legislation of last year. The districts of the Local Board of Swinton and Pendlebury, of the Local Board of Barton and Eccles, and of the Barton Rural Sanitary Authority had up to the present time been supplied with gas from the works of the Salford Corporation, whose mains traversed the district. This supply had been eminently unsatisfactory to everybody concerned, both within and beyond the borough, but especially for those outside. The former mismanagement of the Salford Gas-Works had become perfectly notorious ; and a Committee of Investigation, appointed to look into the matter, reported that the capital expenditure had been extravagant, that thousands of pounds a year were lost in the working of the undertaking, and that there was no proper supervision. Their Lordships, therefore, would not wonder that, under these circumstances, everybody dependent upon Salford for gas was dissatisfied. But the districts outside the borough had the greatest reason to be discontented, because the Corporation, although they had no express parliamentary power authorizing them to do so, had been in the habit of charging a differential rate for gas. In Swinton, Barton, and Eccles, an additional rate of 4d. per 1000 cubic feet was imposed for the gas, as compared with what was paid in the borough ; and in the outer districts, it was 9d. per 1000 feet extra. As, notwithstanding their extravagance of management, the Corporation took large amounts realized by the gas undertaking, and applied them in relief of the rates in the borough, their Lordships would understand that the outlying districts thought it a monstrous thing that they were being charged so high a rate for their gas, and that big profits were obtained from them in order to relieve the inhabitants of Salford of their rates. This was the state of things when last year the Salford Corporation applied to the Local Government Board for a Provisional Order, to enable them to raise further capital for the extension of their gas-works. Thereupon the Swinton and Pendlebury Local Board and the Local Board of Barton and Eccles, considering that the time had come when they must appeal to Parliament, presented a joint petition against the Order, urging that the Corporation had ample works for their own borough, and that, if additional ones were required, it would be much better that the petitioners should be allowed to construct their

own, and supply themselves, rather than that they should any longer submit to the oppression they had hitherto borne from Salford, and pay an unnecessarily high price for gas in order to relieve its rates. [The learned Counsel quoted at some length from the petition, and animadverted in strong terms upon the management of the gas-works.] The petition was a general indictment of the Corporation in respect of the management of their gas-works ; but it was not uncalled for ; for when they went before Parliament, the facts were admitted, and their own Committee of Investigation had endorsed every word in the petition. In the course of the proceedings, the Salford people intimated their willingness to carry out the wishes of the petitioners ; accordingly a clause was inserted in the Order to the effect that if at any time, within two years from the passing of the confirming Act, the Local Authorities for the districts of Swinton and Pendlebury, and of Barton, Eccles, Winton, and Monton, should, either jointly or separately, apply to Parliament for power to supply with gas their own and other districts within the limits of supply of the Salford Corporation, and to purchase the portion of the gas undertaking of the Corporation situated within these districts, it should not be lawful for the Corporation to oppose the application, except in so far as it might be necessary to secure the insertion in any Act of clauses to protect their interests with respect to the purchase ; and if such powers of purchase were granted, the Corporation should sell the portion of their gas undertaking in question, at such price as should, in default of agreement, be fixed by arbitration under the provisions of the Lands Clauses Act. It was in consequence of this clause that the promoters were now before their Lordships ; and he was sure they would regard it as a reasonable arrangement. When districts had something like 50,000 inhabitants, they had a right to have their own gas-works ; and if any profit was made from the supply of gas, it should go to the relief of their own rates.

The CHAIRMAN : Is the population of Swinton and Pendlebury 50,000 ?

Mr. BIDDER replied that Swinton, Pendlebury, Barton, and Eccles together contained 50,000 people ; but the population of Swinton and Pendlebury alone was about 22,000. The learned Counsel then proceeded to explain that last autumn the present Bill was initiated by a Joint Committee of the two Boards, but that the Barton and Eccles people had changed their minds, and that therefore the Swinton and Pendlebury Board were alone promoting the Bill ; but they were prepared to agree to a clause giving the Barton and Eccles Board power to acquire from them the works in their district, in the event of their making up their minds to this effect within twelve months. It was necessary that they should put upon them a definite time to decide, because, until they knew whether or not they were to build gas-works to supply the Swinton and Pendlebury district only or the whole district, they could not set to work with their plans. He then referred to the petition of the Salford Corporation, which objected to the proposal on the ground that last year's arrangement authorized them to sell to the two Local Boards, and not to one alone ; but he (the learned Counsel) maintained that the promoters were acting quite within the lines of the clause in coming separately for the present Bill. He was astonished that, before a Parliamentary Committee, which did not usually encourage mere technicalities, such an argument should be attempted. What could be more absolute than the former part of the clause, which said that, if the two Boards jointly, or either of such Boards separately, applied to Parliament for powers to supply the districts, and to purchase the necessary portion of the gas undertaking, it should not be lawful for the Corporation to oppose, except for the purpose of getting protective clauses ? With regard to anything they might have to say as to the terms of purchase, or any clauses that were proper for their protection, so that they should be dealt with justly in all respects, he was not only willing that they should present their case to the Committee, but was anxious to give them everything they could reasonably ask at their Lordships' hands. Nothing could be further from the wish of his clients than that the purchase should be carried out in any way that would do injustice to the Corporation of Salford. Turning to the petition of their "*quondam* partners, and now unwilling opponents," the Local Board of Barton and Eccles, the learned Counsel said it was presented entirely against their own conviction, and at the instigation of the ratepayers, or such of them as had been brought under Salford influences. The petition claimed the right to deal directly with Salford for the purchase of the works within their district, instead of through Swinton as proposed in the Bill ; and they objected to the maximum price to be fixed in the Bill as being " far in excess of what is now being charged for gas in their district, and to the proposed quality or illuminating power of the gas, which is less than that now given by the Salford Corporation." The maximum price in the Bill was 4s. per 1000 cubic feet ; and undoubtedly it was greater than that now charged—viz., 2s. 8d. ; but everybody understood the difference between actual and maximum price. The latter was intended to cover all contingencies that might arise in the future. Coal might go up to 40s. or 50s. per ton ; and if Trades Unions went on as they were now doing, it was quite within the bounds of reason that it would do so. The price of labour might advance, and other matters occur to increase the expense of gas production ; and residuals might not be saleable at the same price as now. But the proper comparison should, he maintained, be between the maximum proposed in the Bill and the maximum price of the Salford Corporation gas, which was 5s. per 1000 cubic feet, though they were only charging 2s. 8d. now.

Mr. BATTEN : It is 2s. 6d. to large customers.

Mr. BIDDER said it was useless to confuse the matter with the question of large consumers. The maximum price was 5s. ; and therefore, in substituting for it a maximum of 4s., they were *pro tanto* giving them an advantage. As to the illuminating power, the position was this : In the Bill as originally deposited, the illuminating power proposed was 14 candles, which was a very common standard ; but, in view of the circumstances of Salford and its neighbourhood with regard to coal and other matters, they considered they ought fairly and reasonably to take upon themselves a higher responsibility. They therefore now proposed to fix it at 16 candles, which was the same as that which applied to the London Gas Companies. In respect of the illuminating power of Salford gas, there was a falling off on paper, as in the Salford Act it was 18 candles. This, however, was a very exceptional thing ; and they did not conform to it, because, as a matter of fact, their gas averaged

about 15 candles. They were bound by law to give 18 candles; but the gas went down to 15½ and 15 candles, and sometimes, he believed, even lower.

Mr. HANS HAMILTON, on behalf of the Salford Corporation, protested against Mr. Bidder's statement; and said he should have evidence to show that the illuminating power was 19 or 19½ candles.

Mr. BIDDER said that at the proper time, evidence would be given by those who had tested the Salford gas, and found it 15 or 15½ candles. He was not prepared to deny that there were occasions when it might have risen as high as 18 candles; but they were exceptional.

The CHAIRMAN asked, supposing it was fixed in the Bill that the illuminating power in any place should be 18 candles, and it was found to be only 16, what remedy had the complaining party.

Mr. BIDDER explained the gas-testing arrangements of the Metropolis, and the penalties attaching to non-compliance therewith; and he said the same process was adopted in the case of provincial gas-works. Learned Counsel then proceeded with the petition of the Barton and Eccles Local Board, which complained that the promoters might charge an excessive price for gas supplied in their district, and apply the whole of the profit to the reduction of the rates in the Swinton district. In other words, they urged that the promoters might play the same game with them as Salford had been playing, and put on a differential rate, and make profits out of them to the relief of Swinton. It was not their intention to do anything of the kind; and they were prepared to put into the Bill a clause prohibiting a differential rate, so that the price of gas should be the same throughout the whole district, and this would effectually protect them against any such oppressive inequalities in prices as they had both experienced at the hands of Salford. Referring to the petition of the Guardians of the Barton-upon-Irwell Union, he said the promoters were willing to accede to the suggestion in that petition, and to insert a clause providing that they should come under the same obligations as to the limitation of profits, and have the same remedy at Quarter Sessions, as in the case of a gas company. With regard to the fear expressed in the petition that the purchase of the works, accompanied by an expensive arbitration and the construction of new works, would result in the charge for gas being increased, Counsel said that, if the petitioners would reflect upon the conditions at the present time, and remember that they were paying a differential rate of 9d. beyond that paid in Salford, they might be perfectly certain that the promoters would be able to supply them with gas at a considerably lower figure; and he thought he should be able to show clearly that they would get a reduction of something like 5d. or 6d. per 1000 cubic feet. Having dealt with the petition of the Little Hulton Local Board, to whom, he maintained, the provisions of the Bill would be beneficial, he suggested that if Mr. Balfour Browne, on behalf of the Salford Corporation, wished to maintain their extraordinary position—notwithstanding last year's arrangement, under which they were not to oppose the preamble—it would be better that the Committee should hear what he had to say.

Mr. BALFOUR BROWNE then addressed their Lordships in support of the *locus standi* of the Salford Corporation against the preamble of the Bill; urging that the proposed sale to one only of the two Local Boards concerned made a very material difference to them, as he should be able to show when they came to the evidence. No doubt his hands were tied to a certain extent; and therefore he intended to leave the fighting on the preamble mainly to those whose hands were unfettered.

Mr. BIDDER having been heard in reply on the *locus standi*,

The CHAIRMAN said the Committee took what he believed was the common-sense view of the clause, and were of opinion that the Corporation had no right to oppose the Bill.

Evidence was then given on behalf of the promoters.

Mr. P. Hampson, ex-Chairman of the Pendlebury Local Board, detailed the steps that led to the action of the Board, and recapitulated the main provisions of the Bill.

Cross-examined by Mr. LITTLER, witness said he was of opinion that the control in a matter of this kind should be in the hands of the body that was willing to carry out the provisions of the Act of Parliament. Eccles, he admitted, was the larger municipal body; but Swinton was willing to do what the Act proposed. There was a clause in the Bill providing that Eccles should have the option either of taking their gas from Swinton, or of purchasing their share of the undertaking, and supplying their own customers.

Monday, March 21.

On the resumption of the proceedings this morning,

Mr. BALFOUR BROWNE intimated that the Corporation of Salford would reserve further action until the Bill was in the House of Commons.

Mr. Hampson then gave further evidence, and expressed, on behalf of the promoters, a desire to meet the wishes of the Eccles Local Board as far as possible. He said he believed there would be no objection to extending the arbitration period so as to enable Eccles to acquire its share of the undertaking.

In answer to Mr. LITTLER, witness said he believed that, in the outlying district of Cadishead, there were five or six miles of mains, and only about 50 consumers. It was a great concession, he admitted, to propose to supply these people at the same rate as the consumers in the populous part of the district.

Mr. LITTLER said that the Eccles Local Board did not desire to act the part of dog-in-the-manger, and would prefer that Swinton should get the Bill, provided Eccles obtained reasonable terms, and was not unduly handicapped in regard to the outlying district of Cadishead.

Mr. BIDDER stated that the promoters of the Bill were quite prepared to adopt the principle of equal rating all over the district; but assuming that Eccles took its share of the gas undertaking—as he had little doubt it ultimately would—Cadishead would fall to the Eccles district; and he fully admitted that Eccles should not be bound to anything that was unreasonable. If the Eccles Board could convince the Committee as to the reasonableness of a differential rate for a certain portion of the district, he should not oppose the proposal.

Mr. PEMBROKE STEPHENS, on behalf of the Barton Rural Sanitary Authority, complained that his clients were directly affected by this change of front.

Mr. H. Bramall, Civil and Mining Engineer, of Pendlebury, and

General Manager of Messrs. Knowles's collieries, next gave evidence as to the unsatisfactory character of the gas supplied by the Salford Corporation, and said that his firm had been compelled to substitute the electric light.

Mr. Corbet Woodall, C. E., examined by Mr. FREEMAN, said he had been acquainted for a considerable time with the promoters' district, in connection with the Salford gas supply, and was retained by the Eccles and Swinton Local Boards with reference to the opposition to the Salford Provisional Order of last year; and it was partly in consequence of his advice that the objections which those Local Boards raised were brought before Parliament. He was not in a position to speak as to complaints about the gas itself, but he was as to the administration of the undertaking as against the out-townships. His chief complaint was that the price charged to these out-districts was excessive, and most unnecessarily high. He considered that the inserted clause was a reasonable one, and that the proposals of the present Bill would fairly carry out the concessions obtained last year. He thought the site selected a good and convenient one; and he had had under consideration the size of the works proposed to be erected. The quantity of gas supplied by the Salford Corporation in 1889 in the outlying districts was as follows: Eccles and Patricroft, about 77 million cubic feet; Swinton and Pendlebury, about 50½ million cubic feet; Barton rural district, about 21 million cubic feet; and Little Hulton, 5½ million cubic feet. He had assumed an increase of 20 per cent. upon these figures, as representing not only the increase between 1889 and now, but from 1889 to the time when the works would be finished and ready to supply gas; and this gave about 170 million cubic feet as the quantity to be provided for when the works were put into operation. Taking 170 million cubic feet per annum, it would work out to something like a million cubic feet of gas per day; and for this he had provided in his estimate. The works were arranged to allow of extension to about double the capacity named. The cost of works, &c., he estimated at £61,000, which included way-leaves, approach-roads, and all matters of that kind. In addition to this, payments had to be made to the Corporation of Salford, in respect of property which would be taken over from them; and, beyond the £61,000, it would be necessary for the Local Board to have a certain amount of working capital in hand, which would be provided out of the £100,000 named in the Bill.

Mr. RAM (in cross-examination): If Barton and Eccles were not united to Swinton, and made their own gas, they could produce and supply it certainly cheaper than Swinton and Pendlebury can hope to do under the present scheme, could they not?

Witness: I think they would have some little advantage.

May I put it that, in your opinion, they would be able to sell it at least 3d. per 1000 cubic feet cheaper than Swinton and Pendlebury will be able to sell it at under this scheme?—No, you may not.

How much cheaper would it be?—I would rather not name an amount as a mere guess.

If Swinton has already bought from Salford, we naturally, if we came to buy from Swinton, should have to pay a proportion of the price which Swinton had paid to Salford?—It would be reasonable.

Would it not be reasonable, that being so, that Eccles and Barton should have a voice and be heard at the arbitration which would settle the price to be paid to Salford?—I think it would be desirable, undoubtedly, if Eccles and Barton are to take a portion of the supply, that they should be present at the arbitration; but I altogether decline to take any responsibility upon the Local Board of Swinton for the fact that Barton will not be there then.

I do not ask you to take any responsibility. But do you share the opinion which Mr. Hampson expressed, that it would be not unreasonable that the action should be suspended for a time, in order to enable Eccles and Barton, after they are incorporated, to come in, if they so desire, and be a party to the arbitration between Swinton and Salford?—So far as I have seen, there has been an entire disposition upon the part of the Swinton Local Board to remain by the Eccles Local Board. I heard what Mr. Hampson said; and I agreed that they should postpone it, and that the two Boards should work together in that arbitration.

If differential rates are wholly abolished, and if the Barton Rural Sanitary Authority and Little Hulton are to be supplied, would it not, in the absence of a differential rate, be a necessity that the price of gas must be very much higher than it has hitherto been in the district?—No; it is not a great matter of difference. The total value of the differential rate to Salford in the year 1889 was a little more than £3000; and the Barton Rural Sanitary Authority and the Little Hulton Local Board contributed £1020. It is undoubtedly a very large concession to the out-districts, and is a matter of very vital consequence to the supplying body.

You agree, do you not, that in the district of the Barton Rural Sanitary Authority there is one part where there are six miles of pipe and only about 50 consumers served from it?—I do not see how that is possible. But I would say, even upon that supposition, if I were advising the Swinton Local Board, and found the supply of that district could be only had at the rate at which we are supplying Swinton, that I would lay the mains and take up the business rather than not supply it. That district is likely to profit very much by the construction of the Manchester Ship Canal, which happens to run right through it; and I have no doubt whatever that there are districts round about that will grow very rapidly; so that it is worth while to invest money in order to occupy them.

The CHAIRMAN: Does this Bill propose to supply all the districts at an equal rate?

Witness: The Bill does not propose that; it says nothing about a differential rate. But, within the maximum price named in the Bill, the promoters would be at liberty to charge a differential rate if they pleased.

Mr. J. D. FITZGERALD: There are no clauses in the Bill preventing the promoters from imposing a differential rate. They may charge 4s. instead of 2s. per 1000 cubic feet outside the district.

In cross-examination by Mr. FITZGERALD, witness stated that, when he advised the Local Boards last year, he said the price charged by Salford was unnecessarily high to the outside districts, and that this was due, first, to the fact that they had differential rates; and, secondly, because they made a profit upon the supply of gas. He did

not, however, express the opinion that there should be no differential rate. In the case mentioned by Mr. Ram, he (witness) would advise the laying of the main and taking possession of the district at the same rate as that charged in Swinton, if by this means only it was possible to get possession of it. Although it was reasonable to charge a differential rate, it should not be without limit; and he should think 3d. per 1000 cubic feet would be reasonable.

Mr. FITZGERALD: If it is unreasonable for Salford to charge a differential rate of 2d. per 1000 cubic feet would it not be unreasonable for Swinton to charge one of 3d.?

Witness: You are mistaken about the Salford differential rate—it is 9d. as against that district; and I say that that is a somewhat unreasonable difference. The great point was that, in addition to this differential rate, Salford was charging a very large amount in order to relieve the rates of their borough. What I say is that, if a gas undertaking is conducted in the interests of the consumers, it would be reasonable to charge a differential rate; but when it is carried on as at Salford, so that upon the whole capital they take 13½ per cent. profit, it is most unreasonable to make the out-districts contribute their proportion, and pay in addition a considerable differential rate.

You know that, under the Bill as it stands, you can use the profit in aid of the rates?—We can.

In addition to the differential rate outside?—You have heard that the differential rate is surrendered, and you have heard also that the Local Board are willing to consent to limiting the amount of profits they may take. So far as I am aware, this is the first time that a local authority has made such a proposal to Parliament.

It is not the first time that Parliament has imposed such a condition upon a private company?—No; I know of one case.

Cross-examination continued: With regard to the limitation of profits, he was not authorized to make any proposal. The only suggestion of a limitation was that of adopting the principle applied to a gas company; and in that case they were allowed to divide 10 per cent. on original capital, and 7 per cent. on future capital. With reference to the suggestion made last year on the Salford Order, that, after paying the expenses connected with their gas undertaking, and the annual charge for annuities, interest on moneys borrowed, adding to the sinking fund, and properly providing for their depreciation fund, the Corporation ought to have applied the balance of profit for the benefit of the general body of gas consumers, both within and beyond the borough, by reducing the price of gas, he thought in a certain sense it would be reasonable. If it were applicable to one, it should be to the other. But this must be carefully remembered—that Salford had for many years been taking out of the gas undertaking, and from the consumers both outside and within the borough, the most extravagant amount of profit; and it was not unreasonable for the petitioners, when they went to Parliament last year, to say the Corporation had taken so much in the past that they ought henceforth to take no more.

Mr. FITZGERALD: I suppose you will agree with what has been already stated—that the larger the works, the more cheaply gas can be manufactured?

Witness: Within limits, yes.

And it follows from that that the Salford Corporation can manufacture gas more cheaply than the Swinton Local Board could?—The Salford Corporation should be able to do so; but it is one thing to manufacture, and quite another to supply. I have never said that we can manufacture gas more cheaply; but I do confidently hope that we shall supply it more cheaply.

Of course, if you can manufacture more cheaply, you can also supply more cheaply?—If we choose.

If your profits are limited?—Yes.

Cross-examination continued: The difference between the cost of supplying the whole district and the cost of supplying Swinton alone I take to be about 3d. per 1000 cubic feet. In my estimates I have taken the cost of coal at 10s. 6d. per ton delivered into the works; and from this quantity I have assumed that I sell 9500 cubic feet of gas. I have credited against the cost of the coal 5s. 8d. for the value of the residual products. This leaves the net cost of coal at 4s. 10d. Allowing for salaries and wages, purifying, wear and tear, expenses of distribution, rent and taxes, and management, the cost comes out to 17s. 8½d. per 1000 cubic feet. I may say that, in view of the disturbed condition of the coal trade, I made another calculation, assuming the price of coal to be as high as 12s. per ton; and this came out at 19s. 7½d. But I think the 12s. is an unnecessary amount to estimate for the cost of coal. The difference in the cost of manufacture between 16 and 18 candle gas would be about 3d. per 1000 cubic feet—rather more than less. If the works are situated at a higher level than the district to be supplied, it involves additional pressure; but that does not necessarily mean an increase of leakage. If there are leakages at all, more gas would escape at a high pressure than at a low one; but we should try to avoid having any leaks. Besides, the quantity of gas lost through leakage from mains is not very considerable.

In cross-examination by Mr. BATTEN, witness said he thought there were probably no gas undertakings in the immediate district of Salford supplying gas at a lower price than that charged by the Corporation of that borough; but he believed he had made it clear to the Committee why he considered the promoters would be an exception to the general rule. The Corporation ought to be able to manufacture and supply gas as cheaply as anybody else; but it did not matter to the promoters at what cost they produced it. They knew what they had to pay for it. Out of the price the Corporation had been charging, they made practically 17d. profit, from which they had to pay interest. The conveyance of coal to the gas-works at Farnworth and Kearsley might involve 2d. or 3d. per 1000 cubic feet charged to the cost of the gas.

In re-examination by Mr. FREEMAN, witness said he did not know, as a matter of fact, that the gas supplied by Salford was not always up to the standard. He found that the returns made by Mr. Davis were identical with those obtained by the illuminating power meter; and having on two occasions tested the results with Mr. Davis's apparatus and the meter, he could confirm the accuracy of the observations. The results Mr. Davis obtained were either 15·6 or 15·8 candles; and on the last occasion, it was 16·4 candles.

Mr. G. E. Davis, Analytical Chemist, of Manchester, gave the results of tests he had made of the Salford gas. In July, 1891, its illuminating

power averaged 14·7 candles; in August, 14·34 candles; in September, 14·40 candles; in October, 15·20 candles; in November, 15·16 candles; in December, 14·72 candles; in January, 1892, 15·09 candles; and in February, 14·76 candles.

The CHAIRMAN said that the Committee had quite sufficient evidence with regard to the quality of the gas. They were of opinion that the complaints as to both cost and quality were well founded; and therefore they did not want this evidence to be overlaid.

Mr. PEMBROKE STEPHENS respectfully suggested that their Lordships should not assume this from the statements made on one side, as that would be to assume the whole case. He had the official records, which showed that those statements were not well founded.

In reply to the CHAIRMAN, witness said the illuminating power of the gas might drop 1 candle in transit from the gas-works to his premises; but it was not a question of loss. The average gas that went out from the works was of lower quality than that tested by the Corporation photometers. He did not mean to imply that the deficiency arose from anything fraudulent; but merely from careless manufacture.

Sir F. Bramwell, F.R.S., examined by Mr. SAUNDERS, quoted the case of Birmingham and the outlying authorities as a precedent for the purchase by Local Boards of portions of the undertaking of a large Corporation. He said he considered it a desirable thing that the promoters should have the powers they applied for.

This being the whole of the evidence for the Bill,

Mr. BATTEN addressed the Committee on behalf of the Little Hulton Local Board. He objected to the inclusion of that district in the area of the Swinton and Pendlebury Board, but said that, if included, it ought not to be charged any more than it was paying at present for the same quality of gas.

Mr. J. Roscoe, a colliery proprietor at Little Hulton, was called in support of the learned Counsel's case, and stated that the district was supplied by the Farnworth and Kearsley Gas Company as well as by the Salford Corporation, and the inhabitants were averse to any change.

Mr. PEMBROKE STEPHENS, for Barton-upon-Irwell, called Mr. J. W. Whitworth, as representing the Guardians; and the witness stated that they also objected to being included in the Bill.

Tuesday, March 22.

Mr. Cosmo C. Hooley, Surveyor to the Rural Sanitary Authority of Barton-upon-Irwell, gave details as to the population and levels of the district, and other local circumstances; stating that there were colliery workings beneath the surface of the ground, which was liable to subsidence.

Mr. T. Newbigging, C.E., examined by Mr. PEMBROKE STEPHENS in opposition to the Bill, said he was well acquainted with the districts which were the subject of the present inquiry, having lived in the neighbourhood for 17 years. The Barton Rural Sanitary Authority desired that the present arrangements should not be disturbed; and they had very good reason for it. First of all, the proportion of outlay of capital by the establishment of other gas undertakings would be larger; and they did not desire to see a multiplication of gas-works in the locality. The cost of administration and management, and the general working expenses, would necessarily be increased; and therefore the selling price of the gas would be greater than if it were produced and distributed from one common centre as at present. The consumption of gas in the Swinton district during 1891 was 52 million cubic feet; in the Eccles district, 89 million cubic feet; in the Little Hulton district, 6½ million cubic feet; and in the district of the Barton Rural Sanitary Authority, 30½ million cubic feet. The four places added together gave a total of 178 millions. This was the consumption which the Swinton Local Board proposed to take over. It was only 20 per cent., or one-fifth, of the Salford gas supply, which in 1891 amounted to 901 million cubic feet; but assuming that the promoters obtained their Bill, it would not be sufficient that they should erect works for the supply of only 178 million cubic feet of gas. The increased consumption of four more years—from 1892 to 1895—would have to be added to this figure, because the works could not possibly be commenced until well into next year, and it would be the supply of 1895 that the Swinton people would have to deal with. The increase in the consumption of gas in the Salford district during five years had been 3½ per cent. per annum; and taking the future increase at the same rate in the districts named, in 1895 the consumption would be 203 million cubic feet. At the very outset, the works would have to be made capable of supplying at least one-fourth more gas than the quantity he had named, because it would never do to build them without a margin to meet contingencies, and also to provide for the growing increase. This would bring the total up to 254 million cubic feet, which the works should be capable of supplying when completed. He had taken as the cost of erecting works and providing the general capital of an undertaking of this size £625 per million cubic feet of gas produced per annum. Multiplying the 254 millions by £625, it gave a total of £158,750 as the capital required for the erection of the works and plant; but this figure did not include anything in the shape of goodwill that might have to be paid to Salford. That amount would have to be ascertained by arbitration. He had prepared a table showing the price per 1000 cubic feet at which gas of the same quality as that of Salford could be made and sold at works equal to a consumption of 254 million cubic feet, with a capital of £158,000. The year's production would be 279½ millions; but there was always a certain amount of loss, or unaccounted-for gas, which he estimated at 25½ millions, or about 9 per cent. In order to produce gas of the Salford quality, which was between 18 and 19 candles, it would be necessary to use cannel with the coal. To supply 18-candle gas, and to be safe from penalties, it was necessary to supply gas of a quality about 1 candle above that prescribed. The amount of coal that would be required to produce the above-named quantity of gas would be 22,360 tons, at 12s. per ton, which was the price delivered at the proposed gas-works. Salford was paying not quite so much—about 11s. per ton; but it was because they had a contract running for three years at the lower figure. [Witness produced a price list of January, before the disturbance in the coal trade began, but said the price was now 2s. or 3s. per ton higher.]

Mr. BIDDER asked to see the list, as he said he happened to be the Chairman of a Gas Company buying it at 9s. 6d. per ton.

Witness: Yes; but where do you get it from? Newcastle, I suppose?

Mr. BIDDER: It is the best Durham gas coal.

Witness: Exactly; we do not use any Durham gas coal at Salford.

Examination continued: They had to use at Salford, for the purpose of producing the high quality of gas—18-candle—which their Act required, a considerable quantity of cannel. During the last ten years, the proportion of cannel to coal had been 30 per cent. The coal and cannel together—the latter at 22s. per ton, the former at 12s.—amounted to £19,565, or equal to 1s. 6.48d. per 1000 cubic feet of gas sold. From this he deducted the produce of the residuals, which he put down at £7991, or equal to 7.55d. per 1000 cubic feet of gas sold, which left the net cost of the coal at 10.93d. To this must be added the working expenses, the cost of purifying, including the materials, wages and salaries, repairs and maintenance, rates and taxes, stationery and printing, and incidental expenses, which amounted to 1s. 3d. per 1000 cubic feet of gas sold; making 2s. 1.93d. To this should be added 2d. per 1000 cubic feet for depreciation, or, as it was called in the case of a statutory gas company, the reserve fund. The interest on the money borrowed and the sinking fund would amount to 7.07d. per 1000 cubic feet, which would bring the total cost up to 2s. 11d. If Swinton charged meter-rent, this would reduce the price by 1d.; so that they could make their gas and sell it at less than 2s. 10d. per 1000 cubic feet—giving them every advantage. This was the future before the Swinton district if the Bill should pass. The position to-day was as follows: The price within the five-mile radius outside of the borough was 2s. 8d. per 1000 cubic feet to small, and 2s. 6d. to large consumers; beyond that line, 2s. 11d. and 3s. 1d.; and he believed there was a reduction announced on those prices. He had not the slightest doubt that, if the Bill passed, the price would be raised all round the district; and therefore it was not surprising that they should wish to be left alone. In all his experience he had never heard of a district being, against its will, taken out of the area of one authority and put into that of another; nor was there any precedent in England for reducing the illuminating power of the gas as proposed in this Bill.

Mr. PEMBROKE STEPHENS: If you have a quality of gas which has existed for years, and is a recognized standard, would you say that to reduce it was a forward or a retrograde step?

Witness: A very retrograde step. In these days of competition with oil and the electric light, it is a most serious step to take. Indeed, to approve of such an arrangement as that, and to reduce the standard of illuminating power, would be to create a very objectionable and most dangerous precedent. I should look upon it as a calamity to the district to reduce the illuminating power of the gas 2 candles.

In further examination, witness said the charge made by Mr. Davis that the gas sold to the consumers was 3½ candles below the standard was a very serious one. It so happened that on the very day—the 12th of March—on which Mr. Davis tested the gas, and gave it at about 15 candles, he (witness) himself tested it, and found it to be 18.4 candles. He considered the site of the proposed works very badly chosen. However well conducted gas-works might be, they were more or less a nuisance in their neighbourhood. The level was also bad, as the gas would have to flow down; and it lost an inch of pressure in every 100 feet of descent. Extra pressure would have to be put on, which would tend to create leakage through the pipes; and in a colliery district such as the one in question, it would be especially objectionable.

Mr. BIDDER (in cross-examination): You have given a number of figures to show that we cannot make gas at the price we have named. You began by stating that the cost of coal, after deducting the residuals, would be practically 11d. per 1000 cubic feet of gas sold.

Witness: In a book published every year, giving statistics referring to all the large gas-works, it was shown that the cost of coal in Salford, less residuals, was less than 7d. per 1000 cubic feet. At Manchester, it was 9½d.; at Leicester, 4½d.; at Leeds, 6d.; and at Oldham, 7½d. Swinton could not work so cheaply with regard to coal as Manchester or Salford. The figure of 1s. 3d. for the cost of labour compared well with 1s. 2d. at Salford, because they could not reduce to the price of Salford the working expenses in a concern which was five times smaller. He believed Salford did not at present put aside anything for either depreciation or reserve fund.

Assuming we get our coal at the same price as Salford, that we work at the same cost, and do not have the depreciation fund, in addition to the sinking fund, following the example of Salford, what does it make your figure of 2s. 11d. as the cost of gas?—If you have no depreciation fund, it would take off 2d.

But then there is 4d. off coal, 2d. off working expenses, and 2d. off depreciation. According to your own account, the 2s. 11d. comes down to 2s. 3d.?—Yes; that is so, taking your figure. That is for 16-candle gas. Now we are getting 18-candle gas.

I am adopting the Salford price for 18-candle gas. Taking the cost of coal and working in the Salford case—2s. 3d. as the cost price, including interest on capital and sinking fund—we can well afford to sell gas at 2s. 5d., or even 2s. 4d., per 1000 cubic feet. Is not that so?—Yes; if you economized to that extent.

Mr. Woodall contemplated providing for 180 million cubic feet of gas; and you say he will have to meet a larger consumption. If that is so, that is so much the better for us, because, by your own showing, the larger the consumption the cheaper the gas?—No; I do not say the larger the consumption the cheaper the gas. Within certain ranges, it makes no difference whatever. I should say from 150 to 300 millions makes very little difference; but when you come to 1000 millions you have a difference.

Does an increased consumption tend to cheapen the cost?—It does, but within that range very fractionally indeed.

Then if you are right and Mr. Woodall is wrong as to the quantity of gas we shall have to provide for, it is so much the better for us, though it may be only a fraction in the cost of production?—No; but I have endeavoured to show how crude this scheme is. They only reckoned for 177 million cubic feet, whereas 254 millions must be provided for. I have shown very distinctly that this scheme has not been well considered.

Mr. Woodall has told us that he provided, in the first instance, for the consumption he has to deal with. I suppose the works can be put up in a year, can they not?—No; they cannot be commenced for a year and a half, because, under clause 48 in the Bill, Eccles has power to purchase. It would never do for Swinton to expend £150,000 or £160,000 upon works of which they are going to dispose. It will be 18 months before the works are commenced; and it will be a year and a half or two years from the present time before they are completed.

You have given us £625 as the capital cost per million cubic feet of gas. That is larger than the ordinary expense of corporations, according to these statistics, is it not?—The cost of gas-works belonging to local authorities in England and Wales is, on an average, £681 per million. I have taken it at £625. The cost of gas-works belonging to companies is £630 per million.

Is it the fact that in the last ten years Salford has applied to the borough fund, in reduction of its own rates, £400,000 out of the gas profits?—I do not know how much it is; I know they have applied a good deal.

Obviously, having regard to the differential rate, the bulk of it has been taken out of the outlying districts?—I do not agree with that at all. There is a good deal of "blowing hot and cold." At one moment they say these works have been disgracefully managed; at another, they say they have laid aside, in reduction of the rates, £400,000. Which are we to believe? Either the one or the other must be wrong.

But have they disgracefully managed the profits taken out of us by the monstrously high price?—Whatever has been laid aside has been done legally. Personally, I am opposed to the making of these large profits.

But assume for a moment, though it is open to argument, that it has been done legally, and assume that the bulk of the £400,000, or a large proportion, has been taken out of the pockets of Swinton, Patricroft, and the Barton rural district, and applied in reduction of the Salford rates, do you not think that it is almost time that this sort of thing should cease?—Yes, I do, if that is so. I have invariably advocated it, and also a lower differential rate; but I have been always in favour of some such rate. I say there ought to be a differential rate in a sparsely-populated district.

Are you prepared now to tell their Lordships that at least half of that £400,000 has not been taken out of the pockets of the outlying districts?—I am not; and I do not believe it. There is just one point I should like to mention. Mr. Woodall was asked if his clients would agree to a limitation of the profits. He suggested adopting the principle of a gas company, and said that in the case of a company the original capital is allowed to carry 10 per cent., and future capital 7 per cent. dividend. The effect would be this: The capital of the company, I say, would be £156,750. Mr. Woodall proposes that this should be called original capital, entitled to 10 per cent. Now, 10 per cent. on that amounts to £15,675. The sinking fund and interest, as I have shown, amounts to about £7500. Deduct £7500 from £15,675, and we have £8175 left as net profit, which it is suggested these people should make, after paying all their expenses, and even allowing for depreciation. The Salford works are five times larger than these, and yet Swinton proposes to make £8000 profit, after paying all expenses.

Mr. Corbet Woodall was recalled, and said he desired to make an explanation. It had been a little difficult to follow the evidence, and prepare anything like a reply to it, on the spur of the moment; but he would like to point out that the estimate of 170 million cubic feet, which he had given on the previous day, was a printer's error in his proof. The quantity with which he dealt totalled up to 185,633,000 cubic feet; and this bulk of gas he calculated would have to be delivered at the end of the year 1893. The figure that Mr. Newbigging had given was 178 million cubic feet in 1891; and with 3½ per cent. in addition, it would come to almost exactly his figure. Furthermore, the cost of the works which he had given on the previous day was necessarily based upon the maximum quantity of gas to be made in one day. His estimate for those works was a million cubic feet a day; and he found that he had a margin of a little over 10 per cent. This would be sufficient to provide 190 million cubic feet per annum, according to Mr. Newbigging's multiplier of 190. He had therefore provided works amply large enough, according to Mr. Newbigging's own estimate, to meet the demand at the time they would be brought into use; and if the quantity was to be increased, he was quite prepared to enlarge his works. The site was capable of allowing an extension to 2 million cubic feet per day; and the more they made, the better they would like it. Witness also explained that there was very little in the objection that had been taken on account of the levels.

Sir F. Bramwell was also recalled; and, in reply to questions put by the Committee, said he attached no importance to the differences in the levels.

Mr. F. Jones, F.R.S.E., examined by Mr. FITZGERALD, said he had been Consulting Chemist to the Gas Committee of the Salford Corporation for some years, and had made regular examinations of the illuminating power of the gas supplied. He tested it from the main supplying the town; and the results showed that the quality varied from 18½ to 19 candles.

In cross-examination by Mr. SAUNDERS, witness said that, in his opinion, the illuminating power meter used by Mr. Woodall for testing the gas was not a reliable instrument, and that it was possible for it to err to the extent of 4 out of 18 or 19 candles. It was not so reliable as the standard photometer.

Mr. FITZGERALD then addressed the Commissioners on behalf of the Barton Rural Sanitary Authority; commenting at considerable length on the evidence which had been given on either side. If the Bill were passed, he asked that they should be struck out; and he urged that it would be unjust, under all circumstances, that the district he represented should be excluded from relief of its rates from the profits, if any, realized on the gas undertaking.

Mr. LITTLER followed for Barton and Eccles; maintaining that the promoters would not be able to make gas any cheaper or better than Salford was doing, and asking that they also should be excluded from the operations of the Bill. If Swinton and Pendlebury were capable of having their own works, *a fortiori* Barton and Eccles should have theirs; and he asked that no steps should be taken which should in any way bind the district for which he appeared.

Mr. BIDDER was heard in reply. He urged that, if the opposing districts were struck out of the Bill, it meant defeating it altogether. The promoters were faithfully carrying out the intention of Parliament, as expressed last year. They were there alone, because their partners would not come with them. However, they were acting in perfect good faith for the benefit of everybody; and he thought it would take a great deal to bring their Lordships to the conclusion that Parliament was wrong. In point of fact, no one had shown any reason for reversing the decision of 1891.

After some consideration in private, the Committee declared the preamble of the Bill proved; but they declined to include in its operation Eccles, Barton-upon-Irwell, the district of the Barton Rural Sanitary Authority, and Little Hulton.

The clauses of the Bill were agreed to on the following day; and the Committee ordered the Bill to be reported to the House.

HOUSE OF COMMONS COMMITTEE.

Monday, March 28.

(Before Mr. HERBERT GLADSTONE, Chairman; Mr. W. F. LAWRENCE, Mr. A. C. CORBETT, and Mr. DUNN.)

LONDON COUNTY COUNCIL (SUBWAYS) BILL.

The Committee on this Bill, whose proceedings, as far as our readers are concerned, were reported in the JOURNAL last week, resumed their sittings to-day, and proceeded to deal with the clauses.

Mr. LITTLER, Q.C., Mr. PEMBER, Q.C., and Mr. FREEMAN appeared for the promoters; Mr. POPE, Q.C., and Mr. BIDDER, Q.C., for the New River and other Water Companies; Mr. POPE, Q.C., Mr. BIDDER, Q.C., and Mr. RIGG for The Gaslight and Coke Company; and Mr. READER HARRIS for the Commercial Gas Company.

Mr. PEMBER said he would take the clause which was still in contest between the promoters and The Gaslight and Coke Company, although it had been agreed with the Water Companies. The clause was to the effect that it should be lawful for the Council to make on the Company using any subway a charge for such use, and for the supervision of the subway and the pipes and wires therein, according to a scale to be determined; and until such scale was settled, the amount of the charge (if not agreed between the Council and the Company using the subway) should be determined by an arbitrator. He thought that, the subway being a matter of very considerable advantage to everybody, the Companies as well as the public, it was fair that the former should contribute something towards the expenses of management and supervision.

Mr. POPE thought it was not unfair for a public authority to say to the Gas Companies that, if they derived any advantage from being in the subway—such, for instance, as not having to bear the cost of breaking up the streets—this should be calculated as a payment to be made by the Companies for the user. He was quite content, on the part of the Gas Companies, to assume this view of the question. But the clause would do more than that—it would make the Companies not only responsible for any advantage they might derive by reason of the transfer of their mains to the subways, but would make them responsible for contribution towards the supervision and maintenance of the subways, which were maintained and supervised in the interest of the public. It would make them responsible for such sum as the arbitrator might say was fair, although they might not derive any pecuniary advantage whatever from this management and supervision.

Mr. READER HARRIS, on behalf of the Commercial Gas Company, concurred in the remarks of Mr. Pope.

The CHAIRMAN: I think the arguments are perfectly clear upon both sides. I should like to know whether the arbitration clause of the Act of 1868 has been acted upon, and whether any guide is given to the present case.

Mr. PEMBER: The Gaslight and Coke Company pays at the present time £150 10s., and the other Gas Companies certain smaller amounts. That sum is paid by agreement.

The CHAIRMAN: I take it that practically there is no opposition to the preamble of the Bill.

Mr. POPE: I am told that the Electric Lighting Companies are opposing the preamble.

The CHAIRMAN: The promoters, I understand, have closed their case.

Mr. PEMBER: That is so.

After some discussion with reference to the points on which the Electric Lighting Companies opposed the Bill,

The CHAIRMAN announced that the Committee considered the preamble proved.

On the following day the case of the Electric Lighting Companies was proceeded with.

Wednesday, March 30.

On the re-assembling of the Committee this morning, Mr. LITTLER replied on behalf of the County Council to the case of the Electric Lighting Companies; and subsequently a clause was inserted securing that the Council should pay the cost of removal into the new subways of the Companies' wires.

Clause 2c, which was dealt with by Mr. Pope on Monday, regarding the charge to be made by the Council for supervision and management, was further discussed.

Mr. CRIPPS stated that he had had some conversation with Mr. George Livesey, the Chairman of the South Metropolitan Gas Company, and understood him to be satisfied with the clause.

The CHAIRMAN announced that the decision of the Committee was that the clause, as presented to them, was approved.

Thursday, March 31.

On the re-assembling of the Committee this morning, Mr. POPE, dealing with clause 11, as to liability for accident, said that, although he was not concerned to put this on the County Council, he contended that no new form of liability should be fixed upon the Water Companies.

Mr. READER HARRIS said the clause would not be sufficient, unless

it included a clear definition as to who was to bear the liability for any explosion, which might not be attributable to either their negligence or their default. He thought the point was vital to the Commercial Gas Company. At present their mains were underground, and there was no danger. They submitted that danger should be provided for, and a liability properly assessed in the Bill.

The CHAIRMAN: Who paid the cost of the explosion in Tottenham Court Road?

Mr. POPE: The Gas Company. They had to pay the whole of the damages that were claimed. I think the liability would be this—that if the explosion occurred by reason of an extension of a *bona fide* order of the Council, nobody would pay the damage, and we (the Companies) should be responsible for relaying our pipes and mains at our own expense; but if it were a *bona fide* exercise of the power of the Council, we should be entitled to recover against them.

The CHAIRMAN: The Committee consider that the provisions of the Bill shall not extend and apply to any subway which may hereafter be constructed, excepting so far as those provisions shall be incorporated in any such General or Special Act.

The Committee then concluded their consideration of the clauses of the Bill.

Messrs. R. and J. Dempster have recently received orders for a gasholder 80 feet in diameter on the Gadd and Mason system for the Normanton Gas Company. The Wakefield Gas Company have also placed with them the contract to convert two two-lift holders, each 100 feet in diameter, into three-lifts; the top lift being on the above-named system. The Penrith Local Board have ordered a two-lift holder, 75 feet in diameter; both lifts being on this plan. A 60-feet holder, on the same system, with cast-iron tank, has just been put into use at Formby.

The Management of the Goole Gas and Water Works.—A special meeting of the Goole Local Board was held on Monday last week for the purpose of considering the conduct of the Directors of the Goole Gas and Water Company in dismissing the Gas Manager (Mr. J. Whittaker) and appointing a successor without consulting the representatives of the Local Board, who have one-third share in the directorate of the Company. The Chairman (Mr. Gleadow) offered an explanation, showing that he had not been consulted about the dismissal of the Manager, and that when this had been done there was another gentleman in attendance ready to take his position. A resolution was passed protesting against the treatment extended to the representatives of the town on the directorate of the Company.

Opening of New Water-Works for Bombay.—Last Thursday afternoon, the Viceroy of India (the Marquis of Lansdowne) made a special visit to Bombay to perform the ceremony of opening the new water-works for the city, by connecting the existing mains with the new great main which brings the water from the huge reservoir formed by the damming of the Tansa Lake. The construction of this dam, which is one of the largest in the world, and of the mains and conduits through which the water flows to the city, has taken seven years, and has cost the Bombay Municipality about 15,000,000 rupees. The extent of water is about seven miles, and the catchment area 52 square miles. The dam itself is two miles long, and the water from the reservoir is conveyed to Bombay through 61 miles of tunnelling, ducts, and mains. The new works are capable of supplying 31 million gallons of water daily; and the storage capacity of the reservoir is sufficient to ensure an ample service even in dry seasons. The work was designed by Major Tulloch, and has been carried out, with some modifications, by Mr. Clerk, C.E. The contractors were Messrs. Walsh, Lovett, and Co., of London and Birmingham.

The Constitution and Duties of the Royal Commission on Water Supply.—In the House of Commons last Friday, Sir R. Temple asked the President of the Local Government Board whether he would consider the expediency of adding to the Royal Commission on the London Water Supply the names of one or more influential residents in that part of the county of Surrey which is interested, as being supplied by one of the existing Water Companies, and because their present supply is drawn from the River Thames, which is being exhausted of all its water, to the great detriment of that county. Mr. Ritchie in reply, said that before the Commission was appointed the question of its constitution was very carefully considered. The Commission had not been formed on the principle of obtaining representatives of different districts, but of securing the services of gentlemen who are specially qualified for the important inquiry the Commission have to undertake. The Government could not, therefore, accede to the suggestion of the honourable member. It would, he added, be borne in mind that the Commission, by the terms of their appointment, were to have regard to the needs and claims of the localities not supplied by any Metropolitan Water Company, but within the watershed of the Thames.

Clevedon Gas Company.—At the annual meeting of this Company yesterday week, the Chairman (Mr. E. Button), in moving the adoption of the Directors' report, spoke with regret of its unfavourable nature, and offered some explanations as to the reduced dividend of 5 per cent. on all classes of shares. The cost of manufacturing, he said, had been increased through the consumption of Yorkshire coal mixed with Bristol small; the Directors having been anxious not to reduce the illuminating power of the gas. There had been also an increase under repairs and maintenance of works of £150, which would not appear another year. They had economized in the item of management, by which they hoped to effect a saving in the future. Their residual products had realized considerably less. They could get no purchaser for the ammoniacal liquor; the consequence being that they had a large quantity in stock, producing a loss of £50. They had, however, made arrangements so as to avoid this loss in the future. The Directors hoped that, with the economies effected, they would be able next year to recommend a dividend of 7 per cent. at least. One serious occasion for loss resulted from three breakages of mains, which entailed an outlay of £50 in coal alone, while the leakage was very considerable. The report was adopted, and the dividend recommended was declared.

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Thursday, March 31.

(Before Lords Justices LINDLEY, BOWEN and KAY.)

Savory and Moore v. The London Electric Supply Corporation, Limited.

This was an appeal from a decision of Mr. Justice Kekewich, reported in the JOURNAL for Dec. 29, 1891 (p. 1187). The action was by Messrs. Savory and Moore, the well-known chemists and druggists, of 143, New Bond Street, to restrain the defendants, who had been using certain adjoining buildings as an electric light distributing station, from so carrying on their business as to be a nuisance to the plaintiffs. At the rear of their shop in New Bond Street, the plaintiffs had extensive premises, which were used as a laboratory and store for large quantities of chemicals and other valuable goods of an inflammable character. In 1887 the defendants took certain premises adjacent to the plaintiffs' warerooms; and they were also in occupation of the cellars under the Grosvenor Gallery, which lay near the plaintiffs' premises, and they fitted up their buildings and cellars with engine, boilers, and other machinery for the production of electricity and the general purposes of their business. The plaintiffs alleged that in 1890, owing to their remonstrances, the defendants ceased to generate alternating electric currents as they had previously done in their buildings and cellars, and removed the plant. In lieu thereof, they, without the plaintiffs' knowledge and sanction, proceeded to adapt and use their buildings and cellars as a converting and distributing station. The plaintiffs complained that their use for this purpose was highly dangerous. They further stated that already, on the 17th of October and the 15th of November, fires had occurred on the defendants' premises, both of which occasioned great risk to the plaintiffs. By the latter of these fires, the premises were practically gutted, and damage was caused to the plaintiffs by dirt, water, and smoke. As the defendants were proceeding to reinstate their premises with the view of using them for the same purposes as before, the plaintiffs commenced an action on Nov. 20, 1890, claiming an injunction. The defendants denied that their business was attended with risk from fire or would be dangerous to the plaintiffs' premises, and stated that they had proposed to the plaintiffs to take certain precautions against accident. They also stated that they had obtained the approval of the Board of Trade for the supply of the electric current from their premises; and they insisted that the storage of highly inflammable and explosive materials by plaintiffs created considerable danger to those premises. Justice Kekewich granted an injunction; and the defendants appealed.

Mr. MOULTON, Q.C., and Mr. W. F. HAMILTON appeared for the appellants; Mr. RIGBY, Q.C., Mr. WARMINGTON, Q.C., and Mr. VERNON R. SMITH represented the plaintiffs.

After the appeal had been opened, the parties came to a settlement, on the following terms: The injunction to be dissolved, the defendants undertaking (1) not to use any room except the basement (which was admitted to be free from danger) for transformers until satisfying some person, to be agreed on by the parties, as to its safety for that purpose; (2) not to store inflammable materials in any room used for transformers—the defendants agreeing to pay the costs of the appeal and of the action.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Tuesday, March 29.

(Before Mr. Justice KEKEWICH.)

Gadd v. Mayor, &c., of Manchester—The Gasholder-Guiding Patents.

This was an action brought by the plaintiff, in association with his partner (Mr. Mason), against the defendants for an alleged infringement of his patent of Dec. 12, 1888, for controlling the action of gas-holders without the use of the customary guide-framing. The defendants generally denied infringement, and claimed that the patent had been anticipated.

The ATTORNEY-GENERAL (Sir R. E. Webster, Q.C., M.P.), Mr. MOULTON, Q.C., and Mr. L. O. CLARE appeared for the plaintiffs; Sir HORACE DAVEY, Q.C., Mr. WARMINGTON, Q.C., and Mr. CARPMAEL, for the defendants.

The ATTORNEY-GENERAL, in opening the case, said the action was brought by Messrs. Gadd and Mason, under a patent dated Dec. 12, 1888, against the Corporation of Manchester, in respect of an alleged infringement of letters patent for checking, controlling, and steadying gasholders.* He then briefly described a gasholder, and explained its use; and went on to remark that, in connection with the present action, it would be a very material matter to remember that gas-holders had been in existence for something like 70 or 80 years, and one of the alleged anticipations dated back to the year 1823. It was quite clear that gasholders, as such, were in existence prior to that time. His Lordship might remember that there were round a gasholder a number of columns fixed at equal distances, and having girders or bracing round the top. There were also counterbalance weights for controlling the pressure of the gas, and taking off some of the dead weight of the holder. There was further this utility in the standards: There were against the sides of the holder wheels which ran in grooves against bearings on the columns, or there were wheels on the latter which moved in grooves on the side of the holder and restrained it. A very large number of anticipations—some 16 or 17 in all—ranging from the year 1823 to 1887, were to be put forward; but he did not propose to encumber his opening remarks by going through them. Before dealing with the plaintiffs' patent, he might state, as fully and fairly as he could, what had been done prior to the year 1888. As far back as 1823, Malam patented a device for a gasholder in which posts were not dispensed with. [The learned Counsel described the holder.] Between that year and 1887, although

there had been a number of other inventions with regard to gas holders, none of them had dispensed with the columns. There were still posts standing at various points round a gasholder, which posts would be useful for the purpose of controlling the motion of the vessel by wheels, pulleys, gearing, or any other appliance which pressed against the post. All that had been done prior to 1887 was to improve the method of attaching the gearing to the holder, and connecting it with the surrounding columns. Many of the arrangements would not be applicable to telescopic holders. Side by side with Malam's specification, there were a number of others relied upon, consisting of various modes of applying steadying machinery to pontoons, or vessels of that kind; but it was not necessary to go into those at present, because it would turn out that they would not be anticipations. If they were, they would only be some selected instances. He admitted that there had been for more than 50 years past attempts to solve the problem of steadying gasholders. In the year 1887, Mr. Gadd and Mr. Mason invented a device which was an entirely new departure—viz., a gasholder without either standards or weights. They put on the side of the tank in which the holder worked spiral rails, and on the side of the holder small rollers which fitted into the gearing, so that the vessel twisted as it rose. The pressure of the wheels against the sides of the spiral rails checked the tendency of the holder to topple over, or cant. The invention was perfectly successful, and was an extraordinary departure, because it dispensed altogether with the columns which had been used before. Shortly after 1887, Mr. Gadd, who was not by any means satisfied that he had arrived at the end of the matter, commenced to invent again. As early as the end of 1887 and the beginning of 1888, he was still experimenting on further improvements; and this would be an important matter with reference to an allegation as to the first and true invention, and also as to novelty. During the year 1888, he designed the arrangement described in the patent of the 12th of December, which was the one now in question. The drawings were shown to Mr. Mason, who was unwilling that the patent should be taken out so soon, as he thought the 1887 patent was likely to be a success; and as a considerable amount of time and money had been expended upon it, he did not wish it to be superseded by something else. But, as not unfrequently happened in these cases, another gentleman was also thinking of Mr. Gadd's invention. It appeared that, about the 10th of December, a Mr. J. B. Terrace wrote to Mr. Gadd, intimating that he had an invention for gasholders, though he never made the slightest suggestion as to the details. In consequence of this letter, Mr. Gadd communicated with Mr. Mason; and they determined that, as other people were in the market, and they might be forestalled, they had better at once patent their improvement. He should have to satisfy the Court, by evidence, that what was subsequently included in the provisional and complete specifications had been thought of at that time. The new invention related to three forms of development of the 1887 patent. It would not be incorrect to paraphrase it by saying that in all cases there must be suspension of the holder from the base—getting rid of the columns—and that there was to be a girdle of mechanism whereby the tendency of the holder to twist or topple over was controlled. This idea was identical with Mr. Terrace's; but he (the learned Counsel) should prove that the design had been drawn months before by Mr. Gadd's son. That Mr. Terrace had invented it was common ground; but that Mr. Gadd had invented it long before Mr. Terrace would be proved by evidence. He was now solely dealing with the arrangement for controlling the holder by torsion; but there was another method which Mr. Gadd had at the same time designed—viz., by tension—which had identically the same function of correcting pressure due to any tendency of the vessel to topple over. The principle was this: Upon the curb or ridge were fixed little studs or brackets, to which was attached rigidly a rope. The pulleys ran round in pairs. Another design also made by Mr. Gadd before the provisional specification was lodged was for putting the corresponding gearing on the tank instead of on the curb. There would be some contest as to whether the invention, as claimed, was or was not described in the provisional specification. He understood that his learned friend, Sir Horace Davey, would contend that it was only put into the complete specification. The only function of a provisional specification was to define the nature of an invention. The specification described the improvement as relating to the construction of gasholders; and it had for its object the supporting of the vessel in its working position in such a manner as to allow of the external guide-framing being dispensed with, and yet give the requisite stability, although a modified form of framing might be employed. It was not denied that the racks and toothed wheels which were part of the arrangement were within the specification; but the defendants denied that the tensional gearing was. The question was really whether Mr. Gadd had sufficiently expressed it in the specification. There were passages from which it was not only clear that it was expressed, but the language could only, and did only, refer to tensional gearing. The wheels were to be mounted on suitable shafts or studs. A stud was a different thing altogether from a shaft. No doubt his Lordship would be told that, if studs were used, a tensional gear would not operate at all. They were to have toothed wheels, or the mechanical equivalents thereof. By having vertical racks, or their equivalents, to the outer face of the holder, the wheels might be geared by means of intermediate wheels, or by chain or link gearing. These things fairly indicated some difference from the torsional gearing, and pointed to tension. Mr. Gadd would state that the words referred to the design which he himself had previously made, and which he had explained both to his son and to Mr. Mason. He (the learned Counsel) was mentioning this mainly with reference to any question of *mala fides*; but when he came to the dry law on the complete specification, he should be able to show this was a development of the specification. On the original drawing [produced] his Lordship would see drawn, from point to point, some pencil lines, and three methods of gearing. These were drawn by Mr. Gadd at the time, to explain to his son the method of tensional, as distinguished from torsional control. Mr. Gadd saw Mr. Mason in the early part of 1888, and discussed the new arrangement with him. At the same time, he sketched a tensional design on a rough piece of paper; and Mr. Mason would say that the sketch fully explained the matter to him. The next thing to which he would call attention was that, on the 14th of December, a Mr. Pease took

* The arrangement constituting the subject of the action was fully described and illustrated in the JOURNAL for Sept. 24, 1889 (p. 599).

out letters patent for a tensional arrangement. No publication of this arrangement, of any sort or kind, was made until months afterwards; and Mr. Gadd would state that he never had the slightest idea of it until after he had perfected his own design. The complete specification showed the development of the provisional specification. The plaintiffs would have to satisfy the Court that the words in the provisional specification did refer to that which was invented, and that the complete specification was a fair development of those words. He thought nobody reading the provisional specification fairly could come to any conclusion but that the tensional arrangement was referred to, and that what was described in the complete specification was the mechanical equivalents referred to in the provisional specification. The claims were very simple. They were for the employment round a gasholder-tank of torsional and tensional gearing; in other words, there was communicated, by means of tensional or torsional gearing, a corresponding motion to every part of the gasholder—dispensing with the columns and with everything except what was upon the holder or in the tank. From a model of the defendants' gasholder which he had before him, it would be at once seen that, from a mechanical point of view, there was absolutely no difference. Instead of taking the rope continuously through, the defendants had a piece of dead rope on to which the running rope was joined. The expert witnesses would state that, having regard to the function of the tensional cords, and of the wheels or pulleys on the side of the holder or tank, there was no distinction whatever between what was described in the complete specification of Mr. Gadd and the infringement complained of. He thought it would turn out that the Corporation of Manchester were only the nominal defendants, and that the action was really being defended by the contractor, or by the gentlemen who had been opposing Mr. Gadd's patent. However, this was not material, because the question was what had the defendants used, and was it an infringement of the plaintiffs' patent? In the plaintiffs' specification, there were one or two other modifications—for instance, where the cords crossed one another. Returning to Mr. Terrace's invention, he did not know whether or not his learned friends were instructed seriously to allege that this was an anticipation of the plaintiffs' patent.

Sir H. DAVEY: Certainly.

The ATTORNEY-GENERAL said if his Lordship would look at the particulars of objection, he would find that on Nov. 17, 1888, Mr. Terrace wrote to Mr. Walker, Mr. Livesey, Mr. Paterson, and Mr. Gadd, stating what he was doing; the letter to Mr. Gadd concluding with the words that, as he might soon be going into the patent list, "he expected the matter to be kept very quiet." In every single case Mr. Terrace was writing confidentially; so that this could not be treated as a publication of his invention. The reason it was not patented was because he found out that Mr. Gadd had done it before him. They would see how far the defendants were justified in setting up a right on the part of Mr. Terrace; but, having regard to the whole of the facts, he thought the Court would come to the conclusion that the communications were of a confidential character. He had already mentioned the fact that, two days after the plaintiffs' patent, Mr. Pease, of Darlington, took out a patent for a tensional arrangement. Mr. Pease would be entitled to raise the question of whether or not Mr. Gadd was the true and first inventor. Upon this all he would say was that, if Mr. Pease was practically defending this action, and was behind the Corporation of Manchester, he had had the advantage of cross-examining Mr. Gadd and Mr. Mason. He had had the whole of his case thrashed out once, with the result that no effect had been given to Mr. Pease's allegation. From correspondence which was published at the time, he should be able to show that Mr. Gadd was referring to his tensional arrangement months before he ever saw Mr. Pease. It was suggested that there had been some publication of Mr. Pease's invention in the *Gas and Water Review* before the complete specification was filed; but the plaintiff had never been able to see the article. He would state in the box that he had never had a copy of it in his life; that he prepared his specification from his own development; and that there was no truth in the suggestion that he obtained any part of it from Mr. Pease. Hearing that Mr. Terrace proposed to patent something, Mr. Gadd became alarmed, knowing that he and Mr. Mason had perhaps unwisely delayed for eight or nine months, and kept secret, that which was known to them; and accordingly the provisional specification was at once sent to London to be filed. This was done within 24 hours of the suggestion being made that somebody else might be in the field. In the specification there was no claim of any sort or kind made in regard to the details of the gearing. All these details were old—they having been applied to a number of different things; but during the entire range of experience of gasholders, they had never been applied to anything in the way that Mr. Gadd had applied them. It was, in fact, a double invention—an invention of applying gearing to gasholders, and indicating a way in which it was applied. In conclusion, the learned Counsel said he felt sure that, in the end, his clients would not suffer from his having had to condense his opening remarks within a short compass.

Wednesday, March 30.

On the resumption of the case this morning, evidence was given on behalf of the plaintiffs.

Dr. J. Hopkinson, examined by Mr. MOULTON, said he had read the plaintiffs' specification. He described the structure of an ordinary gasholder, and said one or two had been made as large as 300 feet, while there were many 200 feet in diameter. In early days, the holder was supported by counterbalance weights; but now the gas was sent in under pressure, and this supported the vessel. Gasholders were kept steady by guides. The steadying of holders in rising and falling was of great importance. A three-lift holder might be 90 feet high; and the wind pressure on so large an area was necessarily very great. The holder was in unstable equilibrium; but the wind pressure was the most important element affecting the stability. The circular staging to carry the guides had to be the height of the holder when fully extended, and was therefore very heavy. Prior to plaintiffs' patent, in 1887, he knew of no other device for supporting the holder. In that patent the position of the holder was determined by its lower edge. There were two forms. In one there were on the side of the tank rollers which ran on spiral rails, and so the holder went up with a

screw motion, turning round as it rose. In the other modification, the rails were on the holder instead of the pulleys. This he should not call a torsional arrangement, although the holder twisted in its rise. It was a geometrical rather than a mechanical twisting. Torsional gearing was a means by which power was transmitted by the twisting of a shaft, as in cog-wheels. There was also torsional action with a flexible shaft, as in a dentist's drill. In tensional gearing, the power was transmitted by the direct pull of a rod, rope, or chain. The specification of 1888 now sued upon first stated the object—viz., to enable the upper guide-framing to be dispensed with, and yet secure the requisite stability. Witness described one way of doing this with certain variations. There was a model in Court showing one method described. On the gasholder were fixed a series of racks in a vertical position, eight in number. On each of those ran a toothed wheel carried on shafts running in bearings on the rim. Being connected in pairs on each horizontal shaft, the toothed wheels could only turn at the same rate; and this being similar with each pair all the way round, no portion of the holder could rise higher than any other. Every point must rise to the same height; and it rose, not with a screw motion, but with a parallel vertical motion. The same principle would apply to a two-lift or a three-lift holder. In the converse case, which was described in the plaintiffs' specification, the racks would be fixed in the tank, and the pinions were attached to the holder at the lower part. The form shown in figs. 1 and 2 of the provisional specification referred to such a method. That specification indicated that certain modifications might be employed; for instance, mechanical equivalents for the racks and for toothed wheels. In his opinion, there was nothing in the complete specification not properly included in the provisional; they were all adumbrated there. Two distinct forms of torsional gearing were shown: In figs. 1, 2, 3, and 4, pinions carried on shafts; and in figs. 5, 6, 7, and 8, one of a different kind, but still torsional—there being fixed on the holder nuts in which worked vertical long-pitched screws, each of which carried at the top a bevelled wheel, which geared into two other bevelled wheels carried on a horizontal shaft, and so it was rendered impossible for one of the nuts to rise to a greater height than another, because they were connected together through these screws and wheels. Figs. 9 and 10 showed another arrangement, in which both torsional and tensional forces came into play; chains being introduced. Figs. 11 and 12 showed a method in which ropes were attached to the holder carried under rollers on the tank up to the top of the holder, and down again in such a manner as to preserve its equilibrium. In another form, the ropes were fixed to the tank instead of to the holder; but the effect produced was exactly the same. Models showing the application of these different methods were exhibited, exemplifying the various modes in which the ropes might be carried. They were all equivalents for one another, and were fairly included within the provisional specification. Witness said he had had a drawing made, following one of the alternatives in the provisional specification; and it was practically identical with one of the models produced. [Witness explained this drawing to his Lordship.] The other figures could be dealt with in the same way; chain gearing might always be substituted for racks and pinions—they would produce the same effect. So far as he knew, the invention was novel at its date; and it was useful. He had not seen the infringing gasholder—only a model and a drawing of it. A model was produced; if that was correct, it was an infringement of the plaintiffs' invention. The sole difference was that at the top there was a rope which ran round the gasholder, and to this rope the vertical ones were attached. The existence of that circular rope round the top did not make any material difference. The directions in the plaintiffs' specification were quite sufficient to enable the invention to be carried out.

Cross-examined by Sir H. DAVEY: Gearing was any instrument by which power was transmitted from one point to another. That was in its broadest sense. He should describe a driving-belt as gearing, because it imparted motion. *Prima facie* it meant some device by which the motion of two parts were connected together or imparted from one to the other. He knew Spon's "Dictionary of Engineering." Counsel having read from that work a long definition of the word "gearing," witness said he did not consider it adequate, as it assumed throughout that one element had a circular motion, which he should not regard as necessary. He could not mention any book on mechanics in which this was not referred to as one of the elements.

Justice KEKEWICH said he had referred to the "Century Dictionary," in which the definition was wider—"parts collectively by which motion communicated to one part of the machine is transmitted to another." This seemed to sweep up a good deal.

Cross-examination continued: The word "gearing" was undoubtedly a little ambiguous. It was sometimes used in the narrower, and sometimes in the wider sense. He should describe as a "gearing" a rope used to pull up something; but he could not refer to any book in justification of that statement. The word "rack" was perfectly clear—a straight bar with teeth cut upon it, in which a toothed wheel worked. Turning to the plaintiffs' provisional specification, and comparing it with the beginning of the one of 1887, they were, he held, practically identical. The patent was for the means of effectuating the object therein described. It was contemplated that the upper guide-framing might still be employed, if desired. The specification referred to vertical racks, or any mechanical equivalents, attached to the tank. Anything attached to the tank which would guide the holder vertically would be an equivalent. The vertical screw would be one. The nuts on the holder worked in the thread of the screw, and converted vertical into circular motion. In the model with the ropes, those ropes were a mechanical equivalent; it effectuated the same object, and, broadly, in the same way. The words must be taken in connection with the subject-matter. Fig. 7 was an arrangement of cog-wheels round the base; all the wheels being mounted on studs. In the other figures they were mounted on shafts. Witness was then cross-examined as to the mechanical equivalents of pinions and mitred or toothed wheels; and he said that a nut in which a screw worked would be an equivalent. He should consider it meant the next link in the chain of connection between the tank and the holder. He pointed out, on the model, the portions of the rope which he allocated as the mechanical equivalents of the rack and of the pinion respectively. He did not say that any mechanical

engineer would have seen that these things were included in the provisional specification; but when he saw the latter, he would see that it was included. Every variation by which the object of preserving the horizontality of the holder was effected was not within the specification; it must be a parallel vertical action, and supported from the base, where the patentee dispensed with the framework. He should not say one piece of a continuous rope geared with another portion of the same rope, but, taking it broadly, the ropes and pulleys were the equivalent of the rack and pinions. The provisional specification contemplated the pinions all being geared together, so causing the whole circumference to rise at the same rate. In the rope arrangement, the pulleys were merely to save friction. In figs. 11 to 14 there was no case in which one wheel was connected with another by chain or link gearing, as mentioned in the provisional specification. Asked if any mechanical engineer, reading the provisional specification, would gather that the nature of the plaintiffs' invention was to steady and preserve the horizontality of a gasholder by means of an endless rope passing round four pulleys, as shown in fig. 16, witness said he did not think the words would induce an engineer to put that construction on it, but he considered that it was included. The complete specification was fuller in its description, and introduced the words "vertical chains or bands passing over or between pulleys or wheels at or near the bottom of the tank." He gave as an equivalent of a toothed wheel "a notched wheel, or in some cases a plain wheel." He referred to "the peculiar character of the invention, which consists in connecting, by means of torsional or tensional gearing, a number of points round the bottom curb of a gasholder in such manner that, when one point thereof tends to rise or fall, the same tendency is transmitted through such gearing round the circle to every other point." "Torsional gearing" was a perfectly accurate expression, though he could not say he had seen it before. He could not suggest any mode of accomplishing this object which could not come within those words. The word "gearing" was employed in the broad sense; he did not think it was in a different sense from that in which it was used in the provisional specification. The rope by which a pail was raised from a well was gearing, though an engineer, if he wanted to be descriptive, would not use this term. He should not call electric wires gearing; one must have some actual mechanical motion in the elements which formed the gearing. The provisional specification adumbrated the invention shown in figs. 11 to 16, but did not clearly describe it.

Justice KEKEWICH: If a man independently arrived at the invention shown in figs. 11 to 16, and then read the provisional specification, would he say, "I have produced one of the mechanical equivalents pointed at in that?"

Witness: I think he would, almost; but it is very difficult to say, because it certainly is not there described. He would see that it effectuated the end aimed at.

Cross-examination continued: The method described in the specification of 1887 was altogether different; when there was a tendency to rise on one side, the spiral on the other side pressed on the under side of the roller, and made it rise equally. The witness was then taken to the alleged anticipations, the first being Malam's. [A model of the top lift of the Manchester gasholder, which was alleged to be the infringement, was here admitted by Sir H. Davey to be correct, and was put in and marked X.] Malam's patent was taken out in 1823. The counterbalance weights were abolished long before plaintiffs' patent; but they were in use in Malam's time. They involved the use of columns to support them. Malam's object was the same as plaintiffs'. He used three or more shafts with pinions at their outer extremities, taking into racks on the interior of the columns. At the central point they were all geared together; so that, when one side of the holder rose or fell, it caused the shaft to rotate, and by gearing into the other two shafts in the centre caused them to rotate, and so raised or lowered their exterior ends and caused the whole holder to rise or fall horizontally. This was a mechanical equivalent to Gadd and Mason's rack and pinions, effecting the same object but in a different way, and was put in a different position. If it were put underneath the holder instead of on the top—which could not be done with a large holder—it would be more nearly equivalent. It might perhaps be used in this way to steady the top lift, if it could be carried—which he doubted; but subject to correction, he did not think it could be used for the bottom. The columns were used to carry the balance weights; they might have been dispensed with for that purpose if the weights were let down into a pit, that would not require much invention. It would not require very much invention to put the racks inside the pit; but he did not think the horizontal shafts could have been carried underneath the holder to meet in the centre gear-box. [A model of Malam's holder was put in, and another model in which the gear and shafts were placed underneath the holder.] This was an exact equivalent of the plaintiffs'; but it would not be applicable to large holders. It would be in a mechanical sense the plaintiffs' arrangement. It would operate as the top lift of a telescopic gasholder. He had not seen the actual Malam gasholder at Grantham or elsewhere. The columns would not be necessary in that model if the balance weights were not required. The picture of the Grantham holder seemed to be in accordance with the specification. Having four points, connected in pairs by shafts, would be substantially the same as three converging in the centre. Wild's patent of 1850 was next dealt with. It had reference to dock gates and caissons working vertically in guides in the side of a dock. It consisted of a caisson, made in four air-tight compartments, which was filled with water and sunk, and a ship floated over it. Air was then pumped in to expel the water, and the caisson rose, raising the ship with it for repair or examination. Such a structure would be in unstable equilibrium, and the method of keeping it horizontal was described, consisting of pinions on shafts, working on racks; and various other modes were referred to. The instrument was the same as that described by the plaintiff. The caisson was analogous in a general way to the gasholder. There were mechanical differences; and the forces to be provided against were different. There was the vertical pressure of the ship in the one case, and not in the other. The object aimed at was the same; and the means employed were the same. A competent engineer, having in his hand Wild's specification, would probably be able to apply it to the case of a gasholder. He had

never seen the gasholder at Staindrop, in Durham. On a model being shown him, he said it achieved the same object as the plaintiffs'. There were ropes attached to three points of the holder brought up over pulleys, and all attached to one weight. As a mechanical problem, it was the same as the plaintiffs'; but there were certain important differences in the way in which it was carried out. He had seen Hanlon's American patent—it was in substance the Staindrop holder duplicated. Nicholson and Cole's patent was for a portable gasholder for use in railway carriages, with flexible sides and rigid top and bottom. It provided for the horizontal descent of the diaphragm or top, by means of cords and pulleys; and it was similar to the plaintiffs' fig. 14—the same principle, undoubtedly. A reasonably skilful engineer with this in his hand would be able to apply it to an ordinary gasholder by strengthening the cords or using chains; it was all old mechanism applied to a new purpose. Hayward's American patent, of which a model was produced, was practically the same thing over again. The last alleged anticipation was Standfield's patent, of 1883, for floating docks, hydraulic lifts, pontoons, &c.; but he said it was applicable to any other kind of platform which required to be kept horizontal. Fig. 21 there was identical with one of the elements in fig. 16 of the plaintiffs'. There was no question of mechanical equivalents. It was exactly the same thing, and used for the same purpose, in the sense of preserving the horizontality of the structure. In Gadd's case, the forces to be provided against were quite different. With a gasholder, there was practically only wind pressure to be dealt with—lateral pressure. In all the other cases, the disturbing pressure was vertical. He did not draw a distinction from the fact that the plaintiffs' had to be used in several sections; but it had to be arranged symmetrically round the holders. The invention consisted in the application of the means to a particular object. He had seen Sir Frederick Bramwell's paper on the St. Thomas's Floating Dock. In that case, there would be a certain surface exposed to the wind, but nothing like that in a gasholder.

Re-examined by Mr. MOULTON: The claim in plaintiffs' patent was for torsional gear arranged round a gasholder. That was an important matter, as contrasted with crossing over the top, especially in large holders; and it was essential for telescopic holders. In Nicholson and Cole's patent, the arrangement was diagonal; the element of mechanism was the same, but was applied in a different way. In the plaintiffs', the various elements passed the strains on from one point to another all the way round. In Hayward's patent also the strains were taken straight across from one point to the opposite one. In Malam's torsional gearing, the same thing occurred—it was carried over the top. Malam's patent could not, he thought, be applied to the middle or bottom lift of a telescopic holder—it was not directed to doing away with pillars. In the Staindrop arrangement, the force counteracting the wind force was limited by the weight employed; in the plaintiffs', the whole weight of the holder was utilized in that way. A man would not pass from that to Gadd's without invention. In Wild's patent, there was a long shaft along the side of the pontoon, with pinions at intervals gearing into racks on the wall of the dock. In none of the anticipations was there anything to suggest the application to a gasholder. Questioned as to whether invention was required to go from one to the other,

His LORDSHIP said he declined to take the opinion of Dr. Hopkinson or anyone else on that question. He should be glad if he could.

Re-examination continued: A pitch chain and tooth-wheel was an equivalent of a rack and pinion. Several hypothetical questions founded on assumed alterations in the patentees' description were put; and the witness said they would work.

Sir H. DAVEY objected to this kind of examination.

His LORDSHIP said he did not think it was of much use; but he could not stop it.

Re-examination continued: The object of the invention was clearly stated in the provisional specification.

Mr. W. Gadd was the next witness. He said he was one of the co-patentees, and he was a consulting engineer, carrying on business in Manchester. He had given a good deal of attention to the question of gasholders, commencing in 1887. As far as he knew, the patent of that year was the first instance of a gasholder stayed against wind pressure without framework. After that he continued to give his attention to the matter, to see if he could find any other means of arriving at a similar result. In November or December, 1887, he made the second invention. In December, or the beginning of January, 1888, he instructed his son to make studies of the matter; and two drawings or sketches were made, besides one which was abortive. One only of those drawings had been preserved, which was made certainly before February, 1888. It bore some marks of his own upon it; but the greater portion was his son's work, who was then a student. He spoke of the invention to his son, and to Mr. Mason—to his son in December or the beginning of January, and to Mr. Mason in February—in his dining-room. He was conversing about the first invention; and said he was prepared with another. Mr. Mason was financially interested in the first patent. He explained to him how the new invention was to work; that he proposed to accomplish the same end as in the first by means of gearing at the base of the holder, so that the guide-framing might be dispensed with. He made some rough sketches on the margin of a newspaper—some racks and pinions, and some arrangements of ropes, similar to the one shown in fig. 12. He communicated to his son the nature of the invention generally and the torsional gearing; the notes on the drawing showed that, and also an indication of tensional gear. [The drawing was produced.] The question of applying for a patent was discussed with Mr. Mason; and he thought it better to wait a little, and push the first patent. The first holder on the system was erected at Northwich in 1890. In December, 1888, he received a letter from Mr. Terrace. It was dated the 7th; but he did not receive it until the 9th or 10th. He answered it on the 11th, saying he had applied for a further patent; and did not think any plan could be devised which would not be an infringement of one patent or the other. At the time, he had no idea of what Mr. Terrace's plan was. On the same day—the 11th—he sent up the provisional specification; and on the 13th, received the certificate. He subsequently learned Mr. Terrace's method, which was shown in one of the models. Nothing in the provisional specification came from

Mr. Terrace or any other person. Further correspondence ensued; and on Jan. 8, 1889, an article appeared in the JOURNAL OF GAS LIGHTING on Mr. Terrace's invention, which he replied to on the 15th of that month. He saw nothing anywhere which aided him in drawing his complete specification.

Thursday, March 31.

Mr. Gadd, in further examination by Mr. MOULTON, said the invention disclosed in the provisional specification was for guiding a gas-holder without upper framing—placing in the base all the resistances to lateral pressure. Arrangements for that purpose were described, and mechanical equivalents were referred to. All the figures in the complete specification were a fair outcome of the provisional specification; and they could all be applied to telescopic holders. Before this he knew of no method for steadying from the base gasholders rising vertically. Arranging the tensional gear round the holder was an important point; it transferred the strain from one point to the other, and was much superior to a method which carried the strain across the top, which was impracticable for all but small holders, and would not do at all for telescopic ones. The devices shown on the second sheet of drawings were mechanical equivalents for those on the first sheet. In one case the force was transmitted by torsion through the shaft, in the other by tension. Rope gearing and belt gearing were common terms, especially in Lancashire; and the use of rope gearing in lieu of tooth-wheel gearing was also very common. Dealing with the anticipations relied upon by the defendants, he said Malam's specification contained nothing that would lead a person to think he could dispense with the vertical framing, or that would suggest that the gearing could be put underneath the holder. He knew of no such arrangement existing anywhere; and it was generally thought that it was improper to guide a holder solely from the base. As to the Staindrop holder, it was suspended from columns, and balanced by one weight instead of several as in old forms. It was totally different from his own method. Hanlon's was very similar to the Staindrop holder. The chief object appeared to be to enable the pressure on the gas to be regulated; but the columns were the same as in the ordinary method. Nicholson and Cole's patent would not teach anyone how to keep gasholders steady from the base, without upper framing. The base was a fixture, and the top rose and fell like an accordion; and the cords were carried across, not round the circumference. In Wild's patent, there were long shafts round the side of the caisson, carrying pinions working in racks, one at the top and one at the bottom. They were not connected by bevelled wheels. Nothing there would teach a person how to keep a gasholder firm and steady. The elements of his appliance were all old. There were the same elements in Standfield; but the latter was only applied to platforms, and the top of the platform could not rise above the guides. There was nothing there to teach a man how to apply the principle to gasholders without invention. The defendants' model had been made from drawings supplied by them, and was an infringement of his patent.

Cross-examined by Sir H. DAVEY: The Patent Gasholder Syndicate consisted of himself and Mr. Mason. An advertisement in the JOURNAL OF GAS LIGHTING in February, 1890, headed "Revolution in Gasholder Construction," was inserted by the Syndicate; the statement, "our alternative arrangement of torsional and tensional gearing we do not now recommend," referred to the 1888 patent. It was not suitable for large holders. It was for small holders, when used in its entirety; and for the upper lifts of large holders. He was not aware of any gasholders being erected under the 1888 patent. The Syndicate proposed to carry on the business of making and supplying gasholders. The advertisement was repeated several times in 1890; he did not write the advertisement. He knew the JOURNAL well, and had written several letters to it. He took it in in 1888, 1889, and 1890, and generally read it. He wrote a letter which was published on Jan. 15, 1889, referring to Mr. Terrace's suggestion, in which he said "he could not advise its adoption except for very small holders." He should adhere to that still, except that he should omit the word *very*. On the 15th of October, there was another letter, in which he said: "We do not think, any more than does Mr. Bridge, that any of these variations are either so good as the spiral, or likely to be accepted with favour by gas engineers, except perhaps for small holders, or it may be added lifts to existing holders." He still remained of that opinion; it was useful for small holders, and for upper lifts of any sized holders. The drawing he produced yesterday was the only one made before the date of the specification which had been preserved. He was quite sure that one of the rough drawings he showed to Mr. Mason was an elevation of such a plan as was shown in fig. 12—ropes affixed to the base, and carried round. In a letter of October, 1889, he said his specification did not confine action to the bottom curb, although his studies led him to the conclusion that nothing was gained by leaving it. This expressed his view then and now. He thought he had detected in Mr. Pease's letter an attempt to limit the words "bottom curb" to one particular piece of angle-iron. The provisional specification he considered indicated the rope arrangement. It was not specifically mentioned, because he thought that was proper matter for the complete specification. He considered he had more than adumbrated it. It was clearly shadowed forth—a fairly-defined shadow. He showed clearly that the arrangement was for gearing round the gasholder-tank. Witness was cross-examined at some length on the wording of the provisional specification, and as to what were the mechanical equivalents of the arrangements specified. He did not agree with Dr. Hopkinson that the pulleys on which the ropes ran were merely friction pulleys; they were also points of resistance by means of which the force was transmitted, and therefore formed part of the gearing. A strained rope round a pulley he had always been taught was the equivalent to a rack. In figs. 12, 14, and 16, he thought all the wheels were geared together by the rope. He considered the tensional transmission of the motion by means of the ropes was equivalent to the torsional transmission by means of the pinions on the horizontal shafts. He could not say whether or not he agreed with every answer given by Dr. Hopkinson on this subject, because it depended on the definition in each case of the word "gear." The peculiar character of the invention was guiding a gasholder, by means of gearing at the base, in such a manner that every point should be raised together; it included any known mechanical device

for securing the same end in the same manner. The object of the 1888 patent was expressed in the same language as that of the patent of 1887; but the method of this patent was not included in that. In that case the base of the holder was held horizontal by the spiral guides; the stress was communicated by the holder itself, acting as a girder. The patent of 1888 was for a means of effecting a known object. He regarded it as an alternative method of attaining the object aimed at in the 1887 patent. Being a patent agent as well as an engineer, he drew his own specification. He did not think it necessary to describe more particularly the tensional method of carrying out the invention. It included three methods—torsional, tensional, or a mixture of the two. Any method included in these would be within the patent. Since 1887 he had given much attention to gasholders. In March, 1889, he did not, so far as he recollected, hear that the Corporation of Manchester desired to add a lift to one of the gasholders at the Rochdale Road works. He did not remember seeing an advertisement for tenders. He knew the firm of Messrs. Ashmore, Benson, Pease, and Co., Limited; and they were large manufacturers of gasholders. He knew that Mr. Lloyd Pease applied for a patent two days after his own application. He had read the complete specification, which described a means of effecting the same object as that in his own patent by ropes and pulleys. The infringement was in substance in accordance with Pease's patent. He knew nothing about the contract with the Corporation, or the arrangements Mr. Pease made with them, or that a model was sent to the Gas Committee which was placed in the Town Hall for public inspection. He never heard of it till that moment. If he had heard of it, it would have interested him; but he had never heard anyone mention such a thing. There were newspapers in Manchester, and they fully reported the proceedings of the Corporation. He could not say he always read them, not even when they dealt with gas matters. He had been informed that Messrs. Ashmore erected the holder of which he complained as an infringement. He never read the *Gas and Water Review*; he did not know he had ever seen a copy. He did not therefore see an article in the number for April 20, 1889, describing Mr. Pease's invention, and models of it. Reverting to the alleged anticipations, he did not deny that the mechanism employed by Wild was the same as his own; but the structure was not analogous. The pontoon never rose above the guides in which it moved, though the ship upon it did. A gasholder was entirely different from a pontoon. It would require invention to apply Wild's mechanism in the manner he had done; but the problem to be solved was different. The invention came in in applying the mechanism to the base of a circular structure. He did not know of Wild's invention, but he did of similar arrangements. Standfield's was identical with one section of his fig. 16. But it was applied to lifts, floating docks, platforms, &c.; and he thought it would require invention to apply it to a gasholder. The change from a platform to a gasholder was not obvious.

Justice KEKEWICH remarked that the change was certainly not obvious to him; he could not see any at all.

Cross-examination continued: He thought the gasholder being circular made a difference. The bottom curb of the holder would not come under the description of a frame. In Malam's plan, he thought the ropes acted as guides. Malam probably placed the pillars there for the purpose of carrying the balance-weights. There would be no mechanical difficulty in putting his horizontal shafts under the holder; but the suggestion was never made until after this patent. He was quite sure that the rough drawing he had produced contained memoranda indicating to his mind the tensional arrangement; they would not indicate it to anyone else without explanation. He had seen the gasholder at Staindrop, and had talked to the Manager about it. He was much interested in it, as a matter of archæology. Ordinary separate balance-weights would have the same tendency, to a certain extent, to keep the holder horizontal. He had not seen the gasholder at Rotherhithe, but he had descriptions of it. While the top lift was rising, it was guided in the frame; when it became cupped, it formed a dome above the lower one.

Re-examined by Mr. CLARE: Malam's apparatus could not be attached to the middle lift of a telescopic holder. Wild's patent had the same elements as an old gasholder in a frame; it was supported top and bottom throughout its motion. The 1887 patent was quite different to the 1888 one. In the former there were no moving parts; the holder could not rise vertically; and therefore no part of it could do so. The strain was transmitted from point to point through the material of the holder itself, not by means of moving mechanism.

Mr. Thomas Newbigging, C.E., of Manchester, said that he had read the plaintiffs' specification, as well as that of Mr. Pease. They were identical in principle. The means of carrying out the invention could be considerably varied. The provisional specification referred to vertical racks fixed in the tank, or mechanical equivalents therefor. He should consider the vertical screw working in a nut, or the rope gearing, mechanical equivalents. He explained, with a small "fiddle" drill, the analogy between a cord passing round a pulley and a rack and pinion. He considered the methods described in the final specification were included in the provisional specification under the term mechanical equivalents. Until the 1887 specification was published, he knew of no means of constructing gasholders dispensing with the upper guides. It was a new departure, and a very beautiful one. There was an important difference in the 1888 patent, which provided for a vertical instead of a spiral motion. There were circumstances which rendered it desirable to obtain this vertical motion. He could not suggest any means by which Malam's method could be applied to the middle or bottom lift of a telescopic holder; and it was not suitable at all for the large holders of modern times. Nicholson and Cole's patent could not be applied to a telescopic holder; the ropes passed underneath from side to side, and the holder to which it was applied was totally different. In his opinion, the principle involved in Wild's invention was different from that in the plaintiffs' patent; and the one would not lead to the other. The pontoon was guided in the same way as an ordinary gasholder, in a framework. Standfield's patent was similar to one of the elements in Mr. Gadd's invention; but it required invention to carry it out as he had done. The strains to be met were chiefly vertical in the one and lateral in the other. There was practically no resemblance between the Staindrop holder and that of the plaintiffs, beyond the use of cords. The whole efficiency of the arrangement depended on the

weight used; and there must be an external frame. In his opinion, no one could, without invention, have arrived at the 1888 patent from any of the prior specifications.

Cross-examined by Sir H. DAVEY: There was a great difference between Wild's patent and Gadd's. One was applied to a rectangular, and the other to a circular vessel, which he thought was a matter of importance. It would require some invention even to adapt the method to a circular pontoon; and, when so applied, it would still require invention to adapt it to a gasholder. There would have to be some alteration in the mechanism. In one case the centre of gravity was beneath the top of the guide-frame; in the other, it was always above the point of attachment. He agreed with what previous witnesses had said as to the similarity and differences in Standfield's patent. He did not consider the curb of the gasholder to be a frame such as Standfield referred to. Witness was then cross-examined in great detail on the subject of mechanical equivalents and the meaning of the word "gear." He considered the ropes geared into the wheels, and should not say the wheel geared into the rope; they were geared together.

Re-examined: There were important differences, from a mechanical point of view, between a pontoon and a gasholder. The one was a firm, strong structure, carrying a weight outside; the other, a very fragile one, supported by the gas inside it. This fragility had always been considered the obstacle to guiding it from the base only. Until Mr. Gadd's invention, he had never heard of any device for the purpose.

The further hearing of the case was adjourned till to-day.

The Crowland and Eye Gas Company, Limited, has been registered, with a capital of £5000, in £5 shares.

Exhibitions of Gas Appliances at Hanley and Tunstall.—Under the auspices of the British Gaslight Company, Messrs. John Wright and Co., of Birmingham, held an exhibition of gas appliances at Hanley during the week ending the 26th ult., and at Tunstall during the past week. Lectures on cooking by gas, with practical illustrations, were given twice daily by Miss Lewis, of the Nottingham Cookery School.

Wrexham Gaslight Company.—The annual meeting of this Company was held last Tuesday. In addressing the shareholders, the Chairman (Mr. W. Overton) stated that the consumption of gas was now at the rate of 60 million cubic feet per year; the increase in 1891 having been 3,553,300 feet. During the twelve months, they had erected a retort-house and put in some extra retorts; and the purifiers had been enlarged. It would be necessary to still further extend the works to meet the increasing demands for gas; and for this purpose the Directors would have to consider whether they would make additional calls upon the last issue of shares or raise the necessary capital by way of loan. The maximum dividends of 10 per cent. upon stock and 7 per cent. upon shares for the year were agreed to.

The Mersey Tunnel of the Liverpool Corporation.—The Water Committee of the Liverpool Corporation have resolved to recommend the Council to accept the tender of a London firm to at once construct a pipe (12 inches in diameter) through the Mersey tunnel for the sum of £750. This will really form one of the permanent lines; and the Committee therefore feel themselves justified in incurring the additional expense. If the Council accept the contract, there will in a short time be a supplementary supply of water sufficient to meet the requirements of the city. In connection with this subject, it may be mentioned that the men employed at the tunnelling works held a meeting last Saturday week in commemoration of the successful completion of the boring operations; and they took the opportunity of presenting the Contractors' Manager (Mr. W. Harlowe) with a silver cup as a token of the regard in which he is held by them.

Liability for the Cost of Cutting Off Gas Outside Premises.—At the Wandsworth Police Court last Wednesday, Mr. Henry Webster, of 62, West Hill, Wandsworth, appeared to answer a summons, at the instance of the Wandsworth and Putney Gas Company, for the non-payment of charges due from him. Mr. Dawson said the defendant refused to admit their servants to cut off the supply of gas, and they were compelled to cut it off outside the premises. If the defendant had admitted the Company's servants, the gas would have been cut off without cost. The defendant said he thought he was entitled to a notice. He had had a dispute with the Company about the deposit-money, which amounted to £5. The Company had held this money for three years, and he questioned their right to detain it so long. He asked the Company to accept the deposit-money in part payment of charges for the supply of gas; but they refused to do so. Mr. Dawson said 5 per cent. interest was allowed on all deposits. This system had proved of service to the consumer, as it had resulted in a reduction in the price of gas. The defendant said other Companies returned the deposits. Mr. Dawson said his Company were not bound by others. Mr. Denman made an order for the payment of the amount claimed.

Nottingham and the Water Supply of West Bridgford.—A numerously-attended meeting of the ratepayers of West Bridgford was held last Wednesday, for the purpose of considering the question of the water supply, and adopting a petition to the Local Government Board against granting to the Nottingham Corporation the Provisional Order applied for to include the district in their area of water supply. Mr. J. J. Hill, who presided, stated that an abundant supply of excellent water could be procured in the neighbourhood; and in support of this statement, he read a report by Mr. W. H. Radford, C.E., of Nottingham, who had drawn up a scheme, and estimated the cost, including contingencies, at £7000, and the working expenses at £250 a year. The income from water-rents at West Bridgford was at least £1100 a year. The Chairman also read analyses of two samples of the West Bridgford water from Dr. Percy F. Frankland; and said it was manifest, from the report and the analyses, that the boring for water had been an entire success, that an excellent supply could be obtained in the district, and at a considerably cheaper rate than they would have to pay to Nottingham. In the discussion which ensued, the speakers were entirely opposed to the supply by Nottingham, and in favour of the local scheme being carried out—the result being that it was resolved to forward a petition to the Local Government Board, pressing them not to grant the Order to the Nottingham Corporation.

MISCELLANEOUS NEWS.

COMMERCIAL GAS COMPANY.

The Half-Yearly General Meeting of this Company was held at the Cannon Street Hotel, last Friday—Mr. JOHN BLACKET GILL in the chair.

The SECRETARY (Mr. H. D. Ellis) read the notice calling the meeting, and the minutes of the last meeting; and the report of the Directors and statement of accounts for the six months ending Dec. 31, given in the JOURNAL last week, were taken as read.

The CHAIRMAN stated that, when he last addressed the proprietors six months ago, he was somewhat sharply taken to task for having ventured to pitch his remarks in too despondent a tone. They who lived in a criticizing age were all more or less the victims of irresponsible criticism. He honestly owned that although he felt sure he drew no alarmist picture of their future at the last meeting—nor had he felt it necessary to do so—yet at the same time he could not regard with feelings of pleasure the idea of withdrawing so large a sum from their undivided profits to pay the dividend. He also felt at the time that there was a certain amount of trouble and trial in store for them. He knew perfectly well that it was a subject of considerable congratulation that they had undivided profits upon which to draw in cases of emergency. These, however, were not like the purse of Fortunatus—they were not going to last for ever; and when, half year after half year, it was necessary to make such a large dip into them, one felt a certain amount of anxiety. At the back of their undivided profits, they had their £44,000 in Consols, which could also be used for similar purposes; and possibly the time might come when they would have to draw upon them. At the same time, it was the Directors' wish—and he felt sure it was shared in by the proprietors that they should keep as satisfactory an amount as possible in Consols. It was a good thing for the Company generally that they should do so; for it equalized prices, and kept them stable on the Stock Exchange. Passing to the accounts, he remarked that it was a long time since such an unsatisfactory statement had been submitted; but circumstances had been against them. In the first place, that which was of primary importance—their coal—had cost £5000 more than in the corresponding period of 1890. They had looked to coke to recoup them; but, unfortunately, coke showed a loss of £9000. So that in the past half year their coals cost £85,000, and they had only received back from coke £26,300, against £35,700 during the corresponding period of 1890. This was, to a certain extent, possibly to be accounted for by the bad state of the cement trade, those who were engaged in which were very large buyers of coke, and they had not been using so much of late. The Company had therefore had a considerable stock in hand; but they had always found that, when they paid high for their coal in the North, they had generally been recouped, to a certain extent, by their coke. What had happened in the past half year, in regard to this article, pointed to this fact—that, in common with other companies, they had, no doubt, paid more for their coal last year than they ought to have done, judging by the state of trade. They had paid a fictitious price. But they had been obliged to do so; and when he told the shareholders that 58 per cent. of the total expenditure was on coal, they would see how important it was to get this article at as reasonable rates as they could. But besides paying high for their coal, they had not received as good quality as they should have had; and they had had many complaints to make to their contractors for sending a great deal of dross and rubbish, which interfered with the working and the illuminating power of the gas. This was a subject which always gave their Engineer a certain amount of anxiety. He had been rather surprised lately to find in one of the local papers that the Mile End Vestry were so desirous of testing their gas, that they suggested to the London County Council the advisability of making a test on Sunday. The latter were only too happy to fall in with such a view. They therefore tested on Sunday; and he was glad to say the Company had come out scatheless. They had, however, been given no peace on the Seventh Day. This was certainly a "progressive" movement. In tar they had lost £700; but sulphate was rather better—showing an increase of £1300. On turning to the other side of the revenue account, more cheering figures awaited them. They found they had received £4800 more for gas in the past half year than in the corresponding period of 1890. This, he thought, was a very satisfactory feature, upon which one was glad to dwell. The stove and meter rental had produced £181 more; and they had now 3744 stoves on hire—being an increase of 349 in the half year. In short, it had cost £146,000 to earn £173,000. Their balance was therefore £27,666, which was carried to the profit and loss account; and if the proprietors desired the dividends suggested by the Directors of 13 per cent. per annum on the old stock, and 10 per cent. per annum on the new stock, it would take £18,336 from the undivided profits, and they would then carry forward £18,494. He regretted that it should fall to his lot to recommend the proprietors that day to take a somewhat reduced dividend. The reduction, however, was very moderate—only $\frac{3}{4}$ per cent.; but he felt, after great consideration of the matter, that it was without doubt a right and prudent course to adopt. Earning so much less than their dividend, he felt that there was no doubt that, as good business men, they should certainly make some slight reduction. Another thing had rather weighed with him. As he had said, they would carry forward £18,494. The current half year could not be a very prosperous one. At the present time they were in the middle of what was called the coal crisis, which necessarily gave them all more or less anxiety, although he was happy to tell them that their existing stocks of coal relieved them from any immediate cause for trouble. As, however, they had to pay rather a high price for the coal they were taking to supply the place of that for which they had contracted, the proprietors would see that at the end of the half year the charges would be somewhat higher; and therefore he had been desirous of seeing a sum carried forward which would be sufficient for their dividend next six months. After that, he hoped they would pull through. If they could only settle the unfortunate disputes in the North, and get their coal at something like reasonable rates in the summer, with the slight increase which had been made in their price, he hoped they

would be able in a year's time to produce more satisfactorily results than those submitted that day. He informed them at their last meeting, that they would not raise their price unless they felt that it was absolutely necessary to do so, and that it was good for the Company that it should be done. They had for long struggled to keep their price at 2s. 4d.—which had been for some time the lowest in the Metropolis—and they were also desirous of impressing on their customers that gas was the cheapest and the best illuminant in the world. It was therefore a matter of great regret to every member of the Board and the Engineer that it was absolutely necessary to raise the price by 2d. per 1000 feet. He hoped, however, that this very small increase would not interfere with their business; and he did not think that it could do so. The report told them that they had had a certain amount of stock unallotted, which had had to be sold for the benefit of the Company at the best price they could obtain. They asked the shareholders to tender; and they did so, the stock being allotted to them, at an average price of £197 1s. 5d. per cent., which was very satisfactory. The report said that it was necessary to raise £35,000 of debenture stock. They had already taken powers to do so; and therefore he need only mention the matter. They would see that, having depleted their undivided profits, which had been of the greatest use to them as a sort of floating capital, it was absolutely necessary to supply the place of these funds; and at the same time, the Engineer was somewhat desirous of increasing the storage accommodation at their works to meet the increasing business. The £35,000 would be allotted *pro rata* at par to the shareholders, and it would have to be paid up on or before June 30 next; but full notice would be given of this. While on this subject, he desired once more to draw attention to the fact of how highly they paid for their capital. That day they recommended 10 per cent. on the £35,000 of 7 per cent. stock which they raised a short time ago. In days of prosperity, the Company did not feel the extra charge; and the proprietors were pleased enough to put the premium in their pockets. At the same time, it was a drain on the Company; and the proprietors must remember this, because they were so far differently situated from other companies who raised capital at large premiums which they put to their capital accounts. As to the future, it would be very unwise to prophesy regarding that which he could not possibly tell; but there were some satisfactory features connected with the Company. One was, he thought, their increasing business in the way of gas-rental, which was very satisfactory; and in the past half year they had carbonized 6000 tons more coal than in the previous half year. He hoped, therefore, that they would go on better when things settled down a bit. In their district they had 100,000 houses, out of which only 25,000 were supplied with gas. They had very often heard of the conservative working man; and probably many of them hoped that he would rather come to the front shortly. Whatever his politics, however, the working man was very conservative in the matter of lighting. He preferred his open range, with his dearly-bought coal, to the neat little gas-stove which the Company would be very glad to hire to him; and he also preferred his common petroleum lamp, with all its dangers, to cheap gas. By degrees, they would overcome this prejudice; and he hoped that in time they would derive a large rental from the 75,000 houses which they were not at present supplying. At all events, it would be their business to aim at this. Looking to the future, almost the question of the day was the labour question. It seemed to be everywhere with them. It was an unknown quantity; but it was a great factor in their prosperity. Mr. Livesey, at his recent meeting, remarked that we seemed to be approaching a time of armed peace or open warfare between capital and labour. He might mention in their own case that only a few weeks ago, as the newspapers said, "a bolt fell from the blue sky." Owing to some disagreement with coal men at King's Cross, the Company's Wapping works were not supplied with coal for about a week; because the men decided that they would not go to work until the dispute was settled. The Unions acted upon such dreadfully selfish motives that they never thought of the trouble which they inflicted on their own class, let alone upon their masters. If, however, they had no dispute with the labour market—and at present they were on amicable terms with their men—and if they got their coals on something like reasonable terms, he saw no reason whatever why they should not do better in the future than in the immediate past. Time, which settled all things, would determine this great problem; and he hoped before long that they would have more satisfactory accounts to present to the shareholders. He concluded by moving the adoption of the report and accounts.

The DEPUTY-CHAIRMAN (Mr. Robert Jones) seconded the motion.

Mr. ENNIS said he was sure that the proprietors would endorse everything the Chairman had said as to the increase in the price of the gas. The advance was an exceedingly modest one; and he thought that no consumer should dissent from it in the circumstances. He was very glad to see that the Directors had had the courage to advance the price when they saw that it was necessary to do so.

The motion was carried unanimously.

Resolutions were passed, declaring the dividends recommended, and re-electing the retiring Directors (Sir J. C. R. Colomb, K.C.M.G., M.P., and Mr. J. G. Pilcher) and the Auditor (Mr. G. Ilsley).

Mr. R. H. JONES, J.P., then proposed a vote of thanks to the Chairman and Directors, which was seconded and unanimously agreed to.

The CHAIRMAN, in reply, observed that they generally met the proprietors and proposed either the same dividend or an increase; but on the present occasion they had had to meet them with a reduction. Nevertheless, the proprietors had received them with the same kindness and courtesy which they had always displayed towards them. He could assure them that they might rely upon the Directors doing their utmost to promote the prosperity of the concern. He afterwards proposed a vote of thanks to the Engineer and other officers.

Mr. ENNIS seconded the motion, which was adopted.

The ENGINEER (Mr. H. E. Jones), in reply, said that the Chairman had informed the proprietors that good relations existed between the Company and its employees; and he desired to state that the men who had specially inconvenienced the Company during the half year were in no sense the Company's men. The chief avenue for coal for their Company was the Regent's Canal; and the men there kept the dispute up after the "gentlemen" who originated the trouble had gone back to work. Where the quarrel began, it lasted three days; where it did

not begin it lasted eight days. He received on every one of these eight days from the Secretary of the Union an intimation that he (the speaker) need not take any trouble, as all the men would resume work on the following day. They did not, however, do so; and it was quite clear to him that the Secretary of the Union had no more power over the men after the third day than he (the speaker) had. He desired to sit down with one pious aspiration—that was, that the Gas Companies would take one wrinkle from the Union; for the Unions were united and loyal.

The proceedings then terminated.

HARROW DISTRICT GAS COMPANY.

The Half-Yearly Meeting of this Company was held yesterday week, at Winchester House, Old Broad Street, E.C.—Mr. JAMES GLAISHER, F.R.S., in the chair.

The SECRETARY (Mr. J. L. Chapman) read the notice convening the meeting; and it was agreed to take as read the Directors' report and the accounts, to which allusion was made in the JOURNAL for the 22nd ult.

The CHAIRMAN, in moving the adoption of the report, referred first to the revenue account—remarking that, if it was compared with the account for the corresponding period of 1890, it would be seen that in the Michaelmas quarter the receipts increased by £127; and this implied a steady increase of business of a new kind. Then in the Christmas quarter, the receipts were £119 in excess of those of the last three months of 1890. Recollecting the character of that winter—its severity, and the demand there was for gas—he should have been contented if they had held their own, and done a similar amount of business; but it was very satisfactory to find that they had had an increase. Altogether the revenue had advanced by £258; and this, in a small Company like theirs, was very important. Looking at the expenditure side of the account, they would naturally expect to find that the item of coals had increased; and he might here observe that they had sold an additional million cubic feet of gas. The coal account had gone up by £202; wages were a little higher; and maintenance of works was £47 more. Thus nearly the whole of their increased revenue had been expended. The result of the half-year's working was a profit of £1689. In the course of further remarks, the Chairman said that the unaccounted-for gas was something less than 4 per cent.; and considering the character of their district, in which they had miles of mains upon which there were very few consumers, he thought this was extremely satisfactory. The illuminating power and the quality of the gas had been well maintained above the parliamentary requirements; and they had not received a single complaint from their customers during the half year. Having referred to the prospects of the district, which he thought were good, he remarked that in the first paragraph of their report the Directors recorded, with sincere regret, the death of the Deputy-Chairman (Mr. John Chapman), who was the largest proprietor in the Company, a Director from its formation, and was always greatly interested in its progress and success. The shareholders might well imagine the painful thing it was to the Directors to learn that their good friend, the founder of the Company, had been removed from among them; and he was sure that they would all deeply sympathize with the family. Their Engineer would now become, in place of his father, the chief proprietor in the Company; and at present the Directors did not recommend that the vacancy on the Board should be filled.

Mr. A. H. BAYNES seconded the motion, which was unanimously carried.

On the proposition of the CHAIRMAN, seconded by Mr. C. HORSLEY, a dividend was declared at the rate of $7\frac{1}{2}$ per cent. per annum on the original "A" capital, of 7 per cent. on the first additional "B" capital, and of $5\frac{1}{2}$ per cent. on the second additional "C" capital, all less income-tax.

The retiring Director (Mr. A. H. Baynes) and Auditor (Mr. F. G. Fenton) having been re-elected,

A vote of thanks was passed to the Chairman and Directors, on the motion of Mr. J. RANDALL, seconded by Mr. FENTON.

A similar compliment was afterwards paid to the Engineer and Secretary and the staff.

Mr. CHAPMAN, in acknowledging it, expressed his thanks for the sympathetic remarks which had been made in the course of the proceedings regarding the great loss which his family had sustained.

The proceedings then terminated.

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

The Half-Yearly General Meeting of this Company was held last Thursday—Mr. E. FOTTRELL, J.P., in the chair.

The SECRETARY and MANAGER (Mr. W. F. Cotton) having read the notice convening the meeting, the report and statement of accounts for the six months ending Dec. 31 last, which were summarized in the JOURNAL last week, were presented.

The CHAIRMAN, in moving the adoption of the report, expressed his pleasure at the satisfactory state of the accounts accompanying it, which showed a profit sufficient to allow the declaration of dividends at the rates of $10\frac{1}{2}$ and $7\frac{1}{2}$ per cent., and leave a balance of £334. Passing on to refer to the working, he said that 61,732 tons of coal had been carbonized; being 2070 tons more than in the six months ending Dec. 31, 1890. The cost of this extra raw material increased the expenditure by £4950, not only on account of the larger quantity of coal used, but of the enhanced figure at which it had to be purchased—1s. per ton more than in the corresponding period of the preceding year. Wages, of course, had risen with the greater bulk of coal dealt with. On this account, there was an addition of £1730. On the other hand, the quantity of gas sent out had very considerably augmented—being 646,153,700 cubic feet, or a rise of about 20 millions. The receipts consequently showed an increase of £3385. This, he was pleased to state, was largely due to the extended use of gas-engines, and to the additional

number of gas-stoves employed for both heating and culinary purposes. From July, 1890, to the present date, the Company had sent out 242 cooking-stoves and 232 heating-stoves. The residuals did not show quite so favourable a result as before, in consequence of their market value being less. The Directors anticipated that, with improved trade, the value of these articles would have an upward tendency. Many gas companies had notified to their customers an intended increase in the price of gas to recoup them for the additional outlay they had had to incur. The Directors would, however, keep to the old rates as long as possible. With regard to the electric light, it was premature to offer any remark. Still, the Directors were confident that any revenue lost through its adoption would be amply made up by the increased use of gas in the directions to which he had alluded.

Mr. C. LAWLOR seconded the motion, and it was carried unanimously. The CHAIRMAN next proposed the declaration of dividends at the rates of 10½ and 7½ per cent. per annum on the respective classes of shares; and this was agreed to.

The retiring Directors and Auditor were then re-elected; and the proceedings closed with a vote of thanks to the Chairman.

STOCKTON CORPORATION GAS-WORKS.

A New Gasholder—The Development of the Works.

A further important development of the Stockton Corporation Gas-Works was signalized last Tuesday by the laying of the centre stone of a new gasholder tank. On the invitation of Messrs. Holme and King, of Liverpool, the contractors for the tank work, there were a goodly number of the members of the Corporation present. When these had assembled in the centre of the huge excavation, Lieut.-Col. Holme requested Alderman Richardson, as Chairman of the Corporation Gas Committee, to lay the last stone to the tank, and concluded by presenting him with an appropriately engraved silver trowel and silver-mounted mallet. Alderman Richardson, in the course of a few remarks, said it afforded him extreme gratification to be the recipient of such a handsome trowel and mallet; and he was very pleased to state that the work had been carried out to the entire satisfaction of their Gas Engineer (Mr. W. Ford) and the Committee. The construction of the tank had taken no less than 20,000 tons of earth work, 5000 cubic yards of puddled clay, 300 tons of cement, 1000 tons of gravel and sand, and 1500 cubic feet of Ashlar masonry. The work had originated owing to the neighbouring town of Middlesbrough having been temporarily thrown into a state of darkness by an accident which deprived them of a supply of gas. The Stockton Corporation found that they had only a small quantity of gas in store; and to avoid the town being inconvenienced by the loss of light as in the case of Middlesbrough, this work had been entered upon.

The stone having been duly laid, the company had luncheon together. In responding subsequently to the toast of his health, Alderman Richardson gave some interesting particulars as to the history of the Stockton gas undertaking. He said that the works passed into the hands of the Corporation on July 27, 1857. In that year, the capital amounted to £20,451; in 1864, it was £21,742; in 1874, it was £30,793; in 1884, £109,204; and in 1892, it had increased to £132,856, which included what they had paid on account for the new gas tank, but did not include the completion of the contract. Then as to the make of gas. In 1858 it was 12 million cubic feet; in 1864, 20,891,000 feet; in 1874, 140,000,000 feet; in 1884, 257,053,000 feet; in 1891, 291,350,000 feet; and in the year ending March 31, 1892, 304,000,000 feet. With regard to the storage capacity, in 1857 it was equal to 200,000 cubic feet; in 1864, 450,000 feet; in 1874, 650,000 feet; in 1884, 1,050,000 feet; in 1891, 1,323,000 feet; and in the present year, 2,293,000 feet; and with the new holder they would have a million cubic feet capacity more than before they undertook this work. Regarding the profits, since 1857 they had transferred to the borough fund no less a sum than £76,797. In addition to this, when the electric light first came up, there was a scare in the country, and they thought, as many others did, that it might damage their property; so they started a reserve fund, and since 1880 they had placed to that fund £16,967. Through a loss on the Corporation water undertaking, they had transferred £5000 of the gas-works profit to the borough fund; and they had expended £5813 on renewals, while they had a balance, which he might call a caution fund, of £6154. At the time the undertaking was transferred to the Corporation, the net price of gas was 3s. 10½d. per 1000 cubic feet. In 1863, they reduced it to 3s. 5d.; in 1868, to 3s. 2½d.; in 1870, to 3s.; in 1877, to 2s. 8d.; in 1881, to 2s. 5½d.; in 1882, to 2s. 3d.; and now it was 2s. He believed, with the exception of Leeds (which he thought charged 1s. 10d.) and one or two places in the Tyneside district, there was no other town in the kingdom where gas was supplied so cheaply as in Stockton. The smallest cottager in Stockton paid no more than the largest consumer for his gas. So, too, they dealt with their coke. Every ratepayer was charged the same, whether he purchased 100 tons or bought it in small quantities. In 1886 they did away with the charge for meter-rents, for which in the last year of their collection the substantial sum of £815 12s. 6d. was derived. This was equal to an additional reduction of rather more than 3d. Those were figures of which they might well be proud; and he could say, without fear of contradiction, that the works had been so well conducted, by having one who was unequalled in his ability as a Gas Manager. Before the proceedings terminated, Mr. Ford's health was also drunk, with musical honours. It may be mentioned that the contractors for the holder are Messrs. Ashmore, Benson, Pease, and Co., Limited.

ELECTRIC LIGHTING IN LONDON.

In our "Electric Lighting Memoranda" to-day, reference is made to a series of articles on the above subject now appearing in the *St. James's Gazette*, and especially to the third, given last Thursday, which contains some figures in regard to the cost of the new illuminant as compared with gas and oil. The following is the portion of the article alluded to.

At present the whole Metropolitan area, from West Kensington to

Greenwich, is parcelled out among ten companies. Within these points, and from Swiss Cottage in the north to Battersea in the south, any house or other building can be supplied at a fixed price by the company having powers over the district. Just as gas is charged at so much per 1000 cubic feet, so current for electric lighting is charged at so much per Board of Trade unit, or B.T.U. A current of 1 ampere at a pressure of 1 volt is called a "watt;" and one hour's consumption of such a current is called a "watt-hour." The Board of Trade unit is 1000 watt-hours; and its price varies at present from 6d. to 8d. We shall say something presently about the comparative cost of electric lighting; but the householder who contemplates using it will understand from the above that, if he is charged 8d. per B.T.U., he is paying a full price, while 6d. is cheap and 7d. moderate. Taking London from east to west, the arrangements are as follows: The City, from Aldgate to Temple Bar, is supplied solely by the City of London Electric Lighting Company, Limited, which also has powers in Southwark. . . . The system is a high-pressure alternating current, generated at two central stations, with transformer sub-stations; and the price is 8d. per B.T.U., subject to a sliding scale. The adjacent area westward is in the hands of the Metropolitan Electric Lighting Company, Limited, at present the largest of all these undertakings. Besides the Holborn and Strand districts, it has powers over the whole north-western area, including Marylebone, St. John's Wood, and Paddington. The growth of its business is a good measure of the progress of electric lighting. In March, 1889, the number of lamps connected was 3468; in 1890, they had increased to 18,721; in 1891, to 46,219; and in 1892, to 92,705. Since the beginning of the year, 11,256 lamps have been added. Four large central stations supply the current, which is alternating, of medium high pressure, and transformed down either at sub-stations or in the consumers' houses; the price is 7½d. per B.T.U. Whitehall is separately supplied by this Company on the low-pressure system. The south-eastern district is supplied by the London Electric Supply Corporation, Limited, which is the pioneer Company, formerly established at the Grosvenor Gallery. It has also concurrent powers with other companies over a very large area from Charing Cross to Knightsbridge and Chelsea. Consumers in these districts have, therefore, a choice of two sources of supply. The Electric Supply Corporation has initiated a very bold system. From an immense central station at Deptford, current is conveyed at very high pressure (10,000 volts) to various sub-stations, where it is transformed down to 2500 volts, and again to 100 volts at the consumers' houses. The price is 7½d. per B.T.U. The Company is passing through a period of trouble, and has to meet considerable competition. Consequently, though the plant is designed to supply 250,000 lights, and the engines now working are equal to 90,000, only 36,463 lights are connected, which is a decrease rather than an increase. One of its competitors is the Electricity Supply Corporation, Limited, which has powers over the parish of St. Martin's-in-the-Fields. Originally started as a private concern, it has grown by natural demand, and now supplies 22,000 lamps. The price is 7½d. per B.T.U. The neighbourhood of Regent Street and Piccadilly is supplied by the St. James's and Pall Mall Electric Supply Company, Limited, as well as by the Deptford Company. The former is a small but successful undertaking, with a connection of about 41,000 lamps. The low-pressure system is used; and the price is 7d. per B.T.U. We now come to a large area, including Mayfair, Belgravia, and Victoria, over which the Westminster Electric Supply Corporation, Limited, exercises concurrent powers. The low-pressure system is used; and the price is 8d. per B.T.U. Up to now, 72,555 lamps have been connected; showing an increase of nearly 50 per cent. during the last six months. Farther West, the Kensington and Knightsbridge Electric Supply Company, Limited, ministers to the well-to-do district indicated by its name. The number of lamps connected is 40,600—being an increase of 2200 since the beginning of the year; and the price is 8d. per B.T.U. Notting Hill, again, has a Company to itself, which has made steady progress since it started last year, and now supplies between 6000 and 7000 lamps at 8d. per B.T.U. Finally, there is the House-to-House Electric Supply Company, Limited, which supplies the Earl's Court district with some 20,000 lamps at 8d. per B.T.U. This business has also increased about 50 per cent. since last year. One London Vestry—that of St. Pancras—has started a supply for its own parish; and it will be interesting to see how this experiment in municipal lighting will work. The price to be charged is 6d. per B.T.U.; and it is hoped that this will prove sufficiently remunerative to render a rate unnecessary. A very good start has been made; all the lamps which the plant is capable of supplying (about 20,000) having been taken up since last November. In the foregoing account, lamps have been reckoned at 8-candle power each. In all, the number connected up to date is nearly 400,000, exclusive of private installations.

The prices mentioned above will enable consumers to compare one supply with another; but they give no idea of the cost of electricity compared with other sources of light. On that point opinions differ; but the following table embodies the results of a series of careful experiments carried out under ordinary household conditions. The gas-lamps compared are all of a superior order; common fishtail burners are much more expensive. The following is the annual cost of maintaining a light of 48-candle power—say, 2000 hours' burning (repairs and renewals included):—

Gas at 3s. per 1000 Cubic Feet.	
Argand lamps	93s.
Wenham lamps	41s.
Albo-carbon lamps	55s.
Welsbach incandescent lamps	30s.
Petroleum at 7d. per Gallon.	
Vulcan lamp	44s.
Small lamps	58s.
Electric Lighting.	
Incandescent lamps	245s.

These results will not please everybody; but the large relative cost of electricity must be discounted on several grounds. Even at present prices, however, consumers are generally satisfied that the light is well worth the money.

BRISTOL WATER-WORKS COMPANY.

The annual report of the Directors of this Company, a summary of which has already appeared in these columns, was presented for adoption by the Chairman (Mr. E. Bush) at the meeting of the shareholders last Saturday week. In the course of his remarks, he said there had been an increase of £3528 in the income during the past year; and this he considered highly satisfactory. The number of houses laid on, after deducting voids, was 1294. The number of services for domestic supply was 47,128, the total number of services altogether being about 50,000. He thought the policy of the Directors, in taking steps to obtain additional supplies of water, had not been commenced too soon. The shareholders would agree with him that the first duty the Company had to discharge was the ensuring of a good supply of water for the city. Since the filter beds had been at work—during the whole of last year—there had been practically no complaint. Having alluded to the number and size of the mains conveying water into the city, he said that the interest on the money expended in new works coming out of revenue accounted for the reduction in the dividend proposed by the Directors. The Chelvey works, which would soon be completed, would be an additional safeguard. They hoped to save a good deal of money in pumping, having storage accommodation to the extent of 370 million gallons in the reservoir. Already they had effected a saving of £1300 for pumping, in comparison with the last three months of the previous year, which was something considerable. The Yeo Valley works had not made the progress the Directors had expected; but when they were completed, they would have a daily extra supply of 6 million gallons at a very moderate cost. The motion having been seconded, Mr. W. Latham said he was not altogether satisfied with the report. Notwithstanding that since 1888 there had been a large advance in the revenue, instead of there being an increase in dividend, it had fallen from 8½ per cent. in 1888 to 7½ per cent. He did not consider their prospects as rosy as they ought to be; and whereas last year they carried the large balance forward of £2057, this year it was only £849. He thought that, instead of looking forward to an increase of dividend, the prospect was that they would have a lower one. The Chairman replied that the charges in connection with the new reservoir which had come out of revenue represented at least 1 per cent. dividend. It was impossible to state off-hand what the cost of the Yeo works would amount to. The motion was carried unanimously. An extraordinary meeting was afterwards held for the purpose of authorizing the issue of £20,000 of preferred 3½ per cent. debenture stock; and the necessary resolution was agreed to.

Gas Exhibition at Bury.—A very successful exhibition, to inaugurate the adoption of the hiring out of gas-stoves, was opened at Bury, last Tuesday, by the Mayor. The principal exhibitors were Messrs. Richmond and Co., of Warrington (who showed their "Model" ranges with enamelled tops), Messrs. J. Wright and Co., of Birmingham, and Messrs. Wilson and Sons, of Leeds.

Kimberley Water Company, Limited.—The report of this Company for the year ended Dec. 31 states that the accounts show a profit of £27,025. After providing for the interest on debentures, &c., there remains £20,703, out of which an interim dividend of 2½ per cent. has been paid; and it is proposed to divide a further 2½ per cent.—making 5 per cent. for the year—and to write off £4953 for depreciation.

The Vestries and the Increase in the Price of Gas in London.—At the meeting of the Chelsea Vestry last Tuesday, Mr. Brass stated that a deputation had waited upon the Directors of The Gaslight and Coke Company on the subject of the advance in the price of gas, but he could not promise very much as the result. The price would not be greatly increased; but the Directors could not promise that it would be reduced. At the meeting of the Poplar District Board of Works on the same day, a communication was received from the Clerk to the Chelsea Vestry, with copy of resolutions passed at a public meeting against the increase in the price of gas, and calling upon the London County Council to take steps to protect the consumers against the exactions of the Gas Companies; also expressing the opinion that the true solution of the conflicting interests of producer and consumer in what is now a necessary of life is to be found in the municipalization of the gas undertakings. Mr. Yabsley observed that the state of things in the district did not call for any special action. He would rather be in the hands of the Gas Company, with the regulations under which they worked, than in the hands of a body which already had ten times more than it could well undertake. He moved that the letter lie on the table; and this was agreed to.

The Longton Gas Undertaking.—In the JOURNAL for the 15th ult. (p. 492), reference was made to a comparative statement which the Gas Committee of the Longton Corporation had submitted to the Town Council in refutation of certain remarks made at a meeting of that body as to the management of the gas-works. The Committee obtained statistics in regard to eight gas undertakings owned by local authorities, and 15 owned by companies, having a sale within the limits of 15 million cubic feet above or below that of Longton. The averages of the local authorities, as already given in the JOURNAL, are as follows: Capital, £82,997; price of gas, 2s. 10½d. per 1000 cubic feet; gross profits, £5013; net profits, £1018; quantity of gas sold, 80,801,688 cubic feet; gross profits per 1000 cubic feet, 1s. 2½d. We now complete the statistics by giving the averages for the companies: Capital, £57,059; profit, £5193; price of gas, 3s. 1d.; quantity of gas sold, 86,278,104 cubic feet; profit per 1000 cubic feet of gas sold, 1s. 2½d. The following figures for Longton show that that town does not compare unfavourably with the other places: Capital, £110,000; price of gas, 3s.; gross profits, £7183; net profits, £2234; quantity of gas sold, 85,405,300 cubic feet; gross profits per 1000 cubic feet, 1s. 8½d. In noticing this matter in the previous issue, the gross profits were given as 1s. 5½d. per 1000 cubic feet; but this represented the sum after deducting 175d. and a proportionate amount of meter-rental so as to place Longton on the same basis as the other local authorities. It may be pointed out that the net profits suffer through the heavy capital expenditure with which the concern is handicapped.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Edinburgh and Leith Gas Commissioners had a little diversion on Monday—a sort of sparring match between Bailie Archibald and Mr. Kinloch Anderson—over the price to be charged for gas. The whole affair was no more than a practical illustration of how to get up much ado about nothing. Bailie Archibald moved that the price of gas remain the same as at present till the time for reading the consumers' meters in October and November; and Mr. Kinloch Anderson moved that the price of gas remain as at present until altered by the Commissioners. As it was quite clear that after May 15 no change could be made till October and November, and both were agreed that no change could be made at May 15, there was really nothing dividing the warriors. Bailie Archibald's position was easily understood. He wanted to wait till the annual balance is ascertained and the coal and other contracts fixed before approaching the subject of making an alteration in price. Mr. Kinloch Anderson read this to mean that they were only in September or thereabout to take up the question. That was nonsense; because Bailie Archibald's motion did not preclude the Commissioners at their July meeting, if they were ready, resolving that after October the price should be fixed at a certain sum. All that Mr. Kinloch Anderson contended for was that, as he expects a reduction to be made, it should be announced at as early a date as possible, and particularly before consumers began to consider what lighting agent they would be employing during the winter. That was a sensible proposition; but as it was conceded by Bailie Archibald, it was a pity that the Commissioners should have been divided on the subject. A division was, however, taken, with the result that Bailie Archibald's motion was carried by 14 votes to 5. The idea that it was necessary to have any motion on the subject arose, to my mind, from a mistaken reading of the Commissioners' Act. Section 79 of the Act of 1883, says: "The Commissioners shall from time to time fix the price to be charged by them for gas to be supplied during any succeeding year, half year, or quarter of a year; and until such price be altered by the Commissioners, the price so fixed shall remain in force." The last change of price was the advance from 3s. 9d. to 4s. 6d. for a year as from May last; and it was thought to be necessary to fix the price to be charged after May next, when the year would expire. The clause quoted does not bear any such interpretation. It merely forbids retrospective advances or reductions; and it states most explicitly that, a change having been made, the price fixed shall remain in force until altered by the Commissioners. Had they been able to read their own Act correctly, and had they exercised a little patience, they might have allowed the price of gas to remain untouched till they had disposed of the momentous questions which are already, by anticipation, troubling them.

In connection with the stoppage of Messrs. John Dobbie, Sons, and Co., Leith and Elliot, it is announced that the Committee of Management of the Arbroath Gas Corporation have had submitted to them by Mr. Tait, of Edinburgh, the Trustee of the estate, an offer to take the residuals produced at the gas-works from the date of the stoppage of the Messrs. Dobbie till May 31 next, at 4s. 1d. per 100 gallons; and that they have accepted the offer. The contract price was 6s.; so that the Corporation are losing 1s. 11d. per 100 gallons, and have left over for consideration the question of a new contract for the remaining two years of the term, or the taking of proceedings against the cautioner.

A Sub-Committee of the Dundee Gas Commission have given instructions to the Clerk to advertise for estimates for the proposed alterations at the Corporation Gas-Works. These consist of the laying of a cooling-main in the west retort-house, providing new exhausters, the inspection and repair of two of the gasholders, and the renewal of the sulphate plant. The Sub-Committee have agreed to recommend that, in regard to the sulphate of ammonia and chemical apparatus, a sum equal to a fifth part of the entire cost should be charged against the revenue for ten years; so as to have at the end of that period sufficient funds to renew the plant.

A proceeding which will be watched with interest has been instituted by the Board of Supervision with reference to the Fraserburgh Gas-Works. Residents in the neighbourhood of the works have made complaint that they are annoyed by the smells which emanate from them; and the Board have written requiring the Police Commissioners to furnish them with a medical report as to whether the manufacture of gas in the locality is injurious to the health of the neighbourhood, or is so conducted as to be offensive and injurious to health, in terms of section 16 of the Public Health (Scotland) Act. Although protest was made by one of the Commissioners that, by section 30 of the Act, gas-works are excluded from the operation of the statute, it was held to be necessary to procure and forward a report as directed; and a medical officer was appointed for the purpose. The question arises whether, should the medical officer be of opinion that the gas-works are conducted so as to be offensive to their neighbours, the Board of Supervision have power to require anything to be done.

In electric lighting matters, there are one or two items worthy of chronicling this week. The Edinburgh Corporation have resolved to ask the opinion of Counsel as to whether they are entitled to delegate their powers to a private company; and the Corporation intend to take advantage of the three years allowed by their Provisional Order before doing anything in the way of introducing the light, in order that they may get the benefit of the experience of other places. This is, it must be confessed, a very sorry position in which to place a great and advanced public question. It must be very disappointing to the promoters of electric lighting to find that their protestations of the great progress they have made are not believed; but it is, nevertheless, the true position to take up, if the interests of the community are to be considered. In Dundee a Committee of the Gas Commissioners have had plans of the buildings for their installation submitted to them; and they have sent them to Professor Kennedy for his opinion. This maybe the right thing to do; but it looks like a waste of public money, considering that the plans submitted to him consist of little more than drawings of a few sheds. Messrs. Urquhart and Small, of Westminster, the electrical engineers for Dundee, have also submitted their plans of the plant they propose should be laid down; and these

have likewise been sent to Professor Kennedy. The engineers have adopted the low-tension continuous-current system, as recommended in previous reports by Dr. J. Hopkinson, and Professor Ewing.

The season is now approaching in which gas-works owners and managers must begin their inquiries after coal supplies for the next financial year. Among them all the question is whether coal is likely to go up or down in price. This is a subject on which each body will, of course, have to exercise their own judgment; but in that connection, I must say I do not see why, in these days of rings and unions, there should not be a combination among gas-owning bodies—a sort of co-operation—for the purchase and sale of materials. A Gas-Works Syndicate would be a good name to conjure with in the markets; and what a delightful revel would the gentlemen of the Stock Exchange have in its doings. To speak seriously, were such a thing attempted, these attendant circumstances would probably operate prejudicially to the gas industry; because, if the concern were made a large one, it would but add another link to the already long chain of middlemen who have planted themselves between the coal producer and the consumer. But laying aside the idea of combining in a speculative adventure, there would be great advantage in the owners of several gas-works uniting in the placing of their orders, and agreeing among themselves as to the distribution of their purchases—provided it were recognized that no profit was made by one works at the expense of the other. At present, there are numerous Associations of Gas Managers, which do much to educate the profession; why should there not be associations of owners, at whose meetings the state of the markets, labour questions, &c., could be discussed? Of course, it would require to be a condition of all such discussions that they should be held in private; otherwise the objects of the association would be defeated. This may be rather a Utopian notion, yet in these days of widespread combination and severe competition, something of the sort may come to be adopted for self-protection. At present, intending purchasers of coal may be almost certain that, if any change takes place, it will be in the downward direction. It would therefore seem to be the wisest policy to let coal contracts stand over for a little. There are indications of demoralization among the miners' organizations—a state of matters which, once begun, has always a tendency to spread with the speed of an epidemic; and everyone knows that, with the break down of the strongly-organized strike-promoting Unions of the miners, the adventitious prices which coal has commanded for the past year or two would soon dwindle away.

The local government of Glasgow is recognized to be in the hands of a Municipality which is as near perfection as any system of popular control can be. But the Municipality have the proverbial fly—in their case, it is unfortunately two flies—in their pot of ointment, which sometimes cause unpleasantness. These are the burghs of Partick and Govan, which, though in reality they form part of Glasgow, the Corporation have not yet succeeded in bringing within their jurisdiction. Both places are, however, supplied with gas and water by the Glasgow Corporation; and it is in connection with the water supply that the latest unpleasantness has arisen. In 1885, the Corporation obtained parliamentary powers which would enable them practically to double the supply of water which they take from Loch Katrine. Part of the scheme consisted of the raising of the surface of the loch by 5 feet, and the laying of a new line of main from the loch to the city. A large reservoir at Craigmaddie, which was to cost £250,000, was intended to enable them to store a 24 days' supply, was also included. The works under the new scheme have been in progress during the past six years; and a great deal of tunnelling in connection with the new pipe-line has been accomplished. At Craigmaddie, however, although excavations have been made to a great depth, a satisfactory foundation has not been found for the embankment of the reservoir. As time has advanced, too, various matters have cropped up which were not foreseen in 1885; and the Corporation are at present promoting a Bill in Parliament—a sort of omnibus measure—which is intended, among other things, to enable them to raise by mortgage a sum not exceeding £250,000, to sanction the time for the completion of the Craigmaddie reservoir being extended to July, 1897, to allow a deviation in the pipe-track, to provide water at high pressure for hydraulic purposes, and to give authority to agreements with the Duke of Montrose and other proprietors of land on the shores of Loch Katrine and Loch Arklet for the exclusion of feuing or building in the watershed of the lochs. These look innocent enough proposals, yet when the Bill came before a House of Lords' Committee this week, presided over by the Earl of Lauderdale, opposition was offered to it by the Police Commissioners of Partick and Govan. It is difficult to say what their objections were, for their case scarcely came on for hearing; the Corporation agreeing to insert in the Bill an undertaking that these independent burghs should not be prejudiced by any of the provisions of the measure. So far as can be seen, the only question in dispute was one of differential rates. Within the city of Glasgow, there is a public water-rate; but this does not exist outside, and in Partick and Govan the domestic assessment is 4d. per pound higher to make up for its absence. The Govan objectors made a general grumble that, while they were charged this extra rate, they did not get a sufficient supply of water—a position which they could not make good, and they were set aside. From Partick, the objection was that, it being proposed to levy an extra rate to cover the cost of pumping in connection with the high-pressure supply, the supply should be made compulsory in their district. They also wished to reserve powers to themselves with reference to the opening up of the streets. All the objections were, however, swept away, the general law being held to be sufficient to meet them; and the Bill, as proposed by the Corporation, was passed by the Committee. It is interesting to note in the evidence of Mr. J. M. Gale, C.E., the Water Engineer to the Corporation, that in 1891 they provided something like 42 million gallons of water per day for a population of 850,000; and that the supply to Govan was at the rate of 46 gallons per head per day. The proposed deviation of the pipe-track, Mr. Gale said, would involve the lengthening of some of the tunnels, but would shorten the route from 25½ to 23½ miles. They had in Glasgow 508 hoists and 93 hydraulic presses; and with the present pressure of from 45 to 50 lbs. per square inch, it was found that in the middle of the day, when these appliances were most wanted, the pressure fell off. What they proposed was, by

means of pumping-engines, to send water into the city by two mains, at a pressure of 800 lbs. per square inch. The cost was estimated at £45,000. Another interesting piece of evidence was that of Sir Andrew M'Lean, Provost of Partick, who said that their principal street was even now very full of gas and water pipes; and there was, in addition, a subway running along its whole length, while there was a tramway line on the surface, and a Provisional Order was being asked for the laying down of electric lighting mains. This looks like taking a full use of the ground.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, April 2.

Sulphate of Ammonia.—There has been rather more doing; and the brighter weather is apparently beginning to stimulate the demand. If this be so, it may be expected that—the season being an unusually late one, and not much time left for farm work—there will be a sharp spurt during the first half of the month; and in view of the reduced stocks, and the comparatively small quantity on the market, a probable steady advance in prices. A similar feeling is becoming perceptible in nitrate, notwithstanding that, contrary to sulphate, the position is not at all favourable. Taking the nitrate figures on March 31, the consumption in Europe up to that date (since the beginning of the year) shows a falling off of about 100,000 tons against last year; but holders confidently anticipate that the April demand will compensate for this deficiency. Last year something like 125,000 tons were taken in April; and the visible supply, to meet a similar consumption this year, is a stock of about 120,000 tons, and afloat about 100,000 tons. Sulphate quotations are little changed—Hull and Leith being £10 5s.; and Liverpool, £10 2s. 6d. Nitrate is quoted at 9s. 1½d. per cwt.

LONDON, April 2.

Tar Products.—This market continues as flat as it can possibly be. Buyers hold aloof; and distillers are full up with stocks. The outlook is extremely gloomy; and prices continue weak, with an inclination to go lower. Some business is reported in anthracene; but at a wretchedly low price. Large quantities of common oils and naphthalene salts are being burnt; and it is claimed that, when used properly as a fuel, it is worth a penny per gallon at least, and considerably more where coal is dear. A little demand has sprung up for carbolic products; but so far prices have not improved. Heavy shipments of pitch are going on; but it is mostly, if not entirely, on old contracts. Prices: Tar, 12s. 6d. Pitch, 28s. 6d. Benzol, 90 per cent., 1s. 10d.; 50 per cent., 1s. 6d. Toluol, 1s. 4d. Solvent naphtha, 1s. 3d. Crude benzol naphtha, 30 per cent., 10½d. Creosote, 3½d. Naphthalene salts, 20s.; pressed, 45s. Carbolic acid, crude, 60's, 1s.; 70's, 1s. 4d.; crystals, 4½d. Cresol, 8d. Anthracene, 30 per cent., "A" quality, 11d.; "B," 8d.

Sulphate of Ammonia.—The better weather now prevailing should improve this market. So far, it continues lifeless; and £10 to £10 2s. 6d., less 3½ per cent., seems to be the outside value. Gas liquor (10-oz.) is nominally quoted at 5s. 6d. to 6s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The excessive buying which went on during the recent needless excitement in the coal trade is still to some extent being felt as regards the demand for nearly all descriptions of fuel. During the past week there was again but a very limited quantity of business; and although the better qualities of round coal, suitable for house-fire purposes, have been moving off fairly well, all descriptions of fuel for iron-making, steam, and general manufacturing operations, have been hanging upon the market. Supplies have been considerably in excess of requirements; and stocks are again accumulating at a good many of the collieries. For household coals, prices have been steady, at about 12s. 6d. per ton for the best descriptions, 10s. 6d. to 11s. per ton for seconds, and 9s. to 9s. 6d. per ton for common sorts. The generally depressed state of the iron trade is necessarily affecting the demand for the lower qualities of round coal for forge purposes, and these are difficult to dispose of; while the shipping demand for steam coal has also been extremely quiet. For inland requirements, steam and forge coals could now be bought at about 8s. 6d. to 9s. per ton at the pit's mouth; while for shipment steam coal has been readily obtainable, delivered at the ports on the Mersey, at about 10s. per ton. Engine classes of fuel are again plentiful in the market, especially in the commoner descriptions; and low figures are being taken to effect sales. Burgundy does not average more than 6s. 6d. to 7s. per ton; the best qualities of slack, 5s. 6d. per ton—ordinary common sorts being readily obtainable at 4s. to 4s. 6d. per ton, and inferior descriptions, in some cases, at as low as 3s. 6d. per ton, at the pit's mouth.

Northern Coal Trade.—Despite the fact that for three weeks the Durham coal output has been stopped, prices continue to weaken. Northumbrian steam coal is quoted at about 10s. 6d. to 10s. 9d. per ton free on board, for best qualities; but contracts have been entered into at considerably less prices for future delivery. At the same time, it must be added that there have been sales for inland use at higher prices during the strike, though these were for comparatively small quantities. Second-class coals have ruled about 9d. per ton lower; and small steam coals have been sold at 4s. 6d. to 5s. per ton—a fair demand for manufacturing purposes having been known. The "fancy" prices for gas coal began to pass away when the other collieries in the country began to work; and in the course of the past few days, 12s. per ton, free on board, was quoted by the collieries that had ten days ago asked 14s. to 15s., and which had certainly made some sales at the lower of these prices. Sales, however, have been few—the production of gas coals being taken up in contracts mainly, and stocks at some of the gas works have been brought down; so that the resumption of work—which is not now far off—it is believed, will be looked for with some desire on the part of the local gas companies. Bunker coals have been much less in demand; hundreds of steamers having been laid idle, and

both the coal consumption and the labour market having been thereby affected. Manufacturing coal is dull—so many factories having been laid idle by the strikes. Coke seems to be now dropping in price from the high rates that have been quoted of late; but until operations are really commenced again at the coke-works, it is difficult to state rates. Gas coke is now produced in smaller quantities; and some of the gas companies have raised the price for retail quantities to the summer rates, but these are not likely to continue. Much, however, depends on the prolongation or otherwise of the Durham miners' strike. This appears to be hastening to an end; and there may be a more speedy resumption of work generally than was looked for a few days ago.

Huddersfield Corporation Water Supply.—According to a comparative statement of income and expenditure on revenue account of the Water Department, submitted by the Borough Accountant, at the last meeting of the Huddersfield Town Council, the profit on the financial year ending Feb 29, was £4024, as against £5754 in the preceding year. The income for the two periods was £48,650 and £47,295 respectively; and the expenditure, £44,626 and £41,540.

Lime and Oxide Conveyors.—A considerable number of experiments have been carried out from time to time with different types of conveyors for lime. At the Dawsholm Gas-Works of the Glasgow Corporation, two different designs were tried and failed. Towards the end of last year, however, Mr. Gilbert Little, of the New Conveyor Company, submitted to Mr. W. Foulis different designs of a lime conveyor, and the one approved by him is now working successfully at Dawsholm, as testified by Mr. A. Wilson, the Resident Engineer. The conveyor delivers right to the end of the trough (260 feet); and there has been no trouble with the large pieces of limeshell.

The Importation of German Gas Coal into London.—One of the two vessels laden with Westphalian coal for the South Metropolitan Gas Company discharged her cargo safely at the East Greenwich works on Monday last week, and left. The name of the vessel was the *Rosalind*, from Amsterdam. She brought from 1000 to 1100 tons, and was discharged by the Company's own men, who are non-unionists. The other vessel—the *Angelus*, from Rotterdam—laden with about 1000 tons of similar coal, was due to arrive shortly after. Mr. W. Thorne, the General Secretary of the Gas Workers and General Labourers' Union, admitted, with regard to the German coal, that the Union was powerless. He said he could not see, from the Trade Unionist point of view, that it mattered whether coal came from Germany or from Scotland.

Sales of Shares.—Last Wednesday, Mr. R. Mack sold by auction, at Newcastle, £25,000 of consolidated stock of the *Newcastle and Gateshead Gas Company*, to be issued under the provisions of the Company's Act of 1879. There was a large attendance. The stock was put up in lots of £100 each, nominal value, and fetched an average of £183 4s. 4d.—the total amount realized by the sale being £45,804 5s. The dividend is 9½ per cent.; and the Company have, by lowering the price of gas, obtained power to pay 9½ per cent. At the last sale, in 1888, the average price realized was £187 1s. per cent.—At a sale at Leeds last Tuesday, £200 of stock of the *Newcastle Gas Company* was disposed of privately at £191 per cent.; and a further £200 at £191½ per cent.—Five £10 shares in the *Horncastle Water Company*, recently changed hands at £10 15s. each.—At a recent sale by auction at Southsea 28, £10 (1857) shares in the *Portsmouth Water-Works Company* realized £28 2s. 6d. and £28 per share; 10 £5 (1861) shares, £14; 52 £5 (1868) shares, £13 10s.; 17 £5 (1879) shares, £9 2s. 6d.; and 52 £5 (£3 10s. paid) (1883 issue) shares, from £7 to £7 5s. On the same occasion, three £53 shares in the *Portsea Island Gaslight Company* produced £112 10s. each; four £50 "B" shares, £105 10s.; and six £50 "C" shares, £100.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 616.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.					£ s. d.
GAS COMPANIES.								
590,000	10	15 Oct.	10½	Alliance & Dublin 10 p. c.	10	16-17	..	6 3 6
100,000	10	"	7½	Do. 7 p. c.	10	11½-12½	..	6 0 0
300,000	100	2 Jan.	5	Australlan (Sydney) 5 % Deb.	100	105-107	..	4 13 5
100,000	20	27 Nov.	8	Bahia, Limited	20	12-14	..	11 8 1
200,000	5	12 Nov.	7½	Bombay, Limited	5	6½-6¾	..	5 11 6
40,000	5	"	7½	Do. New	4	4½-5½	..	5 14 1
380,000	Stock.	26 Feb.	12½	Brentford Consolidated . . .	100	205-215	..	5 14 1
150,000	"	"	9½	Do. New	100	155-160	..	5 15 8
220,000	20	11 Mar.	11	Brighton & Hove Original . .	20	39-41*	..	5 12 2
888,500	Stock.	11 Mar.	15½	Bristol	100	95-100*	..	5 0 0
320,000	20	15 Oct.	11½	British	20	43-45	..	5 0 0
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	10	19-20	..	5 15 0
51,510	10	"	8½	Do. 7 p. c.	10	14-15	..	5 13 4
328,750	10	"	—	Buenos Ayres (New) Limited	10	6-7	..	—
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	93-96	..	6 5 0
150,000	20	26 Feb.	8	Cagliari, Limited	20	24-26	..	6 3 1
550,000	Stock.	15 Oct.	13½	Commercial, Old Stock . . .	100	244-249	..	5 4 5
165,000	"	"	10½	Do. New do.	100	190-195	..	5 2 7
150,000	"	30 Dec.	4½	Do. 4½ p. c. Deb. do.	100	118-123	..	3 13 2
800,000	Stock.	30 Dec.	13	Continental Union, Limited .	100	221-226	..	5 15 1
200,000	"	"	10	Do. 7 p. c. Pref.	100	185-195	..	5 2 7
75,000	Stock.	30 Mar.	10	Crystal Palace District . . .	100	185-195*	..	5 2 7
486,090	10	29 Jan.	10	European, Limited	10	19-20	..	5 0 0
354,060	10	"	10	Do. Partly paid	7½	14-15	..	5 0 0
5,470,820	Stock.	12 Feb.	12	Gaslight & Coke, A, Ordinary	100	212-217	..	5 10 7
100,000	"	"	4	Do. B, 4 p. c. max.	100	94-97	..	4 2 5
665,000	"	"	10	Do. C, D, & E, 10 p. c. Pf.	100	244-249	..	4 0 4
30,000	"	"	5	Do. F, 5 p. c. Prt.	100	116-121	..	4 2 9
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	169-174	..	4 6 2
1,300,000	"	"	7	Do. H, 7 p. c. max.	100	150-154	..	4 10 11
463,000	"	"	10	Do. J, 10 p. c. Prt.	100	241-246	..	4 1 3
476,000	"	"	—	Do. K, 6 p. c. Prt.	100	145-150	..	4 0 0
1,061,150	"	11 Dec.	4	Do. 4 p. c. Deb. Stk.	100	113-116	..	3 9 0
294,850	"	"	4½	Do. 4½ p. c. do.	100	118-123	..	3 13 2
908,000	"	"	6	Do. 6 p. c. do	100	163-168	..	3 11 5
3,800,000	Stock.	12 Nov.	12	Imperial Continental	100	222-226	..	5 6 2
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4-4½	..	6 13 4
560,000	100	1 Apr.	5	Met. of Melbourne, 5p. c. Deb.	100	106-108*	..	4 12 7
541,920	20	27 Nov.	6½	Monte Video, Limited . . .	20	14½-15½	..	8 7 8
150,000	5	27 Nov.	10	Oriental, Limited	5	8½-8¾	..	5 14 3
60,000	5	30 Mar.	7	Ottoman, Limited	5	4-5*	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited	10	2½-3½	..	—
People's Gas of Chicago—								
420,000	100	3 Nov.	6	1st Mtg. Bds.	100	100-105	..	5 14 3
500,000	100	1 Dec.	6	2nd Do.	100	100-105	..	5 14 3
150,000	10	15 Oct.	10	San Paulo, Limited	10	9-10	..	10 0 0
500,000	Stock.	26 Feb.	15½	South Metropolitan, A Stock	100	266-271	..	5 14 5
1,350,000	"	"	12	Do. B do.	100	220-225	..	5 6 8
200,000	"	"	13	Do. C do.	100	235-240	..	5 8 4
725,000	Stock.	30 Dec.	5	Do. 5 p. c. Deb. Stk.	100	138-143	..	3 10 0
600,000	Stock.	11 Mar.	11½	Tottenham & Edm'nton, Orig.	100	—	..	—
WATER COMPANIES.								
729,331	Stock.	30 Dec.	10	Chelsea, Ordinary	100	225-235	..	4 5 1
1,720,560	Stock.	15 Oct.	8	East London, Ordinary . . .	100	191-196	-1	4 1 7
544,440	"	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	136-140	..	3 4 3
700,000	50	11 Dec.	8	Grand Junction	50	94-97	+1½	4 2 6
708,000	Stock.	12 Feb.	10½	Kent	100	240-250	..	4 4 0
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max. . . .	100	205-215	..	4 8 4
406,200	100	"	7½	Do. 7½ p. c. max.	100	180-185	-5	4 0 0
260,000	Stock.	30 Mar.	4	Do. 4 p. c. Deb. Stk..	100	120-123*	+2	3 5 0
500,000	100	12 Feb.	12½	New River, New Shares . . .	100	320-330	-5	3 13 6
1,000,000	Stock.	29 Jan.	4	Do. 4 p. c. Deb. Stk	100	125-128	..	3 2 6
902,300	Stock.	30 Dec.	6½	S'thwk & V'xhall, 10 p. c. max.	100	133-138	+1	4 14 2
126,500	100	"	6½	Do. D 7½ p. c. do.	100	125-135	-12½	4 16 3
1,155,066	Stock.	11 Dec.	10	West Middlesex	100	236-241	..	4 16 0

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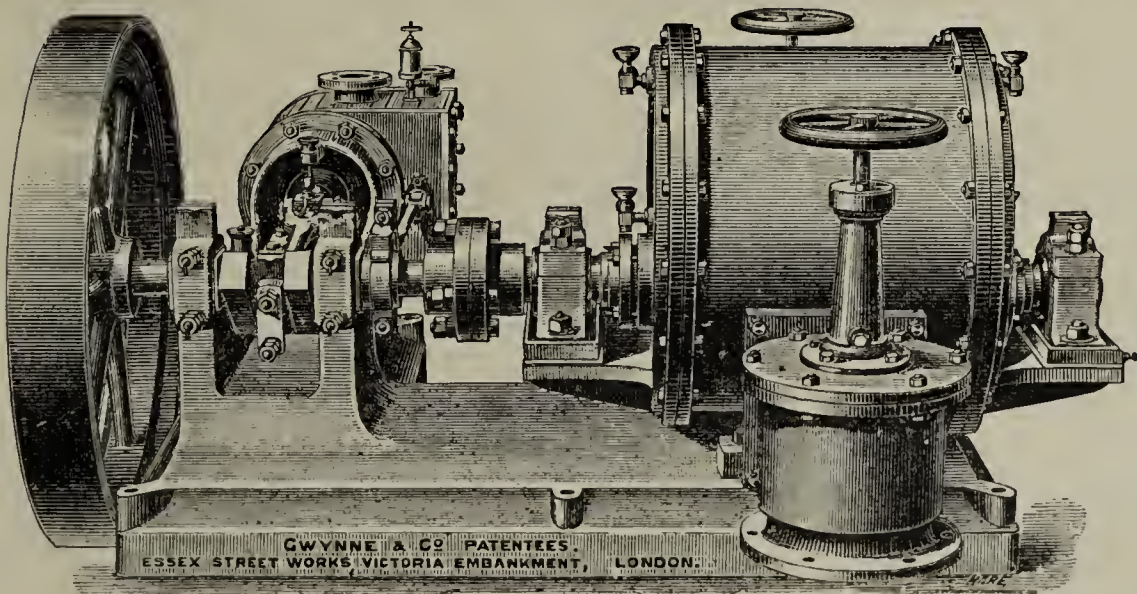
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No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

THE

JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, APRIL 12, 1892.

The Plaint of the Unemployed.

WHILE the Durham Miners' strike is dragging itself out to an exceedingly "bitter end," there has been a significant recrudescence in the East-end of London of the once familiar "demonstrations of the unemployed." Deputations from meetings so described have sought interviews with the President of the Local Government Board and with the London County Council, and there has been a revival of the demand for the opening of "municipal "workshops" for the purpose of providing employment for the men who, it is alleged, cannot find work to do. Seeing that the bulk of the "unemployed" on whose behalf this petition is raised are admittedly dockers and

'long-shore labourers, it is difficult to realize the sort of municipal workshop in which such men could find congenial tasks. Are London and Newcastle, for example, to send, out of the rates, cargoes of coal backwards and forwards from port to port, for the express purpose of their being loaded and unloaded over and over again? However, this is a detail; and it is the invariable character of Social Democratic schemes to break down in regard to details. Messrs. Mann and Tillett will tell the world any day how to abolish poverty *en bloc*; but it would puzzle them to keep in regular remunerative employment the first street loafer they might meet. It may or may not be true that there is an exceptional amount of distress in the East-end of London and elsewhere, through slackness of trade; but if this is so, is it not at least remotely possible that the vagaries of the North Country miners and East Coast engineers may have something to do with it? It may be noticed that the self-styled friends of the labouring classes talk glibly enough about the desirability of the Federation of Labour, by which they mean the collection of all the actuating wires of Trade Unionism into a handful convenient for manipulation; but they seem incapable of realizing the very close economical connection that actually exists between workers, not merely in the same and in different districts of the same country, but also all over the world. Yet it is perfectly clear, as Lord Derby told an audience of Lancashire operatives some years ago, that a famine in China, which would hardly be reported in the English newspapers, might be the cause of many a Lancashire child going supperless to bed. Much more then is it true that the circulation of hundreds of thousands of pounds in wages cannot be interfered with save at the price of inflicting widespread discomfort. But the demagogues who appear to engross the ear of the workman never take account of such considerations as this, and seem to revel in the spectacle of one set of labourers starving another.

Meanwhile, it would be amusing, if it were not so painful a sight, to mark the struggles of the demagogues not only to keep the favour of the class of men whom they pretend to represent, but also to make this favour worth having. Several mutually antagonistic "leaders" are asserting their right to speak in the name of the "unemployed," and accusing each other of complicity in a "put-up job" devised for private and personal ends. The professional organizers of the newer Unions, moreover, are full of complaints against members for not keeping their tickets paid up; but the slackness of many trades is making it increasingly difficult for these Unions to keep their standing. It is all very well in busy times to form "Trade" Societies of dockers, cement workers, ship scrapers, road sweepers, and so forth; but when slack seasons supervene, what is there to prevent followers of one of this order of "trades" from crowding out the duly inscribed members of another? The out-of-work cement labourer has as good a right to look for a job at the docks, as Mr. Tom Mann (say) has to join the staff of the *Workman's Times* when his own *Trade Unionist* goes to pieces from lack of support. The worst of it is, moreover, from the point of view of the professional agitator, that, with the collapse of the Unions, the number of paid officials must decrease; and who is then to provide for the young men with a turn for mob-oratory, and a disinclination for manual labour, who have taken to this easy, dignified, and profitable mode of life? Of course, it is open to the Progressive Party to insert a "plank" in their "platform" respecting the payment of Members of Parliament, and of every other public body, out of the rates and taxes, in order that England may participate with the United States in all the blessings that flow from the endowment of politics as a profession; but, in the meantime, where is the virtuous demagogue to look for his wages? We notice that the working men of London, although accustomed to cheer the great and glorious John Burns to the echo, are by no means free with their coppers for his support. It has recently transpired that John Burns has hitherto been paid his regular wages of £2 per week, and allowances, of which £1 per week has come from the Dockers' Union. But the funds disposable for this purpose "have shown a constant shrinkage, and the outgoings "from month to month have always exceeded the income." This is very sad. Even Battersea, which is understood to worship John Burns, will not come to his rescue in this regard; the reason assigned for this backwardness being

that in Battersea there are no large Trade Unions to which the Committee of the John Burns Wages Fund can look for help. This is as much as to say that such organizations exist for the purpose of affording support to professional agitators. We have long suspected it; but now the admission has been put upon record.

The Gasholder Patents Litigation.

GAS engineering readers of the JOURNAL will naturally take a keen interest in the action of *Gadd v. Mayor, &c., of Manchester*, which is now occupying the attention of Mr. Justice Kekewich. We gave last week a special report of the opening of this case; and a further instalment of the proceedings will be found in another column. The action is really between Messrs. Gadd and Mason, as plaintiffs, and the well-known engineering firm of Messrs. Ashmore, Benson, Pease, and Co., Limited, as defendants; and its subject is the celebrated novel gas-holder guiding without lofty external framing, for which both Messrs. Gadd and Mason and Mr. E. Lloyd Pease (of the Stockton firm) hold patents. We cannot enter at present into the merits of the case, which stands adjourned, after six days' hearing, until Tuesday, May 3, when another day or two may be expected to finish it; but we may at least indicate, in quite general terms, the nature of the issues before the Court. It will be remembered that Messrs. Gadd and Mason patented in 1887 their ingenious method of guiding gasholders from the base, by means of spiral tank-guides; and they followed this up in the succeeding year by a second patent having the same general object of dispensing with lofty guide-framing, but effecting this end without sacrificing the vertical motion of the holder. In the interval between the filing of Messrs. Gadd and Mason's second provisional specification and the deposition of their complete specification and drawings, Mr. E. Lloyd Pease obtained provisional protection for his now well-known system of rope-guiding for gasholders; and he brought this invention out (as is not disputed) without having the faintest notion that he was clashing with Messrs. Gadd and Mason. Very soon after the Pease system had been provisionally protected, the inventor's firm sought to put it in practice in the ordinary course of their business as gasholder builders; and they did so apply it to a holder belonging to the Manchester Corporation. At this time, it is important to bear in mind, for the understanding of the present case, that both patents—the second one of Messrs. Gadd and Mason, and the only one of Mr. Pease—existed merely in the provisional protection stage. According to the evidence, there were no means open whereby anybody could have discovered the character of Messrs. Gadd and Mason's intentions; but there was at least a possibility, in connection with the Manchester gasholder contract and otherwise, of other people learning the nature of Mr. Pease's plan. When the complete specification and drawings of Messrs. Gadd and Mason's patent appeared, however, they contained mention of ropes for gasholder guiding, to which purpose Mr. Pease had also applied them—to wit, in the Manchester example already referred to. In these circumstances, Messrs. Gadd and Mason took the view that this Manchester application was an infringement of their patent, which ante-dates that of Mr. Pease; and consequently they took these proceedings against the Manchester Corporation—practically, against Mr. Pease's firm, who have been under the usual necessity of indemnifying their customers against risks of this kind. The course of the Chancery proceedings thus initiated by Messrs. Gadd and Mason has run upon the lines of the setting up, by the plaintiffs, of their patent as being a good one; while the defendants plead that the patent is bad on account of disconformity and anticipation, in the usual style. How these various pleas are being supported must be ascertained from the reports. We shall content ourselves for the present with remarking that a technical museum would benefit greatly by receiving from the parties a present of the elaborate models and other exhibits used to demonstrate the nature of the issue before the Court. We had occasion last week to refer to the litigation respecting the Lane-Fox electrical distribution patent; and it is a noticeable coincidence that the arbitrament of the Chancery Division of the High Court of Justice should be sought, at practically the same time, by litigants so conspicuously representing the two chief branches of the industry of artificial lighting. The

same leading Counsel have been engaged in both actions; and they have shown themselves equally familiar with the refinements of electrical science and gasholder construction. The technical teaching imparted through the agency of the Superior Courts of Law is doubtless the best that can be had; but the worst of it is that it is horribly dear. We shall have more to say upon this subject on a future occasion.

The Rating of Machinery.

THAT hardy parliamentary "annual," the Rating of Machinery Bill, has again been read a second time in the House of Commons, and duly referred to a Committee, from whose care it will be marvellous if it emerges in time and fit condition to become law. A good deal of assertion and counter-assertion is always made about the scope and object of this measure whenever it comes up for public discussion. The fact that it is called in some quarters the "Manufacturers' Relief Bill," is an indication of the *animus* which it has excited in the minds of representatives of other interests; but there is doubtless much to be said for as well as against it. Seeing that gas-works machinery is exempted from the scope of the Bill, our direct interest in it is small. Indeed, it is the piecemeal and partial character of the measure which has more than anything else prevented it from becoming law. Some people roundly contend that, under the pretence of removing some anomalies, and righting a few wrongs, it will, if passed in its present shape, create more evils and work further mischief than anything existing under the actual law of rating. That the law of rating and the practice of assessment need reforming, nobody who knows what is done under these names will deny. But confusion would be worse confounded by the passing of any Act to discriminate, in the matter of rating, between machinery employed in some kinds of factories, and similar machinery used for other purposes. Let the law of rating be amended, by all means; but let it be done in accordance with some intelligible and universally applicable principle, if this can be ascertained. We are all interested in the improvement of the law of rating, and the cheapening of the process of arriving at fair assessments in cases of dispute; but if we are not all to be treated on the same footing in this regard, things had better remain as they are.

Municipalism in Action.

THE judgment of Mr. Justice Collins, in the action that was brought last year by the outlying Local Boards served with gas by the Oldham Corporation, to compel the Corporation to bring into their accounts the value of the gas used for lighting the public streets within the borough, was taken into the Court of Appeal last week, with the result that the learned Judge's decision was upheld. Looked at in one way, the question in dispute is of very narrow local interest. It can hardly matter very greatly to the outside world whether certain localities in the neighbourhood of Oldham pay 1d. more or less per 1000 cubic feet for the gas which they draw from the central gas-works of their district; but there nevertheless is a point of general interest in this particular Oldham question, which should keep it from being overlooked by students of the higher politics of gas-works administration. In fact, Oldham is a potent example, in more than one respect, of the results of municipalized gas supply. For many years the Corporation Gas Committee treated their outlying consumers in the most high-handed manner conceivable of any gas company of ante-sliding-scale days. In the fulness of time, however, these latter had full and complete revenge, when Parliament did something to bring the Gas Committee to their bearings. Thereupon the Committee found a way to baulk the outsiders of some of the benefit which they had hoped to gain from the action of Parliament, by taking advantage of a sanction undoubtedly existing in an old statute. Herein lies the interest of their proceedings. We may see, by this example, that there is no morality about municipalized gas supply. It is idle to say of a corporation gas committee that this or that ought or ought not to be done. Such language is wholly beside the question; which is only as to what is profitable, and permitted. As we said last week with reference to Salford, anybody who may be disposed to think that gas supply by municipalities cannot give offence, should be recommended to quit the dreamland of the Socialist, and open his eyes to

the facts. Again, every local opponent of a municipality should take warning by Oldham, and see to it, at the proper time, that there are no old statutory sanctions in the background which can be put in operation to defeat later parliamentary intentions. It may well be a question whether some limitation should not be imposed upon the revival of musty statutes under new conditions; but, in the meantime, whenever there is a parliamentary fight over a Municipal Gas Bill, it should be a *sine qua non* that every anterior statutory provision should be paraded for review, and, if necessary, for amendment or repeal. In these matters, there is no falling back upon the common law of the land. Gas supply is an affair of statute law; and where any statutory sanction exists, it is idle to raise the question of right or wrong. Instances like this of Oldham might be supposed to daunt some of our modern "cock-sure" politicians of the study, who prate so glibly of the advantages to be derived from "municipalizing" everything, but for the embarrassing circumstance that these people have a truly Jacobinical trick of ignoring facts which disagree with their pet theories.

A Parisian Story.

THERE are a good many "morals" in the curious and improving story that reaches us from Paris concerning the application to the Municipal Council, in the name of an Electric Lighting Committee, for a vote of 40,000 frs. to defray the increased cost of coke over coal in the case of the Halles central station. It appears that some few months ago the Municipality was suddenly seized with a desire to mitigate the smoke nuisance in Paris, which, to quote a classical description perfectly applicable in the circumstances, "has increased, is increasing, and ought to be diminished." It was, however, pointed out that the Municipality's own chimney, attached to the Halles electric light station, was one of the worst offenders in all Paris; and that, pending the discovery of a perfect smoke-prevention apparatus capable of dealing with the inferior French coal patronized by this intensely patriotic authority, only the use of the coke sold at a very respectable figure by the Paris Gas Company would enable the Municipality to embark upon its new crusade with clean hands. It is not likely that the Company, which is conspicuously French in every one of its dealings, would sell coke for such a purpose at a centime below the highest price that could be screwed out of the Municipal Electric Lighting Committee; but, at any rate, it turned out that the cost of coke-firing in this instance was so much in excess of that of the coal formerly used, that a grant in aid had to be asked for. As the mouthpiece of the Electric Lighting Committee politely put it to the Municipal Council, "the officials were not to be blamed for having conformed to a vote of the Municipality, but the Committee nevertheless felt obliged to remark that the cost of production of the electrical unit was thereby increased." How instructive it would be if all smoke-abatement enthusiasts inclined to use coercion for carrying their point, were similarly led to first try putting their own house in order! But there is one point about this story which seems to require further elucidation. We cannot understand how, at the ordinary comparative values of coal and coke, the latter should work out to be more expensive for steam raising than the former. In most English towns away from the coal-fields, it would be quite the reverse. It may in all probability be assumed, without much error, that in Paris the comparison is that between bad coal and good coke; the latter, moreover, being so much in demand for household purposes, that it comes expensive for any uses to which the former is applicable. Again, the boilers may not be very good steam raisers. As we have already remarked, however, this Parisian story is full of morals for several orders of readers.

The Forthcoming Meeting of The Gas Institute.—Mr. W. H. Harvey, Secretary of The Gas Institute, desires us to remind members of the Institute of the contents of the circular they have received referring to the forthcoming meeting, to be held at the Institution of Civil Engineers, Great George Street, on June 14 and two following days. The Council hope that the intimations contained in this circular, especially with regard to the supply of papers, contributions to the Institute Library, and subscriptions to the Benevolent Fund, will not be overlooked by those to whom it was addressed, and that the members generally will co-operate to ensure a thoroughly satisfactory and successful gathering.

WATER AND SANITARY AFFAIRS.

THE London Water Bill, brought into existence by the ingenuity of the County Council in conjunction with the Corporation, has passed its second reading in an altered form, and under circumstances in many respects peculiar. As originally framed, the Bill was at singular variance with the request urged more than once upon Lord Salisbury by the County Council, that the Government would undertake a complete inquiry into the Metropolitan Water Question, and so relieve the Council of a task for which it felt itself unequal, although designated to its performance by Sir Matthew White Ridley's Committee. The Government not moving fast enough to please the County Council, that body, in the course of last autumn, initiated a Bill conferring certain powers upon itself to conduct an inquiry, and for this measure it obtained the countenance and pecuniary aid of the Corporation. In the middle of January, the Government announced that a Royal Commission would be appointed to deal with the subject; thus entirely changing the situation. The complete withdrawal of the Bill might have been thought the most reasonable course, under this altered condition of things. But, strange to say, it now appears that the President of the Local Government Board recently came to the rescue, and entered into conference with the County Council and the Corporation for the purpose of modifying the Bill, so that it might not be altogether extinguished. The power to make a public inquiry has been struck out, and other clauses either eliminated or altered. The scheme for a Joint Committee of the Council and the Corporation is retained; such Committee being authorized to make any private inquiry relative to the water supply, and to enter into negotiations with the Water Companies. Mr. Ritchie has also consented that the County Council shall have power to introduce Water Bills, the cost to be defrayed out of the rates. In this form the measure has so far received the approval of the House of Commons. It can scarcely be said that the Bill was debated when the second reading was agreed to last week; the speakers being Sir J. Lubbock, who had charge of the measure, and Mr. Ritchie, who approved of it as amended in accordance with his suggestions, followed by Colonel Makins, who was apparently disposed to make the best of a bad bargain, and Mr. Stuart, who took up the cudgels for Sir Thomas Farrer, who had been censured by Colonel Makins for rejoicing over the recent fall in the market value of the Companies' shares, which fall, we may observe, is now being rapidly retrieved. Colonel Makins had some misgiving that the County Council would introduce a Bill for a competing supply; and he was anxious that a clause should be introduced making it clear that no such power was conferred. Mr. Ritchie expressed the idea that it was very unlikely the County Council would think it desirable to introduce a Bill dealing with the Metropolitan Water Question until the Royal Commission had reported. In what light the report of the Commission will place the question of a competing supply is, of course, somewhat conjectural. But that the County Council has a fixed idea for the introduction of a fresh supply, is rendered perfectly clear by the remarks of Sir J. Lubbock, as well as by the general tenor of the arguments used in the County Council from time to time on this subject. All this does not literally mean that the new supply should be competitive; but it is important to observe that Sir J. Lubbock's speech in the House was distinctly founded on the notion that a distant source would have to be sought. He disputed the assertion that the chalk formation would yield the quantity required, and quoted the Duke of Richmond's Commission in support of that denial, regardless of the fact that the Rivers' Pollution Commission had subsequently placed reliance on a supply from the chalk. The Bill, as it now stands, is styled a "preliminary" measure. We look upon it as an unnecessary one, and of a nature to complicate the state of affairs at the date when the report of the Royal Commission makes its appearance. The best we can hope for is that Parliament will yet lay the Bill aside, as something coming before its time. The Water Companies have petitioned to be heard against it; and they are perfectly justified in doing so.

The comprehensive speech delivered by Mr. George Banbury, who occupied the chair at the half-yearly meeting of the East London Water Company last week, affords a vivid review of the situation in which the London

Water Companies find themselves placed at the present time. The position, although critical, is not to be called alarming; and the Chairman very properly reminded the meeting that every water undertaking which had hitherto been acquired by a public authority had been purchased upon a fair and just basis—a course which had also been recommended last year by Sir Matthew White Ridley's Committee in reference to the London Water Companies. Mr. F. Tendron, in a speech which followed that from the chair, displayed a very natural degree of indignation at the manner in which Sir T. Farrer had congratulated the County Council on last month's drop in the market value of the Water Companies' shares. But even Mr. Tendron was without fear for the future; having confidence that Parliament had sufficient respect for the legal rights of property, to secure for every shareholder an income equal to that which he was already enjoying. While agreeing with Mr. Tendron that such is the result to be expected at the hands of Parliament, we have no belief that the County Council will propose anything so equitable. Sir T. Farrer's letter in yesterday's *Times* sufficiently shows this. It is the composition given to the Council by the late election by the ratepayers which excites apprehension among the holders of water stock. But Parliament is greater than the Council, and unless the forthcoming general election for the United Kingdom introduces a new and dangerous element into the Legislature, the shareholders in the London Water Companies may rely on being dealt with fairly, when the terms of purchase come to be finally settled. Mr. Rokeby Price, who also addressed the East London meeting, was as strenuous as Mr. Tendron in denouncing the remarks made by Sir T. Farrer. But the Chairman shrewdly observed that parties wishing to buy water stock would probably find they had to pay considerably more than the price which had been lately quoted. Respecting the Royal Commission, the Chairman rightly expressed his confidence; the Companies now having the chance of presenting their case before "a competent and impartial tribunal." A fair hit was made, when the Chairman referred to the introduction of the London Water Bill, in the teeth of the decision arrived at last year by the Select Committee, and accepted by the House. Mr. Ritchie has now paid such court to the County Council as to permit this Bill to proceed; thereby putting the Water Companies to the expense of fighting their case while a Royal Commission is about to deal with the whole question. But the eve of a general election has a peculiar influence on statesmen, and may account for the special tenderness with which the London Water Bill has been treated, especially as the Corporation are connected with the scheme. Apart from the main question, the internal affairs of the East London Company present many features of interest, including the abandonment of the Old Ford station, and the concentration of the works at Lea Bridge. Other items of progress, possessing considerable magnitude, include the large addition about to be made to the already extensive reservoirs at Walthamstow, where also a new pumping-engine is to be erected. It is an important fact that the wells are found to yield a supply exceeding that which has been calculated upon. This, again, is a matter which bears upon the broad question whether existing sources are sufficient to meet future demands—a subject which will require the most careful and unbiassed consideration on the part of the Royal Commission.

Presentation to Mr. W. Blackledge.—The occasion of the retirement of Mr. William Blackledge, from the management of the Chorley Corporation Gas-Works, after having filled the position for 35 years, was chosen by the employees to offer him a slight memento of their association together, and of their respect and esteem for him. It took the form of a testimonial comprising a walkingstick and an umbrella, a photographic group of the officials and workmen, and a spirit case. These were presented to Mr. Blackledge at a complimentary dinner given to him on the 2nd inst., when the Chairman of the Gas Committee (Mr. Kirkman) presided, and referred to the efforts Mr. Blackledge had always made to do his best for those under his orders and also for the Corporation. In accepting the gifts, Mr. Blackledge thanked the workmen for the great readiness they had displayed to help him in times of difficulty. He was retiring owing to physical weakness, and his work would, in future, be done by someone who was younger and more energetic. He asked for his successor the same hearty co-operation he had himself received, so that the highest results might be obtained for the town.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 678.)

LAST week everything was in favour of improving prices in the Stock Markets. The cheapening of money culminated (as was generally foreseen) in the reduction of the Bank rate of discount on Thursday to $2\frac{1}{2}$ per cent. from the 3 per cent. figure at which it had remained since the 21st of January. Then the fine weather and the generally peaceful prospects abroad and at home had their influence; and, but for the continuance of the lamentable coal strike, the week might be said to have been almost without a cloud. But for all that, business still remains restricted below what one would naturally expect; and when there had been a perceptible rise in prices, they received a check from the resulting move to realize profits. Things may be expected to rule very quiet until after Easter. The Gas Market has been much more active; and the tendency almost throughout was favourable to advancing prices in a moderate degree. Gaslights were freely dealt in. The "A" was very steady, at about 214-216; the best mark being one transaction at 216 $\frac{1}{2}$. The debenture issues were firm and unchanged. The preferences were rather better—"C," "D," and "E" advancing 1; and "K," $\frac{1}{2}$. The limited "H" made the best advance, of $2\frac{1}{2}$. There was not much done in South Metropolitans; but prices were good. The "A" rose 1; and the debenture, 2. Commercial furnished the only instance of flatness; the old stock falling 2. Why this should be, while the new remains firm, is not apparent. The Suburban and Provincial Companies continue almost inanimate—scarcely a transaction being marked in them; and the only alteration in the quotation is a rise of 2 in Brentford new. The Foreign undertakings are also remarkably quiet. European was about the most active, and at firm prices; while Imperial Continental effected a rise of 1—the only change throughout the list. The Water Companies have been much more active, and the recovery in values is proceeding. Chelsea has made the extraordinary advance of $15\frac{1}{2}$; showing how artificial was the previous depression. It would puzzle most people to say why £100 of its stock should be worth £15 more on Saturday than on Monday.

The daily operations were: The Gas Market opened firm on Monday, but remained quiet all day. The movements were a rise of 2 in South Metropolitan debenture, and a corresponding fall in Commercial old. Water remained stagnant. Quietude still prevailed on Tuesday in Gas; and the only feature was an advance of 2 in Brentford new. Water began to rise; Chelsea marking 5 higher. Wednesday was a busier day, dealings being mostly in Gaslight "A" and European; but quotations did not move. Chelsea water rose another 5; and East London, 1. The activity of Gaslight "A" was maintained on Thursday, and the secured issues also attracted notice—making the advances noted above. Southwark water rose 1. Friday was somewhat quieter; and the only move was a rise of 1 in Imperial Continental. The progress in Water was an advance of $2\frac{1}{2}$ in Chelsea, $1\frac{1}{2}$ in East London, 1 in Grand Junction and Southwark, and $\frac{1}{2}$ in Lambeth. Saturday was a very inactive day; but the tendency was favourable, and South Metropolitan "A" rose 1. Chelsea Water improved 3; Lambeth, 2; East London, $1\frac{1}{2}$; and West Middlesex, 1.

ELECTRIC LIGHTING MEMORANDA.

The Affairs of the London Electric Supply Corporation—An Easy Comparison—The Weakness of the Crystal Palace Exhibition.

THE recent ordinary general meeting of the London Electric Supply Corporation was looked forward to with much curiosity. The report and accounts issued by the Directors upon the past year's operations were anything but cheerful reading for those who had put their money into the concern. Upwards of three-quarters of a million sterling has been spent upon this gigantic experiment. The Deptford Station stands the Company in £280,000; and the mains have cost £148,000. The sales of current by meter at $7\frac{1}{4}$ d. per Board of Trade unit realized £13,783; and, taking all the working expenses into account, every unit which was sold for $7\frac{1}{4}$ d. cost the vendors nearly 1s. This is the comment of the *Electrician* upon the Company's transactions. It is shown that while the current generated at Deptford cost $5\frac{1}{4}$ d. per unit, distribution and management added $6\frac{1}{4}$ d. per unit to the cost. Of course, the latter is an entry that can be reduced with increase of business; and it must not be forgotten that the unfortunate fire at the Grosvenor Gallery station was the occasion of great loss of custom to the Company. In addition to this, however, there appear to be several things wrong about the Company's plant. Altogether, a more gloomy prospect than that lying before the ordinary shareholders of the London Electric Supply Corporation can hardly be imagined, bearing in mind the fact that the concern is not, like many of the early electric light companies, a patent swindle. In Mr. J. S. Forbes, however, the Corporation have a Chairman who admits that he is more at home when making the best of a bad business than when recommending the declaration of a good dividend. Mr. Forbes does not despair of the undertaking, but confesses that it is in such straits that it must be mortgaged for £50,000 in order to procure money to carry on the business. The courage that has been so marked a characteristic of this Board

does not desert them now. They believe their principle of supply is right, and they accordingly mean to "stick to the thing, and perfect it up to 90,000 lamps," as the Chairman put it. This is a spirit deserving success, even if it fails to command it.

Municipalities and others interested in the comparison of the two leading methods of distributing electricity for lighting purposes—the high-pressure alternating and low-pressure direct systems—cannot fail to learn a good deal by comparative study of the accounts and circumstances of the various London central station companies. The undertaking dealt with in the preceding paragraph—the London Electric Supply Corporation—are in low water just now; but this is not so much on account of anything really defective in their system, as because circumstances have hindered the commercial extension of their business. One striking feature of the situation of this Company is the comparatively small amount at which their mains stand in their books, which is due, of course, to the nature of the system of distribution. Another Company whose affairs have just been explained to the shareholders is the Notting Hill venture, working with the low-pressure system, with accumulators, and charging in their good residential district 8d. per Board of Trade unit, or 3d. per unit more than the Deptford Company. Now the Notting Hill Company, although they have had no accident to check their development, are not in a very much better way than the unfortunate London Electric Supply Corporation. It is to be noted that of the total capital expenditure of £67,845 for the Notting Hill district, no less a sum than £26,794 has gone for mains. The generating machinery has meanwhile cost only £7965, to which must be added £4892 for batteries and copper connections at the generating stations. Thus it will be seen that a small copper-mine has already been put into the subsoil of the streets of this corner of London, awaiting business which is painfully slow to come. The streets that are actually wired contain nearly 800 houses, for the most part of very good class; and of these only 77 had been serviced up to the end of the year. In the circumstances, it is not surprising to learn that the Directors decline to draw their fees until the fortunes of the undertaking shall have improved. What we desire to point out in connection with these facts is the clear conclusion that profitable electric lighting is a commercial rather than a technical problem.

We are not singular in regretting that so little real service in the cause of the technology of electric lighting is being done by the Crystal Palace Exhibition. Our contemporary, the *Electrician*, claims to have suggested, a long time ago, that the nomination of experts to report upon the Exhibition afforded a "splendid opportunity for doing something, but we could not say what." That is just the attitude which by this time all thoughtful spectators of the show of electrical apparatus at Sydenham have been constrained to occupy. It is quite obvious that such a collection of machinery and instruments ought to be good for something, beyond being gaped at by casual holiday makers, who would, on the whole, be better satisfied with a circus; but the fact remains that nothing is done in this matter. Our contemporary remarks that "a good suggestion or two" might have resulted in something being done to redeem the reputation of the Exhibition; but, at any rate, four or five months have passed without any such suggestions having been heard of. Now the *Electrician* hints that the various meters and measuring and testing instruments shown in the Exhibition might have been practically tried (say) in connection with the lighting of the specimen suites of apartments. It is remarked that even if this proceeding did no good, it could hardly result in making the "farce" of the show much greater than it is at present. Let it be understood that this disparaging observation is not ours, but that of an organ devoted to the electric lighting industry, which the Crystal Palace Exhibition was intended to benefit. We have already expressed, in a general way, the opinion that essentially the show is not creditable, nor likely to be helpful, to the electric lighting industry of the country; and we are glad to have this independent confirmation of our own judgment.

ROBERT HARRIS.

We deeply regret to announce the death of Mr. Robert Harris, C.E., late Distributing Engineer of The Gaslight and Coke Company, which occurred on the 5th inst. from a paralytic seizure. Mr. Harris, who was the eldest son of the late Mr. Robert Harris, of Feltham, Middlesex, was born on Sept. 14, 1835. At 15 years of age he became a pupil of Mr. Alexander Wright, who was at that time Engineer of the Western Gas Company's works at Kensal Green. During his connection with Mr. Wright, he was employed at Luton, Penzance, and other places in the country. At Christmas, 1858, Mr. Harris went to take charge, as Mr. Wright's representative, of the Great Central Gas Company's works at Bow Common; and on Mr. Wright's death in the following year, he was appointed Engineer. This post he held till the amalgamation of the Company with The Gaslight and Coke Company, the staff of which he then joined; continuing the superintendence of the Bow station, and combining other work with it, until 1884. He then left Bow, on being appointed General Distributing Engineer to the Company; and to this office he devoted himself until his resignation, on account of ill-health, in 1889. In 1860, Mr. Harris became a member of the Society of Engineers; and in 1873 he received the honour of

election as a member of the Institution of Civil Engineers without going through a preliminary associateship. He was also an active member of The Gas Institute, of which he was President in the year 1884. As a gas engineer, Mr. Harris was possessed of considerable ability; and his singular simplicity of character and kindness of heart won him not only the respect, but the affection of all with whom he had to do. The funeral took place last Saturday at the Ilford Cemetery.

CONTINENTAL ELECTRIC LIGHT CENTRAL STATIONS.*

THE good-looking volume which has just appeared under the above title is aimed, so to speak, at the heads of members of municipal lighting committees and other amateurs of electric lighting who desire to know, in a general way, what has been done in this line upon the Continent. It consists, for the most part, of a translation from the well-known compilation entitled "Die Versorgung von Städten mit Elektrischen Strom," which was produced in connection with the Frankfort Exhibition; and as the information therein contained is inaccessible to those who do not read German, it cannot be said that Mr. Hedges has not been justified in putting it into an English dress. Whether it was quite necessary that the dress should be such an elaborate one may be a question of taste, regarding which, of course, it would be proverbially idle to dispute. It would have been better, perhaps, if the obviously second-hand character of the illustrations, some of which are hardly legible, did not contrast so strongly with Mr. Hedges's brand-new binding; but one must not be too exacting upon the self-appointed bookmakers of the electrical persuasion. It will be remembered that we recently gave a special translation of the description of the Dessau central station of the German Continental Gas Company, which was originally prepared for the publication to which Mr. Hedges is indebted for most of his matter; and we must be permitted to remark here that our edition of this particular report (see *ante*, pp. 26, 67), which possesses peculiar interest for readers of the JOURNAL, by reason of the use made of gas-engines for driving the electrical machinery, is much fuller and better than that given by Mr. Hedges. On the other hand, the other reports translated and annotated by him never have been, and never will be, reproduced in our pages; and many of these are of importance. Among other installations, Mr. Hedges describes that of the Anglo-Romano Gas Company, who generate electricity both by water and steam power. He also cites the example of the Gas Company of Augsburg, who have a high-tension supply system worked by the power of a stream two miles from the station. The Vienna experiment of the Imperial Continental Gas Association receives due notice.

It is only fair to Mr. Hedges to say that he has not confined his work to its German prototype; but has brought in a variety of instructive matter with a view to making his book a desirable store of information upon those aspects of electric lighting which cannot be set forth at exhibitions, either at Frankfort or at Sydenham. Thus he has a short chapter on "The Distribution of Electricity compared with Gas," another on the "Load Factor," and so forth. Some of the author's observations upon the former topic are refreshingly naive. He tells his readers how "in this matter electricity is ahead of gas, in that the latter is always in the pipes, and consequently ready to escape at any minute leak, while the former does not exist in the mains until the circuit is closed." It might be thought that the same condition of being always in the pipes, or the equivalent conductors, must apply to anything distributed in either way under constant pressure; but Mr. Hedges says that electricity has an advantage in this regard, so we must believe, though at the same time confessing our inability to understand, him. He states, moreover, that "with even the very best distribution by gas, this loss [by leakage] is an unknown quantity, which in London must be very great." Strictly speaking, it is, of course, unknown how much of the very definite entry under the heading of "unaccounted-for gas" in the accounts of the London Gas Companies is actual leakage of the unpreventable kind; but it is not true that this loss is at all serious. Mr. Hedges is good enough to argue, in a special chapter, that, in towns where nobody else cares to do so, the gas company is the best hand to take up electric lighting. It is very kind of him to put it in this way; and one can easily understand that the manufacturers of electric lighting plant would as soon take orders from gas companies as from anybody else. But we fail to understand why these companies should "rush in" where electric light speculators "fear to tread." A new feature of Mr. Hedges' book is the comparative table showing at a glance the equivalent prices of electric and gas lighting; the former being due to incandescent lamps working at different rates of efficiency and at various prices of current charged by the Board of Trade unit, and the latter calculated on the assumption that a burner consuming 5 cubic feet hourly yields a light of 16-candle power. By this table it is once more established that the price of a Board of Trade unit of electricity in pence means equivalent gas at rather more than as many shillings per 1000 cubic feet. Altogether, we are able to recommend Mr. Hedges' book as containing a useful collection of data concerning the subject of electrical distribution for lighting purposes.

* "Continental Electric Light Central Stations; with Notes on the Methods in Actual Practice for Distributing Electricity in Towns." By Killingworth Hedges, M.Inst.C.E., &c. London: E. and F. N. Spon; 1892.

NOTES.

Why Water Floats in Air to Form Fogs.

It is by no means obvious why the particles of water constituting fog or cloud should float in air as they do at various temperatures. Herr von Frank, of Graz, seeks to explain the phenomenon by assuming that every such droplet is surrounded by an envelope of aqueous vapour. He gives 0.7 millimetre as the approximate average measurement of the diameter of every droplet, with its envelope. Supposing 1 cubic metre of cloud to hold 3 grammes of water, there would be an interval of 0.2 millimetre between the envelopes. It is suggested that the difficulty of understanding how water droplets, in the form of cloud or fog, can exist at different temperatures may be overcome by imagining that these vapour envelopes, being bad conductors of heat, guard the droplets to some extent from evaporating and freezing. If such minute particles of water were not in a kind of spheroidal state, they must soon be dissipated by the sun's rays, which are always shining upon the top of the fog or cloud. This solar heating expands the vapour envelopes, so that the fog always has a tendency to rise. Once more, liquid droplets have been observed by Assmann floating in air at a temperature of -10°C . On encountering a solid body, these drops froze into lumps of ice without crystalline structure. Here, according to Herr von Frank, we can see the vapour envelopes preventing freezing of the floating drops of water until they are broken up by the solid. Then the water having lost its non-conducting coat, freezes so quickly that there is no time for the formation of crystals. Herr von Frank supposes that, with much aqueous vapour in the air, larger drops form—the clouds floating lower. With less aqueous vapour, the drops are smaller and the clouds higher; the thickness of the vapour envelope being the same for large and small drops under like conditions of temperature and pressure.

Steam-Raising by Gas and Coal.

Many attempts have been made to use coal gas for steam-boiler heating, but hitherto without success in the commercial sense. It has recently transpired that, since the natural gas of Pennsylvania and Ohio has been charged for, even at the low rate of 10 c. per 1000 cubic feet, it can no longer compare favourably with coal as a steam-raising fuel—at least in connection with the now fashionable water-tube boilers. This failure does not appear to be due to the burners, for there is very little choice in the matter of apparatus. The water-tube boiler has a large combustion chamber formed of fire-brick, which is favourable to the economical burning of gas. A boiler furnace for natural gas designed by Mr. Hartupée, of Pittsburgh, has a gas-supply pipe entering from the front, and going back to the full depth of the fire-box. From this pipe rise a number of vertical smaller pipes, which are surrounded with brickwork, only leaving a nozzle for the entry of air. The arrangement is practically that of a battery of atmospheric burners in brickwork, looking upwards into the fire-box. There does not seem to be anything to find fault with in this disposition of the gas-pipes, and yet the result is not economical. Local coal and gas being used alternately in the same boiler, it was found that, for equal periods of 11 hours' working, 24,000 cubic feet of gas were required to do the work of a ton of coal. For a day's steaming, the consumption was respectively 6.081 tons of coal, or 145,944 cubic feet of gas. At \$1.40 per ton, the coal cost \$8.51; while the gas at 10 c. per 1000 cubic feet would cost \$14.59. To the cost of the coal, however, must be added that of labour for stoking and clinkering, which would reduce the discrepancy.

A Coffey-Still Gas-Generator.

Ceaseless effort is being made by American technicians, to improve gas-generating apparatus, mainly with a view to the solution of the question of fuel gas. A curious attempt of this kind, in which the principle of the Coffey still is applied to the gasification of coal, has been patented by Mr. Dubbs. The apparatus consists of a vertical shaft in brickwork, terminating below in a chamber for the reception of spent material, and provided at convenient intervals, in the Coffey-still manner, with overlapping inclined shelves. Immediately over the axis of this shaft is the hopper containing the supply of raw material for gas making, and also at the top a lateral extension of the shaft contains an ordinary furnace, with fire-bars, and there is also a provision for the supply of superheated steam. The object of the inventor is stated to be the production of a gas rich in combustible elements, as carbonic oxide and hydrogen, but practically free from carbonic acid. His idea is to heat up the still by passing through it in a downward direction the products of combustion of the attached furnace, and then to allow the carbonaceous materials in the hopper, with which a quantity of lime is to be mingled, to drop upon the shelves. Simultaneously therewith, steam is also to be introduced. The result expected to follow upon this proceeding is the separation of the steam and carbonaceous material into their constituent elements, hydrogen, oxygen, and carbon. The gases formed during the passage of the steam and carbonaceous material through the upper parts of the stack are supposed to be further acted upon in the lower portions, where the carbonic acid is to combine with the introduced lime, forming carbonate of lime, which falls ultimately into the lower chamber, whence it can be removed from time to time. The gases are meanwhile passed forward

for treatment in the ordinary manner. This is one of the simplest of the new American inventions having the same object; the majority of them being elaborate combinations of pipes, retorts, and furnaces designed for the hopeless task of making cheap fuel gas by the aid of fluid hydrocarbons.

Mr. Corbet Woodall, M.Inst.C.E., has been elected a member of the Royal Institution of Great Britain.

Institution of Civil Engineers.—At the meeting of this Institution last Tuesday, the monthly ballot resulted in the election of five members and thirty associate members. Among the latter were Mr. G. Lingwood, of the Barbados Water-Works; and Mr. H. O'Connor, of the Beckton works of The Gaslight and Coke Company.

A Testimonial for Mr. George Livesey.—The following appeared in the *Local Government Journal* (formerly the *Metropolitan*) last Saturday: "Mr. George Livesey is shortly to be the recipient of an illuminated address from the Camberwell Vestry, in recognition of his generous action in providing a free public library. Mr. Livesey deserves all the kind things said about him, and will unquestionably prize the testimonial as one of his most precious possessions."

The Secretaryship of the Bristol Gas Company.—Mr. John Phillips has been appointed Secretary of the Bristol Gas Company, in succession to Mr. J. V. Green, whose relinquishment of the position was mentioned in the *JOURNAL* last week. Mr. Phillips has been in the Company's service for upwards of thirty years, and has gained the confidence of the Directors by the way in which he has temporarily discharged the duties of the office in which he has now been permanently installed.

The Management of the Singapore Gas Company.—We learn that Mr. W. T. Batten, Assoc.M.Inst.C.E., Manager and Local Secretary of the Singapore Gas Company, has been compelled, owing to the ill-health of his family, to leave Singapore and return to England. In accepting his resignation, the Directors expressed their regret at his relinquishment of a position which he had so ably filled during the past eight years and a half. As already mentioned in the *JOURNAL*, Mr. Henry Willis Smith, for many years Manager and Secretary of the Caterham Gas Company, and late a Director of the Singapore Gas Company, has gone to Singapore to succeed Mr. Batten.

Professor Vivian B. Lewes, F.I.C., F.C.S., Professor of Chemistry at the Royal Naval College, Greenwich, the newly-appointed Gas Examiner for the Corporation of London, has been elected an associate member of the Institution of Naval Architects. Our readers may remember that Professor Lewes read before the Institution a paper on "The Spontaneous Combustion of Coal," and another on "Boiler Deposits;" the latter being regarded by the Council as worthy of the award of the gold medal offered by the Institution to the member who should read a paper of "exceptional merit." The decision of the Council was made known to the general body of members at their annual meeting last Wednesday.

North British Association of Gas Managers.—We have received from the Secretary of the above Association (Mr. R. S. Carlow, of Arbroath) a copy of the report of the proceedings on the occasion of the thirtieth annual meeting, held in Edinburgh in July last, under the presidency of Mr. R. Robertson, of Bathgate. The papers read by Mr. West, Mr. Love, and Mr. Macfie are illustrated by folding plates; and the technical matter is followed by the Rules of the Association, list of members, &c. Incorporated in the pamphlet is the "Statistical Report of the Gas Supply of Scotland" for the year ending Aug. 1, 1891, prepared under the supervision of the Committee of the Association. These returns were formerly issued separately.

Mr. W. Oldfield, Manager of the North Bierley Gas Company, having obtained a similar appointment under the Goole Gas and Water Company, was entertained to dinner at the County Restaurant, Bradford, last Friday evening. Mr. W. Wood, Engineer-in-Chief of the Bradford Corporation Gas Department, presided; the vice-chair being occupied by Mr. J. Niven, Manager of the Clayton, Allerton, and Thornton Gas Company. In proposing the toast of the evening, the Chairman referred to the excellent work Mr. Oldfield had carried out in connection with the enlargement and remodelling of his works. Mr. Oldfield acknowledged in feeling terms the appreciative remarks made by the various speakers; and the remainder of the evening was devoted to a discussion on technical matters affecting the gas industry.

Death of Mr. George Shepard Page.—We regret to announce the sudden death, on the 26th of March, of Mr. George Shepard Page, of New York, the well-known American financier. Mr. Page was engaged in many branches of industrial finance; but his name was most familiar to readers of the *JOURNAL* in both hemispheres through his connection with the St. Louis and other American Gas Companies, and his efforts to interest English capitalists in the gas industry of the United States. His figure was at one time almost as well known, and quite as welcome, at the meetings of The Gas Institute (to which he was in 1888 elected an associate) as it was at the gatherings of similar organizations in the United States. Mr. Page was about 50 years of age, and was born in Maine. He died at Morris Plains, of puerperal fever, following upon influenza.

TECHNICAL RECORD.

NEW ENGLAND ASSOCIATION OF GAS MANAGERS.

The Annual Meeting at Boston.

(Concluded from p. 620.)

After the discussion on Mr. M'Kay's paper on "A Gas-Works as a Heat-Engine," two papers having reference to the use of oxide of iron for purification occupied the attention of the meeting. The first was by Mr. W. A. Wood, of Boston, and comprised a description of a modification of the apparatus described before the Association by Mr. W. A. Learned, two years ago, for revivifying oxide by drawing air through it *in situ*. Mr. Wood's apparatus consists of a steam-jet exhauster, which can be fixed to the inlet or outlet of the purifier, so that, when the cover is raised, air is aspirated downwards through the material, and discharged at the outlet of the exhauster, from which a perpendicular pipe extends through the roof of the purifier-house. Mr. Wood has pipes fixed permanently over each purifier; and the exhauster, with a few feet of pipe, forms a moveable connection between the outlet of the vessel and the lower end of the pipe. He said he was applying this system to a set of eight boxes, each 24 ft. by 30 ft.; and as he made his own oxide at a cost of from 6d. to 7d. per bushel, and was able to purify from 90,000 to 120,000 cubic feet of gas with this quantity, his purification cost him next to nothing. The second paper was read by Mr. Z. M. Jenks, of Woonsocket (R.I.), and referred to the use of oxide for purifying water gas. The generating plant consists of a double set of the Grainger-Collins type. After passing the scrubbers and condensers, the gas enters a relief holder, from which it goes through a second set of condensers to the purifiers. These consist of four boxes, each 10 feet by 16 feet, with centre-valve and 10-inch connections. The material used consisted of the following ingredients: Sawdust, 20 bushels; lime, 10 bushels; Prince's paint, 8 bushels; and copperas in solution, 300 lbs. This was gradually brought into use to the complete exclusion of lime, with satisfactory results, and no diminution in the illuminating power of the gas. After two or three years' revivification in the usual way, he decided to try a plan similar to that described in the paper just read. The only difficulty he found was that the revivified material, when brought into action again, reduced the illuminating power for several hours. To meet this, he passed a few thousand cubic feet of gas through the clean box at intervals, before bringing it again into use.

On the subject being submitted for discussion, Mr. S. F. Hayward asked if Mr. Wood found any offensive odours caused by his process. He believed that at New York a somewhat similar plan was tried, but that the outlet-pipe was conveyed to the boiler-flue. Mr. Learned found that the process could not be used without some odours escaping; and he quite agreed that, in a thickly-populated neighbourhood, it would be necessary to connect the outlet to a flue. He worked with a pressure of 6 or 7 lbs. of steam, producing 0.5 inch exhaust in the purifier; and he found he was able to do the work more effectually, and within six hours. Mr. Sherman had tried the plan of revivifying *in situ*, but had to give it up on account of complaints of nuisance. Mr. Gifford asked for information as to the best kind of sawdust to use. He said a lot of oxide mixed with pine sawdust worked satisfactorily; but it was rather inclined to fire. Some made up with mixed sawdust, including all sorts of wood, did not appear to recover its colour so well. He thought this might be due to the presence of traces of gallic acid in the wood. The President remarked that he had found a difficulty in getting sawdust sufficiently coarse. The best he could procure came from Maine; and it was delivered in a compressed condition, which brought the carriage down to a low figure. He understood it was pinewood sawdust. Mr. Bush raised the question of mixing lime with the oxide. He thought that it would be left in the mixture in a foul state after the first time of using; and this would prejudice the utility of the material. Mr. Goodno said this was a mistake. When copperas was added, the lime was fixed as sulphate of lime, and remained unchanged. Mr. Isbell used the process mentioned by Mr. Wood, having a steam-jet exhauster and connections to each purifier, so that the lid could be raised and air drawn downwards through the material. Sometimes he connected the outlet from the exhauster to a chimney; but he had treated the air effectually by passing it first through a water scrubber, and then through a lime-box. After this it could be discharged without fear into the open air.

Mr. Wood, replying to questions, said that after about half-a-dozen revivifications, it was necessary to break up the material, as it was liable to cake. He wished to impress upon the meeting the fact that the process could not be expected to answer without careful supervision. The kind of sawdust had some effect in regard to liability to fire. He always used cast-iron borings for making the oxide. There was no nuisance caused from the outlet-pipe. At first starting, there was a little indication of sulphuretted hydrogen; but after a few minutes, this quite ceased. He had tested the blast with lead paper. With respect to heating, the man in charge thrust his hand and arm into the material from time to time, and in this way judged if it was getting too hot. A spray of water was spread over the material from time to time during revivification; and he liked to add as much as could be absorbed. He preferred to

pass the air more slowly than Mr. Learned; and he usually had an exhaust of $\frac{1}{8}$ inch—never more than $\frac{1}{4}$ inch. With regard to cost, he might say that, including everything but the steam, it did not exceed $\frac{1}{4}$ d. per 1000 cubic feet. He did not like the plan of drawing in air with the gas, though it had proved very useful on an emergency; and something like 1 per cent. of air had enabled him to run his purifiers for a considerable time. Mr. Jenks thought there was no special advantage in employing lime. It was useful in a mechanical sense, as it lightened the material. Other things might do just as well. The mixture he used was thoroughly efficient; and the difficulty to which he had alluded in his paper was the only one that occurred with it. He thought it arose from the fact that the material was revivified to a greater extent than was the case in the usual way.

Mr. F. C. Sherman, of New Haven (Conn.), followed with a paper describing results obtained with deep furnaces. He said that some seven years ago he prepared plans and estimates for a retort-house with full-depth regenerator furnaces. But he found that, though the theory was correct, several difficulties arose in practice; and those who were using the system were not altogether satisfied with it. A serious objection in the case of small works was the fact that it called for more intelligence and care than could be expected from an ordinary stoker. In the present state of the labour market, any advantage gained in one way would be lost in another; and if more coke was saved, there was the question of finding a market. In his own case, he could only realize about 12s. 6d. per ton for it. For these reasons, together with the heavy cost of the stage floors and regenerative furnaces, he preferred to put in deep furnaces instead. His works were only about 6 feet above the water-line; and therefore he could only get a depth of 4 feet above the grate-bars, though he would have liked 5 or 6 feet. The arches were 8 feet wide, and measured 13 feet from the ash-pan to the crown; and the furnaces were 5 feet 3 in. long by 16 inches wide, with openings at the top for admitting air. There were six retorts, each 15 in. by 30 in., and 9 ft. 8 in. long, in a bed. After upwards of a year's working, he had averaged 10,700 cubic feet per ton of Westmoreland coal, with a consumption of one-third of the coke. All that was required was a sufficient depth of fuel and a proper regulation of air. He introduced steam below the grate-bars.

Mr. Stiness commenced the discussion on Mr. Sherman's paper by remarking that, after ten years' experience with the Dieterich full-depth regenerator furnace, he could not agree that additional skill or intelligence was called for on the part of the stoker. He preferred to work on the ground floor, with a basement for the furnaces, rather than to lift all the coal to a stage floor. Mr. Harbison had a stack of Stedman-Stanley furnaces, and agreed that no additional expense for labour was necessary. The same men who worked the old furnaces could work the new ones. But he preferred a stage floor, with the cellar at the floor-level, as the men ought to have fresh air. Coke was worth much more than the figure named in the paper for water gas. Mr. W. A. Wood was surprised to hear that a higher class of labour was required for the full-depth regenerator furnace. After having had experience with all kinds, he found that men who could work one could work another. Mr. Nettleton thought it was best to adopt the most advanced apparatus, even in small works; and he said this after personal experience. Mr. Sherman, in reply, claimed that the Dieterich was a generator furnace only. With every change of wind, the draught and dampers of a full-depth regenerative furnace required regulation; and he considered that a fireman of more than ordinary intelligence was indispensable for successful working. The saving in first cost afforded by his arrangement had been overlooked.

This completed the business; and the meeting then closed with the usual votes of thanks.

STOKES AND ARMSTRONG ON FLAMES.

Referring to the recent papers of Professor Smithells and Mr. Ingle and of Professor Vivian B. Lewes upon "Flames" (see *ante*, pp. 68, 338), some correspondence between Sir G. G. Stokes, Bart., F.R.S., and Professor Armstrong, relating to the same interesting subject, has been laid before the Chemical Society, and published in full in the *Chemical News*.

Sir G. Stokes's first letter refers to his optical proof of the existence of solid particles in flames, reference to which was made in the JOURNAL for Dec. 29 last year (p. 1178), which he describes as using a flame as a screen on which to receive an image of the sun. He remarks on the existence of a "lot of compounds" in the interior of the flame. Professor Armstrong, in an address to the Junior Engineering Society, had spoken of oxygen combining with hydrogen in preference to carbon. Sir G. Stokes remarks that he should have supposed it would have been the other way, because steam is decomposed with facility by glowing carbon; and the idea seems to fit in with the phenomena of flames. Sir G. Stokes points out the importance of carefully distinguishing between the changes which take place in the partial combustion of a molecule and those which are produced in neighbouring molecules as a result of the heat thus produced. He calls the former "pure-chemical," and the latter "thermo-chemical;" and he thinks that in the blue base

of the flame of a candle, where oxygen is plentiful, there are pure chemical changes. The blue shell invests for a little way the highly luminous shell, like a calyx investing a corolla; and it is suggested that the thin shell of glowing carbon to which the bulk of the light is due, owes its origin to a thermo-chemical change—the heat being derived from the combinations with oxygen which take place just outside it.

Sir G. Stokes suggests that the hydrocarbon spectrum is due to a gas formed by a pure-chemical, as distinguished from a thermo-chemical change. This gas is commonly supposed to be acetylene; but to Sir G. Stokes it seems more likely to be marsh gas. According to him, this doubtful gas is a hydrocarbon requiring the presence of other hydrocarbons to show the hydrocarbon spectrum. At any rate, Sir G. Stokes suggests that the gas must be something of a simple kind, formed in the process of partial combustion, though probably, under ordinary conditions, itself burnt almost immediately afterwards. The date of this letter is Sept. 23, 1891. In his reply on Jan. 18 last, Professor Armstrong refers to the interim appearance of Professor Smithells's papers, which he says exhibit conclusions practically identical with those arrived at by Sir G. Stokes. He explains that he was led to think the hydrogen was the more combustible constituent of a hydrocarbon by the circumstance that a gas such as methane yields acetylene as one of the products of its incomplete combustion. It is possible, he admits, that this production may be due to the agency of heat alone; but he inclines to the alternative view that it is due to partial removal of the hydrogen from the methane by oxygen. At any rate, Dr. Miller and Professor Armstrong were unable to detect acetylene in oil gas manufactured by passing petroleum hydrocarbons through highly-heated retorts.

Professor Armstrong admits that we know less about the phenomena of combustion than was deemed to be certain a few years ago; but he declines to agree with Sir G. Stokes and Professor Smithells that the carbon is the more combustible component of a hydrocarbon. He does not consider the difference between Sir G. Stokes's pure-chemical and thermo-chemical actions to be important in practice; and he thinks that there is very little opportunity in flames for simple heat-changes to occur—the molecules of different kinds being so mixed up together. He doubts whether, under the conditions prevailing in flames, carbon is ever separated by simple heat-changes. At all events, there is no present evidence to this effect. It is not merely a question of the relative affinities of carbon and hydrogen for oxygen, since the carbon would not be atomic carbon, but "that complex molecular form which occurs in the flame in the solid state, and, being incandescent, renders it luminous." From various other considerations—such as the superior stability at high temperatures of carbonic acid to carbonic oxide, though it is the more complex molecule; the incom-bustibility in oxygen of *dry* carbonic oxide and carbon; and the important influence of surfaces of various kinds (even including gaseous ones) in promoting all sorts of reversible changes—Professor Armstrong argues that it is difficult to draw conclusions in such cases. With regard to the action of surfaces, moreover, there is a quality describable as *compatibility*, which is inherent in the nature of the material composing the surface. Platinum, for example, has a strong affinity for platinum; hence the action of a platinum surface in separating hydrogen from a hydrogen compound would be different from that of copper.

Professor Armstrong remarks that this importance of surfaces in relation to the action and reaction of gases in contact with them was known to Faraday, who, in a paper dated November, 1833, says he is convinced that, "in all ordinary cases of combustion, it is evident that an action of the kind considered (of the superficies of matter), occurring upon the surface of the carbon in the fire, and also in the bright part of a flame, must have great influence over the combination there taking place." Regarding the interactions in flames as consisting in a series of simultaneous and consecutive explosions, of which we can only examine the final steady state, Professor Armstrong remarks that the phenomena must be excessively complex in character, and that it will be unwise at present to infer that the oxidation of the hydrocarbons, or the separation of carbon and also of hydrogen from them takes place entirely in any one way.

To this communication of Professor Armstrong's views, Sir G. Stokes replies by a final letter, further explaining the nature of the conceptions of the different actions which he began by describing as pure-chemical and thermo-chemical. The former he illustrates by citing the formation of water from mixed oxygen and hydrogen; and the latter by the formation of acetylene and hydrogen from marsh gas at a high temperature. In both cases the change is brought about by molecular agitation; but whereas in the one the change is propagated throughout the mass of the mixture by agitation initiated at one point, without need for continuous provocation, in the other case the change is a continuous or progressive one, depending for its gradual operation upon a constant supply of heat from without. With regard to Professor Smithells's results, Sir G. Stokes observes that they make it appear probable to him that the unknown gas mentioned in his first letter "may be carbonic oxide"—*i.e.*, no hydrocarbon at all.

The Chemistry of Gases.—Among the lectures to be delivered at the Royal Institution after Easter, will be four on the above subject, by Professor Dewar.

REGISTER OF PATENTS.

Manufacture of Gas.—Love, J., of Stratford, Essex. No. 19,888; Dec. 5, 1890.

The main object of this invention is to provide for the manufacture alternately of coal gas and carburetted water gas in retorts generally used in the manufacture of coal gas, and for the mixing of such carburetted water gas with coal gas for the purpose of raising the candle power of the latter.

In making water gas, according to the invention, the steam (preferably superheated) is passed through the coke remaining in the gas-retort after the distillation of coal for the production of coal gas has been effected therein. The coal gas is first manufactured in the retorts in the usual manner, after which the fuel or coke in each of the retorts is massed in one end, and blown into a state of incandescence by a hot blast or other current of air. The producer gas formed during this process is conducted to, and consumed in, the furnace for heating the retorts. When the fuel or coke is in a proper state of incandescence, the air blast is shut off, and highly superheated steam is admitted to the retorts at or near one end of the mass of incandescent coke, and is caused to pass through the latter, whereby it is decomposed or converted into water gas. Vaporized hydrocarbon is then admitted at or near the other end of the mass of incandescent coke, and mixed with the water gas. This carburetted water gas is then "fixed," or converted into a permanent gas in the retort, and is conveyed to the gasholder and mixed with the coal gas within; or it is conducted to a separate holder, and mixed with the coal gas in any other convenient manner. The production of water gas is continued either until the coke in the retorts is completely exhausted, or only for a sufficient length of time to cause an inappreciable deterioration in the quality thereof, leaving it still available for use as fuel. In cases where the coke is left in a highly-heated condition after the manufacture of the coal gas therefrom, the air-blast may be dispensed with, and the steam be admitted to the retort as soon as the distillation of the coal is completed.

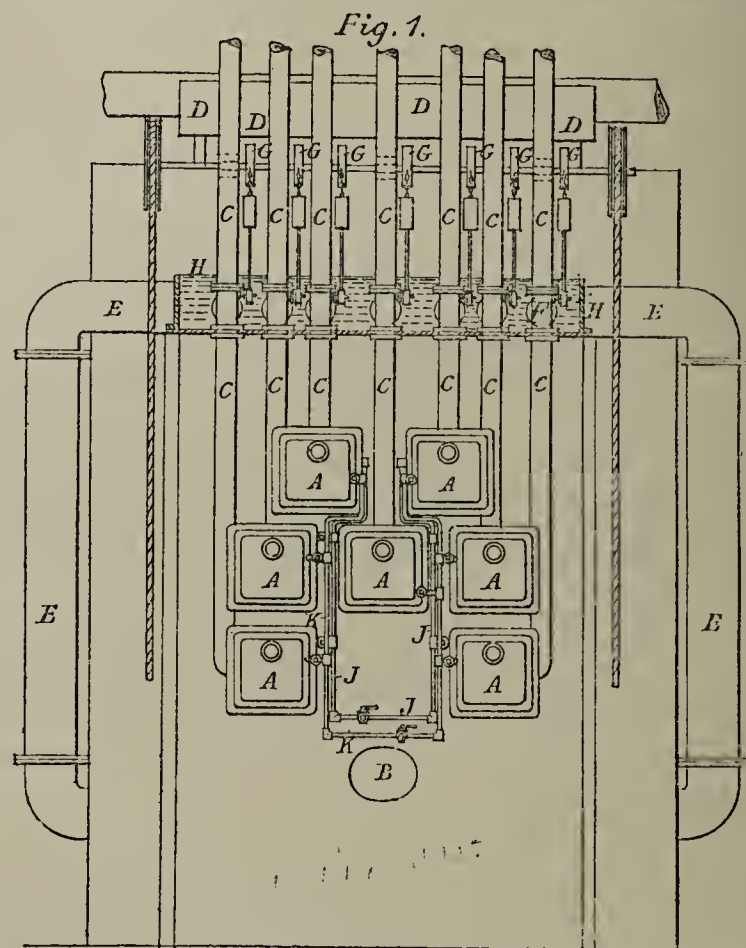
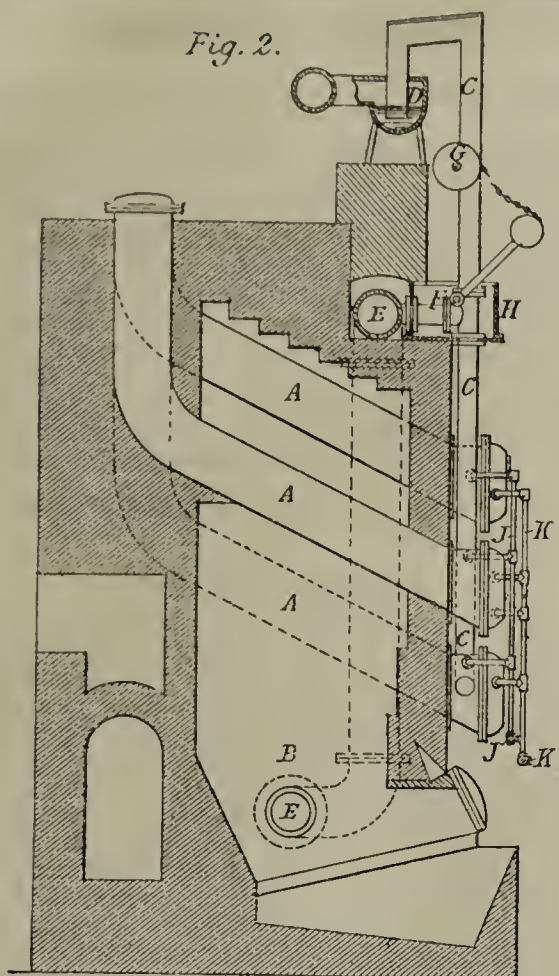


Fig. 1 is a front elevation, and fig. 2 a longitudinal central section, of a bench of gas-retorts having these improvements applied thereto.

A are the retorts; B is the furnace for heating the same; C are the pipes for conducting the gas from the retorts, which pipes dip into a hydraulic seal D in the usual manner. The retorts are set at a suitable angle, and are to be charged from their upper ends. The pipes C are connected with a pipe E communicating with the furnace B; so that, when required, the producer gas generated in the retort by the air-blast as hereinafter mentioned, may be conducted to, and be consumed in, the furnace. The pipes C and their branches are provided with suitable seatings, in combination with which is arranged a double conical valve F attached to a spindle, provided with a weighted arm or lever, so arranged that, when it is moved over in one direction, it will cause the valve F to close the gas-delivery pipe C, and, at the same time, open the branch-pipe, and, when thrown over in the reverse direction, it will open the main pipe C and close the branch-pipe. To permit the simultaneous operation of all the valves F in connection with any one bench of retorts, the weighted arms or levers are connected, by means of cords or chains, to grooved wheels or pulleys G firmly secured upon a shaft, which is supported in bearings attached to the pipes C or in any convenient manner. At either or both ends of this shaft, there is a grooved wheel or pulley, having passed around, and dependent from it, an endless chain or cord, whereby the shaft can be turned in either direction to throw the weighted arms or levers in the corresponding direction through a sufficient angle to permit their descent under the action of gravity. These chains or cords are so arranged that, when either of the weighted arms or levers is moved to the extremity of its throw or movement in one or the other direction, the corresponding cord or chain will remain slack; thus allowing the valve F to be held firmly against either seating by the action of the weighted arm or lever. In the lower part of each of the retorts, a passage or channel is formed in the side or wall, extending



for a suitable distance along it. One extremity of this passage is connected by a branch-pipe with a supply-pipe J, and the other extremity communicates with the interior of the retort. K is another supply-pipe attached to the lower ends of the retorts by branch-pipes. The pipes J K are provided with nozzles for connection with flexible pipes or hose; and the branch-pipes are provided with stopcocks or valves for regulating the supply of hydrocarbon vapour, air, and steam to the retorts as required.

The operation of the apparatus is as follows: The coal gas having been distilled from the charges in either bench of retorts, small doors provided on the retort-covers are opened to admit a rake, and the coke is thereby drawn down or massed in the lower portion of each retort. Flexible pipes or hose are then connected respectively to the pipes K J of the bench of retorts, and the valves F or cocks I are operated so as to close the pipes C running to the gasholder, and open the branch-pipes leading to the pipe E communicating with the furnace B. A blower is then put into operation, and an air-blast is thus forced through a heating coil, whence it passes into the retorts; thus blowing the mass of fuel or coke therein into a state of incandescence, and at the same time generating gas, which is conducted into the furnace B, where it is consumed, thereby greatly increasing the temperature of the retorts. When the coke is raised to a sufficiently high temperature for the manufacture of water gas, the three-way cock is turned so as to shut off the air-blast and admit steam to the heating coil; and the valves F or cocks I are again operated to close the branch-pipes and open the main pipes C. The steam, after being highly superheated in the coil, passes into the retorts, in which it is converted into water gas by its passage through and contact with the incandescent coke therein. A cock is also opened to admit the vaporized hydrocarbon to the retorts, which it enters at or near the end of the mass of fuel opposite that at which the steam is introduced. The water gas and hydrocarbon vapour are, therefore, intermingled; and the carburetted gas thus produced is fixed in its passage through the remaining portions of the retorts, which are very highly heated.

The improvements can be applied to existing gas-retorts as follows: The retort-cover is provided with a short conical pipe adapted to be closed by means of a plug of asbestos or other suitable material carried by a door formed with projections adapted to engage with lugs or hooks on the pipe, which lugs are formed with inclined surfaces, so that, by turning the door about its axis, the plug carried by the door can be forced tightly into the conical pipe. After the coal gas has been distilled, the door and its plug are to be removed, to permit the insertion of a rake for drawing the coke towards one end of the retort. To prevent the escape of gas during this operation, the rake is passed through a plug of asbestos or other suitable material also adapted to close the pipe, and carried by a door provided with projections to engage with the lugs or hooks on the pipe. A tight joint is thus formed around the stem of the rake, without interfering with its required movements. For introducing the air, steam, and hydrocarbon vapour into the retort, another plug is adapted to close the pipe; and this is carried by a door provided with projections to engage with the lugs or hooks on the main pipe, and in the door pipes are secured adapted to be connected with flexible pipes or hose for the supply of air and steam, and of hydrocarbon vapour respectively. The pipe for the supply of the hydrocarbon vapour extends to a suitable distance from the interior of the door, to ensure the introduction of the hydrocarbon vapour into the retort a short distance from the inner end of the coke therein. When the rake is removed from the retort with the main plug and door, the other plug and door together with the pipes are fitted and secured in the passage left in the mass of coke by the withdrawal of the rake through the same. After the manufacture of the water gas, the plug, door, and pipes may all be removed from the retort, and the latter be recharged with coal.

Gas and Hydrocarbon Motor Engines.—Weatherhogg, G. W., of Swinderby. No. 1447; Jan. 27, 1891.

This invention relates to motive-power engines, operated by an explosive mixture of atmospheric air or other gas capable of supporting

combustion combined with the vapour of benzolene, naphtha, crude petroleum, or other hydrocarbon oils—such as the ordinary petroleum of commerce, paraffin, or coal gas. The principal features of the invention are (a) improved means or apparatus for vaporizing the petroleum, (b) improved means or apparatus for creating a Bunsen flame for heating the vaporizers and firing the combustible charge, (c) preventing unevaporated petroleum passing into the power cylinders, (d) improvements in the construction of vapour admission valves for hydrocarbon engines, (e) maintaining the power cylinders at uniform temperatures, (f) improvements in the construction of the timing or firing valves of such engines, (g) improvements in the construction and arrangement of the air and exhaust valves, (h) improved means of starting hydrocarbon engines or coal-gas motors, and an improved governor. The improvements are in part applicable to motors operated by coal gas, but mainly to those worked by petroleum or hydrocarbon vapour.

Gas-Engines.—Higginson, J., of Manchester. No. 5490; March 28, 1891.

This invention relates to the arrangement and construction of gas-engines acting in cycles, whereby an impulse is secured at every revolution of the crank-shaft.

The patentee proposes to have an engine with two pistons in line with each other connected to the same piston-rod. The front piston is placed in an open-ended cylinder, connected to a crank-pin by a suitable rod. The second or back piston works in a cylinder arranged tandem fashion with the first; and the piston moves with the front piston by the piston-rod connecting the two. The front cylinder serves as a pump for taking in and compressing the charge of inflammable mixture. The second cylinder serves as a motor cylinder. The motive impulses are applied behind the second piston; while the gases in front of the second piston are either compressed and expanded at every stroke, or alternately expelled and drawn into that end of the cylinder at each to-and-fro movement. In this arrangement, the acting sides of both pump and motive pistons are the sides farthest from the crank-shaft. Unlike most gas-engines, the motor piston terminates its stroke in the motor cylinder; leaving but a small clearance space between the piston and the back cover. At the side of the two cylinders is placed a third cylinder having ports—one opening into the pump cylinder, and one opening to the motor cylinder at or near the ends of both cylinders. This side cylinder serves to contain a piston valve or valves, by which the whole valve operations of the engine are performed. This consists of two pistons placed at a fixed distance from each other, and connected so as to move together at that fixed distance apart—the connections being preferably made exterior to the valve-cylinder. The valve-pistons are actuated from a crank-pin preferably attached to a disc on the crank-shaft; and piston-rods or trunks of reduced diameter pass and work through covers at both ends of the valve-cylinder.

Water-Meters.—Schinzel, E., of Naples. No. 9500; June 4, 1891.

This invention relates to that class of water-meters, in which the quantity of water is indicated by the number of revolutions of a fan or paddle-wheel—inferential water-meters. It consists of two principal parts (which may be detached from each other)—viz., the inner part chiefly composed of the counting mechanism and the fan or paddle-wheel, and the outer part or paddle-wheel casing. The counting mechanism is separated from the fan by a water-tight partition, on the underside of which are formed three or more (but preferably as many as six or eight) radial compartments situated above the paddle-wheel. These compartments (or the partitions between the same) are intended to oppose to the water at the upper edge of the vanes or paddles of the wheel such a resistance that it cannot flow through the meter without turning the wheel, and consequently not without being measured. To the sides of the disc are secured two posts—one serving to support the plate which contains the upper bearings of the counting mechanism, while the other post supports the lower plate, which holds the step-bearing for the fan spindle or paddle-wheel shaft. The disc containing the lower bearings for the axles of the counting mechanism carries also a cylinder or sleeve for guiding the main-shaft and keeping it water-tight. In order to ensure the smooth and easy working of the entire apparatus, the bearing-plates, as well as the tooth wheels of the counting mechanism, are made of celluloid; while the lower journal or pivot of the main shaft (preferably made of phosphor bronze) consists of ebonite or hard india-rubber running in a cup or plate of polished stone, so that the water of the latter is reduced to a minimum.

Gas-Engines.—Evans, E. W., of Philadelphia, U.S.A. No. 17,815, Oct. 17, 1891 (but date claimed under "International Convention," March 19, 1891—being that of the first foreign application).

This invention has special reference to the construction and operation of a rotary valve and a valve-jacket for gas-engines combining the principles of mixing, ignition, and exhausting; and it has for its object "cheapness and durability in construction and operation, avoiding the use of eccentrics and cams, and efficiency in timing the engine." It consists, according to the principal claim, in an engine having mixing, igniting, and exhaust ports, in combination with a jacket having a supply-port, adapted to communicate with the mixing-port in the valve at predetermined intervals; also an exhaust-port adapted to communicate with the exhaust-port in the valve at predetermined intervals. There is a receiving-chamber in open communication with the piston-chamber, and having part connections with the valve-chamber adapted to communicate with the mixing and exhaust ports of the valve at predetermined intervals; also an annular recess-port in the body of the jacket about the valve in open communication with the receiving-chamber, and provided with seats engaging the valve. The igniting-port in the valve works in alignment with this annular recess-port; and means are provided at or between the seats whereby the gas in the igniting-port may be ignited to in turn explode the main body of gas, whereby a charge of gas may be taken into the piston-chamber, &c., and in turn compressed, ignited, exploded, and exhausted, so as to impart momentum to the piston and its power-transmitting gearing.

Burners.—Gibbons, J., of Jersey City, U.S.A. No. 20,696; Nov. 21, 1891.

The burner referred to in this invention, comprises a detachable body or stem provided with lateral slotted or hook-shaped flanges and a gas-admitting nipple entering the stem, and having headed studs or pins engaged by the burner-stem flanges, and disengaged therefrom by a relative partial rotary movement; the nipple also having an outer plug or stem for connection to a gas-supply cock or pipe.

In the course of his specification, the patentee remarks that gas or vapour burners commonly used in stoves, heaters, furnaces, or elsewhere for cooking and heating purposes, give considerable annoyance in use by choking up at their gas and air inlets or passages, and at the flame cap or tip, by both sooty deposits given off from the fuel they burn, and dusty or greasy particles which accumulate about the parts, and which become hard-baked upon the screw or bolt fastenings usually employed to hold the flame-cap or tip to the burner-stem or mixing-tube. When these screw or bolt fastenings "burn in," it is very difficult and often impossible to remove them; and hence the parts of the burner cannot be dismembered to facilitate convenient and thorough cleaning of it to maintain an effective hot blue flame. Burners of this class have also usually been rigidly and permanently fixed to or within the gas-stove or other support with which they are used—thus making it impossible to remove them by persons using them, and rendering the cleaning operation all the more disagreeable and uncertain. It is claimed that the present invention fully obviates these difficulties.

Workmen's Gas-Lamps.—Fritz, F., of Berlin. No. 22,549; Dec. 24, 1891.

This invention relates to workmen's and other gas-lamps in which a burner is employed having an interchangeable tube for reducing the pressure of the gas coming from the service, as well as a device for heating the gas before ignition. The base of the burner is provided with an interchangeable tube or tip, the upper end of which is bored or slotted according to the pressure in the service and the quantity of gas to be consumed, and through which the gas must flow before it reaches the burner slot or openings. The borings or slots are so chosen that the gas pressure is reduced to such a degree before its exit from the burner that it issues without pressure. Besides the saving in gas thus produced, the patentee also claims to attain a preparatory warming of the gas in the burner by providing the shell carrying the tip or burner with a cup-like part, the bottom of which is perforated so that the gas is compelled to pass round and over the cup, and then downwards to the lower opening of the burner; and in doing so it becomes warmed by coming in contact with the hot walls of the shell and cup. In order to avoid all flaring or unsteady burning of the flame and to render it "steady and brilliant," the inventor proposes to employ a chimney of elliptical section surrounding the upper part of the flame. This is preferably made from sheet metal, so as to be warmed by the flame and air drawn into it. The air flowing into the chimney has the tendency to also force the flame into the chimney, and give it a uniform and regular form.

APPLICATIONS FOR LETTERS PATENT.

5538.—KETCHUM, O. W., "Gas-generating furnaces or gas-producers." March 21.

5647.—DUNGLEY, J., "Fittings for gas and other similar pipes and tubes." March 22.

5740.—BILBAULT, P., "Gas and petroleum engines." March 23.

5994.—RUDD, J., "Increasing the illuminating power of gas." March 28.

6000.—HUNT, C., "Gas-washing apparatus." March 28.

6019.—HERZOG, C., "Gas generator to be independent of climatic variations." March 29.

6020.—HERZOG, C., "Regulating the quality of an artificial gas." March 29.

6062.—BOLTON, W., and DAVIS, G. E., and A. R., "Purification of coal gas." March 29.

6175.—BOULT, A. J., "Lamps or burners." A communication from G. Barthel. March 30.

6188.—CHANDOR, L., "Increasing the illuminating power of flames." March 30.

6240.—OWEN, E. T., "Motors to be operated by either gas or liquid hydrocarbons." March 31.

6284.—CHATTERTON, B., "Use of steam, and afterwards gas, as working fluids in the same cylinder for the generation of power." April 1.

6313.—HARTLAND, T. G., and EVANS, J., "Receptacles for electric and other wires, gas piping, and the like." April 1.

6314.—LAMB, J., "Automatically regulating light." April 1.

6316.—FORD, H. H., and TAVENOR, H., "Generator furnace." April 1.

6362.—LAMARRE, C. B. DE, "Manufacture of illuminating gas." April 1.

6381.—BROOKES, W., "Governors for regulating the pressure of gas." April 2.

6384.—HALL, D. M., and KINDLER, C., "Gas burners." April 2.

6388.—M'INNES, A., "Furnaces and gas-producers." April 2.

What Union Miners Think of their Leaders.—According to an incident which occurred a few days ago in connection with the strike of coal miners in Durham, there is a growing disaffection towards the Federation Board, against the members of which some very uncomplimentary language has been used. It is thought that, had it had not been for them, terms would have been made long ago, and in favour of the miners. The following resolution, passed by the miners employed at South Hetton, will show with what contempt some sections of the men are treating their leaders, and the views they hold with regard to the recent ballot: "That we take the present ballot under protest, seeing there is no change in the situation since the last ballot; and we are of opinion that the persistent efforts of the Board to ram their services down the throats of the men are retarding instead of bringing about a settlement of the dispute."

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

The Yield of English and American Gas Coals.

SIR,—In reply to the letter of Mr. E. H. M'Cullough on the above subject, in the current issue of the JOURNAL, the figures to which he refers, relative to the average yield of Newcastle coal, are taken, as stated in my article, from Mr. Newbigging's "Handbook for Gas Engineers and Managers." It would be beyond the scope of the series of articles on "Coal Gas" for me to particularize on the working results of individual undertakings using specific classes of coal. For information on this point, I cannot do better than refer Mr. M'Cullough to the Board of Trade Returns as to Gas Undertakings in the United Kingdom, which can be obtained in London for a small sum, or to the summarized returns periodically published in the JOURNAL.

April 6, 1892.

THE WRITER OF THE ARTICLES.

Profitable Tar Firing.

SIR,—The residual products from the manufacture of gas being at such low rates, especially tar, I take this opportunity of expressing surprise that the latter product has not been in more frequent use as fuel for retort-furnaces, particularly in places where there is a good demand for coke. A few years ago, tar burning was put into practice in a great many works; and in most cases, after a short trial, was discontinued, owing to the damage it did to the retorts. I, with others, suffered from this cause; and, in consequence, two years ago I erected a retort-bed specially for the purpose—giving plenty of room for the proper combustion of the tar. During the last two winters I have reaped the full benefit of the experiment; having burnt in the meantime 100 tons of tar, carbonizing 4 to 4½ tons of coal daily, every ounce of coke from which was sold. Therefore, for £65, the present value of the tar used, I have 230 tons of coke; and this at 18s. per ton, which I take to be the average price, makes a total of £207. This tar bench was taken up the first week in November, and let down at the latter end of February doing the bulk of the work of gas making here during the heaviest part of the winter.

I may say, in conclusion, that the retorts in this bed have not suffered from the liquid fuel so much as is generally the case from coke firing.

Bodmin, April 9, 1892.

J. THOMAS.

New Joint-Stock Companies.—The Gas Economizing Foreign Patents, Limited, has been registered with a capital of £3600, in £1 shares, to carry into effect an agreement expressed to be made between R. J. Hawkins of the one part and the Company of the other part, and generally to manufacture and deal in hydrocarbons and other materials for carburetting gas. The Gas Power Syndicate, Limited, has been registered with a capital of £60,000, in £1 shares, to carry into effect an agreement expressed to be made between Ernest H. Garze of the one part, and the Company of the other part, for the acquisition of any patents, patent rights, inventions, concessions, &c., and to develop and turn to account the same in such manner as the Company may deem expedient.

Loans to Metropolitan Local Authorities.—An important departure in respect of the borrowing of money for sanitary and other Metropolitan improvements was unanimously agreed upon by the Vestry of Shoreditch last Tuesday evening; they having decided to avail themselves of the powers conferred on them by the Local Loans Act, 1875, by issuing £40,000 inscribed debenture bonds at 3½ per cent., in multiples of £10, for the purposes of dealing with the insanitary areas which have to be cleared under the Housing of the Working Classes Acts. The debt will be redeemed by equal annual appropriations of principal and interest combined, spread over a period of 50 years. After carefully considering the reports of the Vestry Clerk (Dr. H. Mansfield Robinson) and their Accountant (Mr. Ernest A. R. Adams), the Vestry resolved to issue the bonds at 99 per cent., under the official sanction of the Local Government Board.

An Accident at the Shipley Gas-Works.—Owing to an accident at the Shipley Gas-Works, there was a scarcity of gas in the town last Tuesday, and in the early portion of the evening the streets were in darkness. About nine o'clock on Monday night, it was noticed at the works that there must be an escape of gas somewhere; and instructions were given to stop the manufacture until the source of the leakage was discovered. A diligent search was made; but it was not until about noon on Tuesday, that the point of leakage was found. Then it was detected that the end of the principal main from the retorts had broken off, and had sunk in the tar well, and so allowed the gas to escape. The result of the accident, had there been any naked lights in the immediate vicinity, must, of course, have been very serious. Happily, however, no greater damage resulted from the breakage than a loss of gas and consequent inconvenience to pedestrians owing to the public lamps not being lighted. At the Midland Railway Station oil-lamps had to be substituted for gas in the signals.

The Finances of the Darlington Corporation Gas and Water Departments.—At the meeting of the Darlington Town Council last Thursday, Mr. Barron reported that the half-yearly balance-sheet of the Gas Committee was most satisfactory, and showed that they were working in the right direction. The actual expenditure was £9991; whereas in 1890 it represented £10,800 odd. By an alteration in the works and a better supply of material, they had been able to produce gas at less cost; and he had no doubt as the works further progressed the saving would increase. The decrease in expenditure had been accompanied by a considerable increase in consumption. The net profit for the year was £1536, and of this they handed over £1500 towards the reduction of the rates, as compared with £1300 in the previous year. Alderman Harding subsequently submitted the balance-sheet of the Water Committee. The profits for the year, he said, amounted to £2009, and £2000 was to be handed over towards the rates. He hardly expected the current year to do so well on account of trade difficulties.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress was made with Bills last week :—

Bills read the first time: Airdrie and Coatbridge Water Bill; Lanarkshire (Middle Ward) District Water Bill.

Bills reported: Ashton-under-Lyne, Stalybridge, and Dukinfield (District) Water Bill; Glasgow Corporation Water Bill; Ipswich Corporation Bill; Pontypridd Water Bill; Swansea Corporation Water Bill; Swinton and Pendlebury Local Board Bill; Western Valleys (Mon.) Water (Gas Purchase) Bill.

Bills read the third time and passed: Oxford Gas Bill; Rhymney Valley Gas and Water Bill; Southborough Local Board Gas Bill; Tredegar Local Board Water Bill.

HOUSE OF COMMONS.

Monday, April 4.

RETURNS AS TO GAS UNDERTAKINGS.

On the motion of Sir M. HICKS-BEACH, returns were ordered relating to all authorized gas undertakings in the United Kingdom; in the case of companies, for the year ending Dec. 31, 1891, and in that of local authorities, for the year ending March 25, 1892.

THE CONSTITUTION OF THE COMMITTEE ON THE BIRMINGHAM WATER BILL.

Mr. D. THOMAS moved to increase the number of members composing the Select Committee on the Birmingham Water Bill to eleven, by the addition of Mr. Thomas Ellis (Merionethshire), and a member to be nominated by the Committee of Selection.

Mr. J. CHAMBERLAIN opposed the motion. He said it was the business of the Welsh members, if they wanted to secure representation, to do so when the Hybrid Committee was appointed.

Mr. COURTNEY admitted that it was desirable that there should be on the Committee a member representing Welsh opinion. Action, however, should have been taken in the matter when the names of the members to be nominated on the Committee were originally proposed to the House.

Mr. LABOUCHERE remarked that the Welsh members had not interfered earlier, because they had trusted that the Committee of Selection would nominate a Welsh member upon the Committee. He did not think that mere technicalities should be allowed to prevail in a matter of this kind; and an admitted injustice to Wales should be remedied.

Mr. COLLINGS said the question was regarded as if Wales had a predominant interest in the matter, and therefore should be specially represented; but if this were the case, all the counties through which the water supply would come ought also to be represented on the Committee. When the Committee was appointed, ample provision was made for all interests; and now, after three or four days' hearing of evidence, it was too late for the honourable member to come forward with his present proposal.

Mr. W. JAMES said he should be glad to be relieved from service on the Committee; and would withdraw in favour of someone else.

Mr. J. CHAMBERLAIN said he would not make any objection to that.

Dr. CAMERON said the appointment of the honourable member for Gateshead (Mr. James) had been made by the Committee of Selection; and the principle which regulated the action of that Committee was that, while the House put on partisans, the Committee nominated impartial and judicial men. The withdrawal of the honourable member could not, therefore, be accepted.

The House divided, and the numbers were: For the motion, 120; against it, 150—majority, 30.

Mr. THOMAS then notified his intention of moving that Mr. James be discharged from the Committee, and Mr. A. J. Williams (South Glamorganshire) appointed.

The SPEAKER said it was not becoming to challenge an appointment made by the Committee of Selection; and perhaps some amicable arrangement might be come to.

Thursday, April 7.

THE LONDON WATER BILL.

Sir J. LUBBOCK, in moving the second reading of this Bill, said it would be unnecessary for him to go into questions as to the quantity or purity of the water supply of London. The population had of late years increased from 3,350,000 to 5,700,000; and the demand for water for the service of the Metropolitan area had increased proportionately. The maximum quantity which could legally be taken from the Thames was 130 million gallons, and this limit was being gradually approached. Beyond this, it should be understood that if the House should grant powers for a new supply that day, it would be ten years or more before it could be obtained. He was glad to say that, in regard to this question, the London County Council were in agreement with the City Corporation, and that he was, therefore, moving the second reading of the Bill as the representative of both these bodies. The Bill proposed to constitute a Joint Water Committee to deal with the whole question of the London Water Supply, the Corporation having power to name any competent persons to represent them; and although, as the Bill stood, the County Council would be limited to their own members, he thought there was force in the representation of the Committee of last year that there should be freedom of selection on the part of that body. Objection had been taken to the Bill by the Water Companies that it would authorize the County Council to introduce Bills into Parliament for schemes competing with the existing undertakings; but all that was asked was that London should be put in the same position as other municipalities. It was also said that the Bill was not now so necessary as it was, and ought not to be pressed forward at the present moment, when a Royal Commission had been appointed to inquire into the subject. But from his point of view, the fact that the Government had seen fit to appoint this Commission accentuated the desirability of passing such a mea-

sure as the one now submitted. He might, however, state that, owing to the appointment of the Commission, the promoters had materially modified the Bill. Clause 5, which proposed to give the County Council power to examine the Companies' plant, works, and accounts, would, in deference to the wishes of the Companies, not be pressed; and with regard to clause 3, conferring authority to introduce Bills, it was intended to retain only the general powers.

Mr. RITCHIE said he had gone through the Bill in conference with the representatives of the Corporation and the County Council; and he was glad to say that they had agreed to meet the objections he had offered to some of the clauses. The Government were originally of opinion that it would have been better to have followed the suggestions made by the Committee of last session; but they had acceded to those of the Corporation and the County Council, and the House would probably admit that, both in regard to the *personnel* of the Commission that had been appointed and the instructions given to it, the Government had done their utmost to meet the circumstances of the case. It had been already explained that the Government had found it impossible to assent to the clauses enabling the Corporation and the County Council to institute inquiries into the matters at issue, and to examine the works of the Water Companies, at any rate until after the report of the Commission. Beyond this, he had objected to clause 3, which gave power to the County Council to introduce Water Bills; but at the same time he accepted the assurance given by Sir J. Lubbock on this subject. What had been conceded was that in future the County Council should have the same powers as were accorded to other municipal bodies in regard to the introduction of these measures.

Colonel MAKINS, in whose name the following notice stood upon the paper: "To move that it be an instruction to the Committee that they do insert clauses in the Bill for carrying out the recommendations in the special report of the Select Committee on the London Water Commission Bill, presented to the House of Commons on July 14, 1891," said that the Water Companies were perfectly satisfied with the action of the Government and of the President of the Local Government Board. The Bill in its original shape was very objectionable; but now there remained in it very little to which exception could be taken. It now, no doubt, carried out most of the recommendations of the Committee which sat last year; but in one important respect it failed to do so. The Committee laid great stress on the point that countenance should not be given to any desire on the part of the County Council to introduce competing measures as against the Water Companies. If competing Bills were to be brought in, a large amount of the ratepayers' and the shareholders' money would be wasted in vain legislative schemes. It was quite true that other large towns possessed the power to promote Bills; but he was not aware that the authorities of other towns had ever shown the same feeling of antagonism towards the local water companies as had been displayed by the members of the London County Council, and there was no case in which the rights of the water companies in the country had been acquired compulsorily without arbitration. Feelings of the most violent and unjust character had been manifested against the Water Companies by certain members of the London County Council, and especially by Sir T. Farrer. It was only recently that he gloated over the ruin which he thought had been brought upon the Companies by the labours of himself and others; and, in proof of what had been done in this direction, he referred to the great fall which had taken place in the value of the Water Companies' stock. What did that fall in the value of their stock really mean? Simply that a great deal of unnecessary loss and pain would be inflicted on a large number of widows and orphans. But, after all, the reduction in the Stock Exchange prices had nothing to do with the real value of the property. If the present Acts of Parliament were maintained, the property would always retain its value. The Companies were created by Parliament, and said they were perfectly content to rest in the hands of Parliament; and if the right honourable gentleman who moved the second reading of the Bill would give an assurance that the County Council did not intend, by means of the Bill, to bring forward measures in competition with the Companies, and thus unfairly to injure them, he would withdraw his opposition. It would be very desirable, however, that a clause should be inserted in the Bill making this point clear. As to the instruction he had put on the paper with the view of bringing the Bill absolutely into accord with the report of the Select Committee of last year, he thought that, after the very fair and moderate way in which the second reading of the Bill had been moved, and after the speech just made by the President of the Local Government Board, he and those who agreed with him might rest satisfied that justice would be done in the matter. Having made this protest, therefore, in the interests of those whom he represented, against any policy of confiscation in regard to the Water Companies, he begged to give notice that he should not move the instruction that stood in his name.

Mr. STUART complained that the attitude of Sir T. Farrer had been misrepresented by the honourable and gallant member, who seemed to think that the first step the London County Council should be compelled to take was to buy the water undertakings, and to do so at their existing market value. [Colonel MAKINS: No, no; by arbitration.] He would point out that the anticipation of an early arrangement to purchase was a very easy means of keeping up the value of the Companies' shares; but, on the other hand, the alleged fall in their value showed that there was no need of hurry to carry it out. As to the County Council introducing Bills for a competing water supply, he could only say that power to bring in such Bills was in no sense co-extensive with the probability of their being passed. There was no question in this case of granting to the County Council any privilege or rights other than those possessed by every other municipality in the country. All they sought was the right to promote certain Bills, which when introduced, would be considered and decided upon by the House on principles of justice and fairness to all parties.

Sir J. LUBBOCK said he wished merely to add that clause 5 would not have been introduced into the Bill if it had been known that the Government had intended to nominate a Royal Commission on Water Supply. That Commission having been appointed, the clause was unnecessary, and he should propose to withdraw it in Committee. As to clause 3, it was not introduced by the County Council in any

combative spirit; and they were quite willing to accede to the suggestions made by the President of the Board of Trade.

The Bill was then read a second time.

ALKALI, ETC., WORKS REGULATION ACT, 1881.

A Bill to amend the above-named Act was brought in by Mr. Ritchie and Mr. Long, read the first time, and ordered for second reading.

The following progress was made with Bills last week:

Further Standing Orders complied with: Barrow-in-Furness Corporation Water Bill.

Bills read the first time: Bradford Corporation Water Bill; Liverpool United Gas Bill; Oxford Gas Bill; Rhymney Valley Gas and Water Bill; Southborough Local Board (Gas) Bill; Tredegar Local Board (Water) Bill.

Bills read a second time and committed: Bristol Gas Bill; Cleator Moor Local Board Gas Bill; London Water (No. 1) Bill.

Bills reported: Blackburn Corporation Bill; Mold Water Bill; Rhyl District Water Bill; Rhyl Improvement Commissioners Bill; Stamford and St. Martin's Stamford Baron Gas Bill.

Bills read the third time and passed: Airdrie and Coatbridge Water Bill; Lanarkshire (Middle Ward District) Water Bill.

Petitions against the London Water (No. 1) Bill were presented from the New River and other London Water Companies, the Corporation of Croydon, the Corporation of West Ham, the Hertfordshire County Council, the Provincial Water Companies' Association, and the West Kent Main Sewerage Board.

HOUSE OF COMMONS COMMITTEES.

Thursday, March 24.

(Before Mr. HERBERT GLADSTONE, Chairman; Mr. W. F. LAWRENCE, Mr. C. CAMERON, and Mr. BONHAM-CARTER, Referee.)

SOUTHEND GAS BILL.

This Bill, by which the Southend Gas Company seek power for the construction of works, the raising of additional capital, and other purposes, came before the above-named Committee to-day.

Mr. LITTLER, Q.C., and Mr. RICKARDS appeared for the promoters; Mr. PEMBER, Q.C., and Mr. CLAUDE BAGGALLAY for the Southend Local Board, who had petitioned against the Bill.

Mr. RICKARDS, in opening the case, said that one of the objects of the Bill was to enable the Company to raise additional capital to the extent of £45,000. The reason they were before Parliament this year was briefly that, having been incorporated as a limited liability Company in the year 1854, when the Companies' Clauses Act was passed in 1862 they were re-registered under that Act, but without any changes in their constitution, except those which were brought about by the passing of that Act. They became possessed of parliamentary powers for the first time in 1877; and therefore they had found it necessary, having called up and expended all their existing capital, to come to Parliament and ask for further powers. They desired authority for the construction of additional works for the manufacture and storage of gas; and also for making a jetty or landing-stage which would be at the extremity of the town. He did not know how far it projected across the foreshore; but at any rate the Company had to comply with certain rules of the Board of Trade with respect to any encroachment upon the foreshore, and that Board had submitted clauses to the Directors which they had agreed to put into the Bill.

Mr. C. Woosnam, Chairman of the Company, was the first witness. He stated that the demand for gas had been steadily increasing every year. In the year 1885 the sale of gas was 18,456,000 cubic feet; in 1891, it was 29,625,000 cubic feet. The works of the Company at the present time were not sufficiently large to meet the increasing demand made upon them. Their immediate necessities did not require so large an amount as the £45,000 asked for; but they would spread the expenditure over a number of years as required. He thought the jetty and landing-stage would be in every way desirable, and an advantage to the town. It was proposed to carry a line of rails along the jetty and by the Company's private road into their works. The system adopted by the Company had been to reduce the price of gas whenever there was an opportunity; and the figure was now a good deal less than half what it was when they first started. They charged originally 10s. per 1000 feet; but the population was a mere nothing at that time. Now they had come down to 4s. 5d.; the maximum being 6s. The Company had decided to adopt the sliding scale.

Cross-examined by Mr. CLAUDE BAGGALLAY, witness said, with regard to the supply of gas for public lighting, the Company received for the lamps belonging to the Local Board, 40s. 6d. per annum, for which sum they lighted and extinguished the lamps and kept these and the lamp-columns in repair. As to their own lamps, they had 5 per cent. upon the outlay—equal to an additional 3s. per annum. They obtained their coals at the present time by the Great Eastern and the London and Tilbury Railways. There was difficulty in getting coals by water; because they had to take their carts alongside the vessel and pull them up the beach, which meant a great deal of labour and expense.

Re-examined by Mr. RICKARDS, witness said that on their present make the storage capacity was less than their manufacturing power. They had fixed the standard price of 4s. 6d. per 1000 cubic feet upon the calculation of supplying gas having an illuminating power of 14 candles; and although, as a matter of fact, they gave very nearly 15 candles, they could not afford to be put under an obligation to supply this quality at that price. If they had a higher illuminating power, they must have a higher charge. The accounts of the Company had always been made out in accordance with the form prescribed.

Friday, March 25.

On the re-assembling of the Committee this morning, Mr. Corbet Woodall, M.Inst.C.E., was called in support of the application. He said he had inspected the Company's works, and was of opinion that the proposals contained in the Bill were fair and

reasonable. Since the Company came to Parliament in 1877 they had had a career of steady progress and success, especially in recent years. Between 1881 and 1891, the quantity of coal used had increased 99 per cent.; the gas sold, 112 per cent.; the revenue from gas, 87 per cent.; and the capital employed, 61 per cent. The capital had grown at a smaller rate than the business done, which implied that the money had been spent judiciously. The effect of this was important to the consumers, as would be seen from this: In the year 1881 the amount required to pay dividend and interest (assuming the full rates had been paid) was £1350, which was equal to a charge of 23'6d. per 1000 cubic feet of gas sold. In 1891 the amount required to pay the same dividend and interest was £1560, which was 15'2d. per 1000 cubic feet. Judging from the appearance of the town, and the buildings in progress, he saw no reason why the consumption of gas should not continue to increase at the usual ratio. He found that in the last three years the increase had been 11 per cent., 9 per cent., and 14 per cent. respectively in the quantity of gas sold; and if the latter rate was maintained, the business would be doubled in five years. He had been carefully over the works of the Company, and found the apparatus and plant in a very satisfactory condition—showing proper care and administration. Portions of the plant at present required extension. The gasholder capacity was too low; being about 65 per cent. of the maximum output, and it ought to be more than 100 per cent. With regard to the proposed jetty, he understood the coal for the Company was brought from the Silkstone district by rail to Southend, and carted from the railway station, through the town, to the works. This was an expensive way of getting the raw material; and he was in entire accord with the Company in their proposal to establish the jetty for the purpose of discharging the coal just opposite their own gate. He considered it would be necessary to spend £6000 at once in order to make the works and plant fully equal to the demand. The Bill provided that £6000 might be spent in the first year after obtaining the Act. The new share capital asked for was £45,000, with borrowing powers for £11,250; and he estimated that this would carry the Company forward for 10 to 15 years. With regard to the allegation of the Local Board, that "the construction of additional works, and the raising of additional capital, did not arise from the increased consumption of gas, or other ordinary necessities of the case," he thought this was a very foolish contention, and one which would hardly have been raised if it had been thought over.

Cross-examined by Mr. PEMBER, witness admitted that there was a strong tendency in the present day to transfer gas and water undertakings to local authorities; but it was less strong than formerly. If the Bill passed, he did not think it would be necessary for the Company to go to Parliament again for 12 or 15 years.

Re-examined: If the Southend Local Board wished to buy the gas-works, the proper course was to go to Parliament with a Bill of their own for the purpose; or they could approach the Company and offer them terms.

Mr. Henry E. Jones, M.Inst.C.E., gave corroborative evidence. He said the remoteness of Southend from the coal-fields made it very important to have an expeditious and proper mode of getting the raw material into the Company's works. Steamers could not come up to the town, as the beach was not suitable for it; and the coals had either to come by railway or in small sailing vessels and lighters. As a fact, if they came by sea, they were brought up to London and then sent down again in lighters; and the cost was therefore a great deal higher than it was in London.

This concluded the case for the promoters.

Mr. BAGGALLAY said, with the Chairman's permission, he would call evidence for the opponents before addressing the Committee.

Mr. S. Wood, of the firm of Messrs. Alfred Lass, Wood, and Co., said he had examined the published accounts of the Company, and found that the capital expended had been £26,051.

Mr. E. H. Stevenson, M.Inst.C.E., of the firm of Stevenson and Burstal, said he had visited the works of the Company, and he did not consider them to be well designed, because of their great variation. This led not so much to extravagance in the cost of production as to high expenditure upon certain parts of the works. A considerable number of years had to elapse before the growing wants of the district picked up the extra power which had been provided. With the exception of the gasholder and some small apparatus, the Company had sufficient plant to last them for some years; but, of course, not enough for the interval until they would go to Parliament again. The erection of the proposed jetty would certainly not be advantageous, as affecting the cost of the gas. He knew of no reason why the existing public jetty should not be used for the purpose of landing coals. He believed the total cost of the jetty and plant would not be less than £4400—£2900 for the jetty, and £1500 for the plant. In his opinion, the consumption of gas at Southend would double in about eight or nine years; and he thought the existing works, and those which were being carried out, would be sufficient for an increase of about 50 per cent. On these grounds, he thought the additional capital asked for by the Company was about four or five times too much, and that about £7000 would carry them on until 1905. The gasholder, they were told, was to cost about £5000; and then, of course, there was the expense of the Act now applied for, which he put at £1000. This was rather more than the Company paid for their original Act. The cost of the land—it was a sort of marsh land—he put at £500. He thought another £800, in addition to these items, would carry the Company for six or seven years from now; and he should say a further £7000 would carry them on for another seven years from 1905. This would make a total capital which he thought ought to be given, for the 14 years, of about £14,000 to £15,000. He had not included the jetty in that. In his opinion, the standard price proposed was high. The Company stated that if they were allowed to make the proposed jetty, there would be a saving in the price of coal of 1s. 11d. per ton, or equal to about 2½d. per 1000 cubic feet of gas sold. If the Company used the public jetty, instead of making one of their own, they would save about another 2d. Allowing for the price of carting, they would be able in this way to reduce the price of gas between 3½d. and 4d. per 1000 feet—say, 3½d., to be certain. He thought a standard price of 4s. would be more than sufficient to pay the standard dividend. Gas of 15-candle power was

almost the invariable minimum now. He thought it was desirable that the Local Board should have the power to purchase the gas undertaking in a case like this; and certainly the Company would not be damaged in any way thereby.

In cross-examination by Mr. LITTLER, witness said he could not give any instance of a company having a purchase clause, like the one proposed by the Local Board, put upon them against their will, nor of a standard price lower than the actual price being imposed by a Committee. He did not mind giving the Company a fair margin beyond the selling price; what he objected to was giving them such an amount of capital as would keep them from Parliament for 30 or 40 years.

Monday, March 28.

To-day additional evidence was adduced for the opponents.

Mr. W. A. Valon, Assoc.M.Inst.C.E., said he agreed that the amount of capital named by Mr. Stevenson would enable the Company to treble their output, and make provision for trebling their consumption. He also thought that 4s. per 1000 cubic feet would be a very fair initial price; and he certainly considered that the Company would be able to save about 3½d. per 1000 cubic feet of gas, if they had coals brought by water and used the Local Board's jetty.

Mr. J. H. Burrows, Chairman of the Southend Local Board, also gave evidence.

Mr. PEMBER then addressed the Committee in opposition to the Bill. He said that a great number of points had been settled between the parties, but four or five still remained. Dealing first with the proposed jetty, he contended that its erection would necessitate an outlay of some £4000, and [that it was clearly not worth while to construct it. He also submitted that the amount of capital asked for was—even with the auction clauses—outrageously extravagant. Mr. Stevenson had suggested that £14,000 would be a fair amount. But if the Committee gave the Company £20,000, it must be ample for anything they would need for 12 or 14 years; and then it would be time for them to come to Parliament again, so that the people of Southend could take advantage of any new legislation in regard to gas companies. He certainly thought that, at the outside, the Company should be allowed to have £16,000 of additional share capital, and borrowing powers for another £4000. He reminded the Committee of the evidence given by Mr. Stevenson as to what the standard price ought to be; and he (Counsel) asked them to fix it at 4s.

Mr. LITTLER having replied, the room was cleared.

On the re-admission of the parties,

The CHAIRMAN announced that the Committee considered the preamble of the Bill proved; but with regard to the capital, they were of opinion that instead of £45,000 it should be £28,000, with the usual borrowing powers. The standard price they also thought might stand at 4s. 6d.; and the illuminating power of the gas was to be raised to 15 candles.

The Bill, as amended, was then ordered to be reported.

Tuesday, March 29.

(Before Sir S. NORTHCOTE, Chairman; Sir J. COLOMB, Mr. CRAIG, and Sir J. O'CONNOR.)

ORMSKIRK GAS BILL.

This Bill, which was promoted by the Ormskirk Gas Company to obtain authority to extend their limits of supply to Maghull, Melling, and Lydiate, to erect additional works, to alter the price of gas, and to consolidate the shares or stocks of the Company, was considered by the above-named Committee to-day. The Lancashire County Council and the Ormskirk Local Board petitioned against the Bill, but the promoters settled with them; and the only opponent was Mr. J. M. Idle, a shareholder of the Company.

Mr. BALFOUR BROWNE, Q.C., and Mr. FREEMAN appeared for the promoters; Mr. IDLE conducted his own case.

Mr. BALFOUR BROWNE, in his opening remarks explained that the Company proposed to raise additional share capital to the amount of £20,000; and they sought power by the Bill to do this, and also to borrow to the extent of one-fourth more. The money was needed for an extension of the works, including the erection of a new retort-house. With regard to the quality of the gas, it was proposed to put the illuminating power at 15 candles; no definite standard being at present required of the Company. Dealing with the opposition of Mr. Idle, the learned Counsel said that gentleman's fear was that the Company would lay out money in supplying districts that would be unremunerative. This fear, he assured the Committee, was absolutely groundless. It was peculiar, too, that Mr. Idle had increased his holding in the Company since the Bill was promoted; but he could not expect his views could prevail against the desire of the rest of the proprietors.

Mr. J. Martin, Engineer and Manager of the Company, said that further capital was required for the development of the undertaking; and the money would be spent at once on a new retort-house, new mains in Ormskirk, and a new tar and liquor well. The Bill would extend the area of the Company's supply to Halsall and Carisbrick as well as to Melling and Maghull, which were fast becoming residential districts for Liverpool merchants. Unless the persons in these districts who required gas guaranteed a certain payment, the Company were not bound to supply them; and unless such guarantees were obtained, they certainly would not supply gas. He saw no ground for the fears which Mr. Idle entertained that the extension of the mains to these places would be detrimental to the interests of the Company. Witness added that in 1871 the consumption of gas in the district was 10 million cubic feet; in 1881, it was 16 millions; and last year it had risen to 27 millions.

Cross-examined by Mr. IDLE, witness stated that, although the population in the district of supply had not increased, the consumption had; and the price charged in Maghull would all depend upon the demand and upon the consumption. The Ormskirk Local Board had insisted upon a reduction of the Company's maximum price by 1s. per 1000 cubic feet; and so did the Chairman of Committees of the House of Lords (Lord Morley)

Mr. IDLE: Does not that justify my statement at the meeting of the Company, that you would not come back with all the privileges you now possess?

Witness: But we do not charge our maximum price of 6s. 6d. We only charge 3s. net. The price varies in the different districts.

Re-examined: Inquiries had satisfied him that the proposed extensions would be remunerative to the Company.

Mr. T. Alty, Chairman of the Company, said that the whole of the authorized capital of the concern (£20,000) had been called up and spent, and the present borrowing powers exhausted. His opinion was that the extended powers would be advantageous to the Company.

Mr. IDLE then proceeded to argue that the Bill was unnecessary, and that it was unjust to the Company to double the capital.

The Committee found the preamble proved; and they then proceeded to go through the clauses. As originally presented, the Bill contained three clauses relating to the recovery of money by distress. These the Home Secretary, in his report on the Bill to the Chairman of the Committee, recommended should be excluded; and they were accordingly struck out. Other amendments were made; and the Bill was subsequently reported to the House.

The Coze Inclined Retort System.—We learn that the Leigh Local Board (Gas and Water Department) and the North-Eastern Railway (Gateshead works) have decided to erect the system of inclined retorts under licence from the Automatic Coal-Gas Retort Company, Limited.

Reduction in Price at Cradley Heath.—The Directors of the Cradley Heath Gas Company have, at the request of a deputation of gas consumers which recently waited upon them, decided to reduce the price of gas from 3s. 9d. to 3s. 3d. per 1000 cubic feet to consumers of less than 50,000 cubic feet per quarter, and from 3s. 3d. to 3s. to those burning more than that quantity.

Damages for Accident to Mrs. Thwaites.—At the Glamorganshire Assizes, held at Cardiff last Thursday, Mrs. Thwaites, the well-known lecturer on cookery, recovered from the Cardiff Park Hall Company £50 for neglect on the part of servants of the Company in not lighting the vestibule leading to the hall after one of her lectures, by neglect of which she fell down, and sustained injuries to one of her legs.

Gas Explosion at Croydon.—Last Friday morning, shortly after eleven o'clock, a serious gas explosion occurred at Croydon. A few days ago complaints were made at the offices of the Gas Company of an escape of gas in Wandle Road, and some workmen were sent to open the ground. This having been done, the escaping gas became ignited by a lighted torch carried by one of the men; and an explosion immediately took place, the effect of which was to tear up a considerable portion of the roadway and footpath, and to demolish the railings in front of No. 33, and force off the roof of the greenhouse at the back. On the other side of the road, at No. 38, damage was done inside the house; while in the back garden, a distance of 60 feet from the road, three large paving-stones were raised completely out of the ground. A subsequent examination of the roadway revealed the fact that a culvert had become filled with gas through a leakage in one of the pipes. Although the Company's men were much shaken, they soon recovered, and repaired the damaged pipe.

The Public Lighting of Oldham.—In the Court of Appeal last Tuesday, before the Master of the Rolls and Lords Justices Fry and Lopes, the case of the *Attorney-General (at the Instance of the Local Boards of Chadderton, Royton, Crompton, and Failsworth) v. the Mayor and Corporation of Oldham*, came on for hearing. It was an appeal by the plaintiffs from the judgment of Mr. Justice Collins, dated Oct. 29, 1891, in an action which raised the question of the legality of the practice followed by the Oldham Corporation of supplying gas gratuitously for the public lighting of the borough, whereby the outlying Local Authorities served with gas from the Corporation's works were, as they contended, prejudicially affected. The annual cost of the gas so used was stated to be £6000; and this sum ought, it was urged, to have appeared in some shape in the municipal accounts. The views of the respective parties will be found fully set forth in the report of the case when it was in the Lower Court (see JOURNAL for Nov. 3, 1891, p. 804), when the plaintiffs failed to sustain their contentions. These were brought before their Lordships in the Superior Court by the Attorney-General (Sir R. E. Webster, Q.C., M.P.); but, in the result, the judgment of Mr. Justice Collins was affirmed.

Sales of Shares.—A sale of between 400 and 500 shares in various Suburban Gas Companies was held by Mr. Alfred Richards at the Mart, Tokenhouse Yard, E.C., on Tuesday last. Original shares in the *West Ham Gas Company*, paying 10 per cent., were sold at £10 10s. per share. Some £10 *North Middlesex Gas Company's* shares, bearing a like dividend, realized £19 2s. 6d. each. Shares in the *Woking Water Company*, £10 paid, and earning 4 per cent., fetched £10 per share. The *West Kent Gas Company's* £10 shares (10 per cent. class) sold for £18 each; and the £10 shares in the same Company on which £4 has been paid realized £5 12s. 6d. apiece. A number of *Romford Gas Company's* £5 shares, bearing 7 per cent., were sold at £6 10s. each. Original £10 shares in the *Harrow District Gas Company*, carrying 7½ per cent., brought £16 per share; the "B" £10 shares in the same Company (7 per cent.) being sold at £12 17s. 6d. and £13 12s. 6d. per share. Fully paid £10 "C" shares in the same Company, paying 5½ per cent., realized £10 10s. per share.—On the following day, at the same place, Messrs. Fox and Bousfield sold stocks and shares as follows: *Tottenham and Edmonton Gas Company's* "B" stock, at 152 to 152½ per cent.; *Lea Bridge Gas Company's* £10 shares, at £18; *Harrow District Gas Company's* £10 shares, at £13½; *Leatherhead and District Gas Company's* £10 shares, at £8; *Woking Water and Gas Company's* £100 4 per cent. debentures, at 99.—Last Tuesday, Mr. C. H. Morris offered for sale by auction at Lewes, £360 stock in the *Lewes Gas Company*. Several lots of £20 each realized £39; but others were withdrawn at £38 10s.—these being disposed of privately after the sale.—At a recent sale of shares in the *Horsham Gas Company*, some fully paid "A" shares (£10) fetched £19, £19 2s. 6d., and £19 5s. each. Last year a dividend of 8½ per cent. was paid on these shares; and they are capable of carrying one of 11 per cent. On the same occasion, some "B" (7 per cent.) £10 shares fetched £14 10s. each.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Tuesday, April 5.

(Before Mr. Justice KEKEWICH.)

Gadd v. Mayor, &c., of Manchester—The Gasholder-Guiding Patents.

The hearing of this action, in which the validity of Mr. Gadd's patent for the guiding of gasholders without external framing is in question, was resumed to-day; the previous proceedings having occupied the attention of the Court from the 29th to the 31st ult. (see *ante*, p. 628).

Mr. H. Davey was called on behalf of the plaintiffs, and, in answer to Mr. MOULTON, said he was a consulting engineer, and had had considerable experience in such matters as the one in question. He had read the plaintiffs' specification, and was of opinion that the invention there disclosed was new at the date of the patent. There were various mechanical equivalents for a rack and pinion, including a screw working in a nut, and chain gear, in which the chain formed a flexible rack. A windlass and rope would, in special circumstances, be an equivalent; but, speaking generally, he should not say it was. A passage from Galbraith and Houghton's "Manual" stated that a rack and pinion were equivalents for an axle and rope. Professor Unwin's "Elements of Machine Design" was also referred to, to show the use of the word "gearing;" and Mr. Kinnear Clark's "Manual" had a chapter on "rope gearing." A model was put in, showing a rack and gear movement and various equivalents for it. Some of these, witness remarked, performed similar functions; but he should not term them a direct equivalent. They were well-known forms, and were used in place of racks and pinions. Going to the complete specification, witness said the various figures there shown were fair developments of the provisional specification. A model was put in, consisting of three pairs of toothed wheels, each pair connected by a drawing-chain, and forming three sides of a quadrangle, to illustrate the same thing. It was then changed so as to make one continuous chain instead of three pairs; and in this form witness said it represented figs. 11 and 12 in the specification. Figs. 13 and 14, 15 and 16, were substantially the same; they were only modifications of one thing. The drawing put in by Dr. Hopkinson was an exemplification of the specification. A model was produced to show how such a construction would act; and it was so contrived as to demonstrate how it would work either by tension or torsion. There was a great advantage, witness stated, in having round the periphery of a holder, instead of across it, the gear for preserving the equilibrium. This enabled one to attach it to the curb, which could be made strong enough to withstand the strain; while the sides were thin, and ill-adapted for the attachment to them of gear of any kind. He did not think Malam's system could be practically applied at the bottom of a gasholder. There was no suggestion in it that side-framing could be dispensed with, or that the gearing could be carried round the holder. Nicholson and Cole's plan involved side framing, and would not lead to the plaintiffs' method. In the Staindrop case, the mechanism was the same as that of a Venetian blind, and was not like plaintiffs'. Witness was questioned with regard to the other alleged anticipations, and expressed the opinion that they would not lead the mind of anyone reading them to the plaintiffs' arrangement. Wild's invention was simply the application to a pontoon of an old form of parallel ruler. There were important variations between the case of a pontoon and that of a gasholder. The nearest approach one to the other would be to have a gasholder mounted on a square pontoon; and then, if the wind pressure came diagonally, there would be a great strain on the mechanism, which would be transmitted through the material of the construction.

Cross-examined by Sir HORACE DAVEY: The term "rope, belt, or chain gearing" was, he believed, only applied where the rope, belt, or chain was used for driving one piece of mechanism by another piece of mechanism. In the model produced by witness, with the chain wheels and chains, the wheels served different purposes in the two methods of arrangement. In the first instance, one wheel transmitted motion to the other; in the second, they acted merely as friction-pulleys. This observation applied, to some extent, to the model made to illustrate Dr. Hopkinson's drawing. If the drum and pinion were removed, there would be no exact equivalent of the rack; but a like result was obtained. He could not say that in fig. 16 there was any exact equivalent of the "pinion, mitre, or other toothed wheel;" but later on the specification referred to "pinion, mitre, or other wheels," which seemed to indicate that the inventor had in his mind the use of wheels not toothed. He did find in the provisional specification the suggestion of an arrangement which did not involve the use of wheels for the purpose of transmitting motion round the gasholder.

Justice KEKEWICH remarked that he thought the word "toothed" must have been accidentally omitted in the second passage referred to.

Sir H. DAVEY said he had the same idea; but even if it were not so, he did not consider that it would materially affect the question.

Cross-examination continued: He should say the peculiar character of the invention was the holding of the bottom rim of the gasholder, at different places round the circumference, in a fixed position at all points of its rise and fall. In fig. 4, when the holder was at its lowest, the pinion fixed on the tank, which controlled the holder, was near the top; but the point of support was at the bottom, and might be only at the bottom. He did not say any means of achieving the desired object would be within the patent; but only those mentioned in the final specification. He considered the connection with the bottom of the holder was an essential feature of the invention; though it might also be attached to the top. Malam's system would be impracticable under a holder, partly because of the extra weight of girders required to carry the gear; and in modern holders it was not customary to excavate the tank entirely. It could, of course, be done as a mere question of mechanism. It was a perfectly easy transition from Wild's rectangular pontoon to a circular one; it would only require a multiplication of shafts and pinions round the circumference. Mr. Gadd said that, by preference, the shafts should all be connected together; and he considered this essential. Even where he did not connect them directly, they were brought so close together that they were virtually connected. One of

Standfield's figures was exactly the same as one in plaintiffs' specification; but it was applied to a different structure. The novelty of Mr. Gadd's patent lay in the application of well-known means to a gasholder. He told the world what the object was in his patent of 1887; but the world did not make the 1888 invention. It was not obvious, on Standfield's patent that the plan was applicable to a gasholder.

Re-examined: Standfield did not suggest the application of his apparatus to a circular platform. In figs. 12, 14, and 16 in plaintiffs' specification, it would make no difference whether the wheels were toothed or smooth; the action would be precisely similar. The same object was attained in the 1887 patent, but in a different manner.

Mr. W. F. Mason, co-owner with Mr. Gadd of the patent in question, was the next witness. He narrated the circumstances of a conversation with Mr. Gadd, after the 1887 patent was taken out, in which that gentleman described a new method of guiding a gasholder from the base. Mr. Gadd made on the margin of a newspaper some diagrams which conveyed to witness's mind the idea he had. They included racks and pinions, and also rope and chain gearing. He explained how the mechanism was to be arranged round the holder, and what the effect would be—to cause the holder to rise evenly over the whole surface. This was very early in 1888. A patent was not taken out at once, as he was anxious to sell the 1887 patent first. He remembered the filing of the provisional specification of the 1888 patent. Before this he had seen the letter from Mr. Terrace of Dec. 7. He first heard of Mr. Pease's invention in January, 1890. He had not seen the article in the *Gas and Water Review* until that moment; and he never saw the model in the Manchester Town Hall.

Cross-examined: Witness and Mr. Gadd formed the Patent Gasholder Syndicate. He never heard of Mr. Pease's model being at the Manchester Town Hall. He knew some members of the present Gas Committee, but had only done so within the last three months. He did not hear that the Corporation required an additional lift at their Rochdale Road works; and did not see any advertisement for tenders. The conversation with Mr. Gadd was quite casual; and he did not make any note of it, or preserve the sketches Mr. Gadd drew. The conversation impressed itself upon his mind, as it was a new mode of guiding a holder. Mr. Gadd showed a rack and pinion, and also a mode of acting without any rack and pinion. Witness had nothing to do with preparing the specification.

Mr. A. Gadd said he remembered his father explaining in 1887 his method of guiding a gasholder by rack and pinion. Late in that year, or early in 1888, he told witness to make a sketch of it; and he prepared the drawing produced. The ink lines were his; but some of the marks were his father's. He could not now remember what the marks referred to. He made two other drawings, which were destroyed. This one was put aside as he did not know whether or not it was done with.

Cross-examined: He had made a declaration with regard to the drawing, for use in connection with some American proceedings. He believed the object was to show that his father was the first and true inventor. It said nothing about tensional gearing.

Mr. W. Gadd, recalled, said he took proceedings in America with regard to four patents. The tensional method was in a different patent. The one in reference to which the deposition was used was the torsional patent.

This concluded the evidence on behalf of the plaintiffs.

Mr. MOULTON then summed up the plaintiffs' case. He said the main points raised by the defendants were two—first, that the tensional system was not fairly included in the provisional specification, or, in other words, want of conformity between the provisional and the final specification; and, secondly, anticipation, mainly by Wild and Standfield. He submitted, on the authority of the case of *Woodward v. Sampson* (4 Patent Reports), that, if a man described only one method of carrying out the object of his invention in the provisional specification, he was not thereby precluded from adding to his complete specification anything which was fairly within his invention. In the present case, Mr. Gadd had clearly indicated that there were other means contemplated. He did not think that the very minute criticism which had been directed to the use of the words "gear" and "gearing" could be sustained. The drawing prepared by Dr. Hopkinson, and the model constructed to illustrate it, showed how variations could be made in the mode of carrying out the invention; and other illustrations of a similar character might have been given. All that had been done was the fair outcome of the provisional specification, even without the words "mechanical equivalents." He then quoted the case of *Woodward v. Sampson* to show that the patentee in that case described his invention by the same words as he had previously used with regard to a former patent, but that his second patent was held valid by the Court of Appeal. He then addressed himself to the alleged anticipations, in dealing with which there had to be considered, he said, the nature of the claim put forward—viz., to dispense with the external framework of a gasholder and yet retain the requisite stability, and to do this by a ring of mechanical devices arranged round the holder. The only two anticipations which were at all dangerous to his case were Wild's and Standfield's patents. No doubt Standfield's consisted of the same element as the plaintiffs had used. But it was not employed as a ring, and it was applied to a platform, not to a gasholder; and he submitted, on the evidence, that it certainly required invention to pass from one to the other.

At the conclusion of the learned Counsel's speech,

His LORDSHIP suggested to Sir H. Davey that he should address him on the construction of the specification before calling evidence.

Wednesday, April 6.

On the resumption of the hearing this morning,

Sir HORACE DAVEY proceeded to open the case on behalf of the defendants. He said he should first submit that the patent in question was altogether invalid on several grounds, but first on that of disconformity between the provisional and the complete specification. In other words, he contended that the invention described in the complete specification was not the one of which the nature and purport were described in the provisional specification. In the next place, he should argue that, according to the interpretation which had been put upon the patent, both by the Counsel and the eminent witnesses who had been called on the other side, the claim was too large, because it

covered every conceivable kind of machinery by which the purpose mentioned in the provisional specification could be effected. Thirdly, he submitted that the patent had been anticipated. He did not think it was necessary to say that it was an adaptation of an old piece of mechanism to a new and analogous use; he should go farther, and declare boldly that it was the use of an old piece of mechanism for precisely the same purpose as those for which it had been described by earlier inventors. It would be his duty to submit that both Wild and Standfield used the identical thing which Mr. Gadd (he would assume in good faith) believed he had invented. It might be that hereafter something would be said about Mr. Pease's patent, on the same ground. It did not follow that a patentee was aware of everything that had been done before. He might, in good faith, think he had produced a new invention, and take out a patent for it; but, owing to his not being so well acquainted as he might be with what was to be found in the files of the Patent Office, it would unfortunately turn out that he had been anticipated. Although Wild and Standfield carried him to all the extent to which he wished to go, he thought it material to keep the other pieces of machinery and mechanism before the Court, because they showed that the problem was present to people's minds of maintaining gasholders in the horizontal position, and that they employed tensional means, by the aid of ropes and pulleys, for effecting this object. Though they applied tension in the way that suited their objects, the particular means were identical with those employed by the plaintiffs. If they found that the minds of people had been directed to the same problem of preserving the horizontality, not only of a gasholder, but of other moving platforms on frames, by means of similar arrangements of ropes and pulleys, although placing them in a different way to that chosen by the plaintiffs, it would have an important bearing on the question of the validity of the patent. Messrs. Nicholson and Co. had an arrangement identical with the plaintiffs' of the pulleys and the cords, though they put the cords diagonally across the gasholder. Mr. Terrace's drawing, which was made on Nov. 11, 1888, just before the date of the plaintiffs' patent, was admitted to be identically the same thing as fig. 1 in the plaintiffs' specification. The only question was as to whether that design had been published. The publication relied upon was the communication of it to various persons. It was communicated to Messrs. Walker, who were tendering for some extension of the Brechin Gas-Works; and also to Mr. G. Livesey, of the South Metropolitan Gas Company, who appeared, from his reply, to have been much struck with the sketch, and to have suggested that Mr. Terrace should take out a patent for it. He also communicated the sketch to his brother, Mr. Andrew Terrace, a Gas Manager, who also showed it to various persons.

Justice KEKEWICH: If I have followed you so far, you will seek to bring the case within Lord Justice Fry's judgment in *Mapleson v. Sugg*?

Sir H. DAVEY said that was his intention. He was going to suggest this to his Lordship as a test: Was it communicated to any person in England without any conditions of confidence or secrecy? That, of course, was a question of fact for the Court to decide. He would address himself now to the construction of the patent; and he should submit that people must discover, from the provisional specification, what the nature of the plaintiffs' supposed invention was. It seemed to him that the nature of the plaintiffs' invention was the suggestion of a new means for achieving the object accomplished in a different way by the patent of 1887. Dr. Hopkinson had said that he was not aware of any mechanical device for effecting this object which would not come within the scope of the invention. If so, then it was a great deal too broad; and his Lordship would at once see the far-reaching effect it had. Two days after the provisional specification was filed, Mr. Pease, of the firm of Messrs. Ashmore, Benson, Pease, and Co., Limited, filed a provisional specification describing the tensional arrangement which it was alleged was an infringement of what was afterwards described in the plaintiffs' complete specification. Before this was filed, Mr. Pease's firm undertook a contract for the supply of new lifts to a gasholder at Manchester, and furnished a model showing the exact thing which was afterwards put up, long before there was a description of anything of the kind on the files of the Patent Office. The patentee says his "improvements relate to the construction of gas holders, and had for object the supporting of the same in their working position, in such a manner as to enable the external or upper guide-framing, hitherto employed for this purpose, to be dispensed with, and yet to give the requisite stability, although such, or a modified form of framing may be employed in connection with the improvements herein described." Now, this was precisely the object which the patentee placed before the public in his specification of 1887. Assuming it was a valuable idea, it was still public property; and therefore there was no room for any invention, except for an improved means of carrying out that idea, which had become public property. This was not a case where a patentee had a new idea, and described a practicable means of carrying it out; but one where the novelty consisted in the idea. In such cases, the Courts said that, if the same idea were carried out by other mechanical means, it was an infringement. In the present case, the novelty of the patent consisted in the idea; and though a man could not have a patent for an idea, he could have one for a practicable means of carrying it out. In this case, the idea was public property, because, if for no other reason, it had been given to the public in Mr. Gadd's previous patent of 1887. The only room for invention being improvement in the means of carrying into effect an old idea—a purpose which had been given to the world—the question arose as to what were the means which the patentee described, and where did they find the nature of his invention. They did not find it in the purpose; because, if it was for every means of effecting this purpose, he had anticipated himself. A good deal of time had been spent in examining and cross-examining the witnesses with regard to what any mechanical engineer would understand by the term "gearing," or "to gear," which was found in the specification. His witnesses would say that no mechanic, if he saw a description containing the word "gearing," would suppose that it was intended to include a rope which simply passed over a pulley, and was operated by a pull. A patentee might use a word in a different sense from that in which it was ordinarily employed by mechanics and mechanicians; but in that case he must clearly define the sense in which he employed it. There was not the

slightest glimmer of a hint that the plaintiffs used the term "gearing" and "to gear" in any other than the sense understood at the date of the invention. A patentee must describe the nature of his invention; but he was not bound to state in his provisional specification all the details of the machinery by which he intended to carry it into effect.

Justice KEKEWICH: There is an instructive note on this branch of the law in the last number of the "Law Quarterly Review," in connection with the case of *Nuttall v. Hargreaves*, which expresses the principle in these words: "The law insists on the inventor, when he asks for protection, defining precisely in his provisional specification the area of protection."

Sir H. DAVEY said that in this case what the plaintiffs claimed was a totally different kind of thing from what was described in the provisional specification. Supposing Mr. Gadd had taken out a patent for his rack and pinion, and another patentee had said: "I have an improved way of effecting that object, doing away with your racks, pinions, and gearings, and having simply a rope and pulley arranged in a particular manner," would anybody have said that this was not invention which would support a patent? Mr. Gadd, like many other inventors, desired to protect his invention in America as well as in this country, and he took out two patents—one for what he called the torsional arrangement (that is, the rack and pinion, with the wheels), and another for what he called the tensional arrangement, in which he achieved the same object by means of a rope and pulley.

Justice KEKEWICH: Yes; but the American rules are probably different.

Sir H. DAVEY: Yes, my Lord, I know; but it is just as much law in America as it is here in England, that one cannot have two patents for the same invention.

Justice KEKEWICH: I think we may assume that.

Sir H. DAVEY said the inevitable inference to be drawn from Dr. Hopkinson's evidence was that the torsional arrangement was one invention, and the tensional arrangement another. The plaintiffs admitted this by taking out a separate patent in the United States. If the provisional specification entitled Mr. Gadd to show, as a means of carrying out his invention, what he called the tensional arrangement, then his claim covered every conceivable mechanical means of carrying this out, and it would also cover his patent of 1887. To say that anyone might patent an improved means of effecting an old object, and might say that everything which achieved the same end was within the patent, would be a delightful view for patentees; but it was one which was not in accordance with the law. The law required that a patentee should state the nature of his invention, so that everybody who read it could understand what it was. He might not know enough about it from the provisional specification to be able to instruct a mechanic the way to put it into practice; but, at any rate, there was no doubt about the nature of the invention, so that the world and the Courts might know that the patentee had not, by the ambiguous use of language, arrived at a patent for an invention the nature of which he had not disclosed in his provisional specification. His first two points, therefore, were: (1) That the complete specification was a different invention from that of which the nature was described in the provisional specification; and (2) that the complete specification was too large. With regard to the anticipations, they would come out sufficiently in the evidence. [The learned Counsel then cited the cases of *Harwood v. The Great Northern Railway Company*, and *Vickers v. Siddell* in support of his arguments.] With reference to Mr. Pease, his learned friend was quite right in his surmise that the substantial defendants in the case were Messrs. Ashmore, Benson, Pease, and Co., Limited, of Stockton-on-Tees. They had put up the gasholder for the Corporation of Manchester; and, quite properly, the Corporation had required them to clear them of liability. But Mr. Pease was himself a patentee; and his provisional specification describing his arrangement was delivered two days after the plaintiffs' provisional specification was filed. A curious question of law arose upon this, upon which he admitted there was no authority. It was this: Supposing his Lordship should be of opinion that, although Mr. Gadd had not described any tensional arrangement in his provisional specification, but that this arrangement, as described in his complete specification, was not indeed what he had described, but a development which might properly be made by a patentee between the date of his provisional and that of his complete specification, and therefore included in the latter, did it follow that a person who described and published as Mr. Pease had done, necessarily infringed, when the patentee afterwards suggested a new development of his invention which was not contained in any document on the files of the Patent Office? He (the learned Counsel) was aware that there was no authority on this point; but it emphasized the argument he had urged as to the extreme importance of keeping the patentee to his specification. Even a skilled engineer like Dr. Hopkinson could not discover, from Mr. Gadd's provisional specification, anything resembling what Mr. Pease had done; and two days afterwards Mr. Pease took out a patent of his own. He made it public in the form of a model placed in the Manchester Town Hall for people to go to see who were interested in the gas-works of the city; and then the plaintiffs took out a complete specification containing everything; and said they were entitled to stop Messrs. Ashmore, Benson, Pease, and Co., and Mr. Pease personally, from making a gasholder to the model exhibited before the complete specification was filed. If this were the law, of course he must submit, if his Lordship held that the plaintiffs' patent was valid; but it showed the extreme importance of keeping a patentee, in his complete specification, to the invention the nature of which he had undertaken to describe in his own way in the provisional specification.

Evidence was then called on behalf of the defendants.

Sir F. J. Bramwell, F.R.S., examined by Sir H. DAVEY, said he had devoted some attention to gasholders; and amongst those which had been made from his designs was a telescopic holder for a million cubic feet. He had read the plaintiffs' provisional specification, and had found no difficulty in understanding it. It described the connecting of various points round a gasholder by means of gearing in such a way as to preserve the parallelism of the holder in rising and falling. For very many years, the word "gearing," unless there were some qualifying words, implied that there could be no slips between the parts, in contradistinction to driving by means of leather bands.

Typical gearing was a pair of toothed wheels. Gearing was a contrivance by which, unless the parts broke, there must be absolutely a relative motion; whereas, if bands were used, there might be a certain amount of slip. Of late years, since driving by ropes had been introduced, it had been the occasional practice to call this driving "rope gearing." "Chain or link gear" was a well-known term. Formerly, the transmission was made by a chain having ordinary links passed over two pulleys—one being the driver, and the other the driven. These pulleys were provided with prominences and indentations, into which the links of the ordinary chain took. They were known as "chain pulleys;" and the communicating implement was a common chain. The word "gear" had other meanings than "gearing." One spoke of "valve gear," and matters of that kind; meaning the whole combination of parts for attaining a particular end. He did not understand that, if a rope from a pulley were attached to a weight, with a man at the other end pulling the rope, there would be anything there to bear the name of gearing. He had never heard pulley-blocks, for example, spoken of as gearing. In his opinion, the word "gearing" was used in the provisional specification in an accurate sense—something which would convey to the driven thing, from the thing driving, exactly the same amount of motion as was given off by the driver. Reading the provisional specification, and having regard to the prior state of knowledge and the 1887 patent, he should understand the nature of the invention in question to be the mode of gearing described in the provisional specification for attaining the end stated in the outset clause of the complete specification, which, with the exception of a single word, was identical with that which was there before. In the absence of knowledge of the prior specification, he should have understood it to mean that it was the end to be attained; but knowing of that specification, the end being identical in both, he was driven to the conclusion that the patent was for the means of attaining that end. The words in the complete specification, "or vertical endless chains or bands passing over and between pulleys or wheels at or near the top and the bottom of the tank or holder, as the case might be," were to him unintelligible as being equivalent for a rack. A rack was a thing which was in one case stationary, with a pinion working in it, and in another case on the holder, working into a pinion. He could not conceive, therefore, how an equivalent for a rack could pass "over and between pulleys or wheels at or near the top and the bottom of the tank." "Plain chain," in his opinion, would gear, but "plain rope" would not. One could not transmit power by a plain rope, acting by friction on a pulley, with a certainty that it would transmit the same amount of motion it had received. Referring to the detailed description given in the patent, in connection with the figures, he could not conceive the utility of making link-chain in any one of the constructions, because there was nothing to drive, and there could be no reason whatever for passing a link-chain over a mere anti-friction pulley. The pulleys described did not drive anything whatever. They were mere points on the gasholder; and the functions of some of them were to prevent the holder from rising at that particular part, while the functions of others were to prevent it falling. With regard to Wild's patent (which was relied upon as an anticipation), it was, in his opinion, a practical means of securing the end aimed at. It was made of four compartments, each of which, when the caisson was at the bottom of the dock, was filled with water. Then when it was desired to raise it, and the ship was floated on to it, air was pumped in at sufficient pressure to drive out the water and gradually fill the compartment with air. At the time the air was being pumped in, there was free access between the water in the interior and the water outside; and therefore the fact of there being a bottom to the pontoon which came into use afterwards, had no bearing upon the condition of things. In explaining Wild's patent, witness pointed out that, the pontoon being at the bottom and filled with water, the ship was drawn over the keel-blocks, which were laid on the top of the pontoon in the same manner as in an ordinary dry dock. They were laid at the bottom of the dock. Then some air was pumped in until the pontoon rose a very little, so that the keel-blocks took the under side of the keel of the ship; or they waited until the keel settled down on the blocks. Then the ship was bilge-shored to the pontoon, and was ready for raising. Thereupon more air was pumped in; and as the ship was raised out of the water above its own line of flotation, it was unable to support itself, and was held up by the bilge-shores and keel-blocks in the pontoon. It was at this time that the whole thing was in unstable equilibrium, and liable to be turned over, unless means were taken to prevent it. It was then that racks and pinions were of great use. The pumping went on until the pontoon was raised gradually out of the water. The sluices were shut, which made the communication between the middle of the pontoon and the water; and then the pontoon floated, having nothing to do with the air inside, except that the water had been displaced by it, and it was quite competent to carry itself, even without the racks and pinions at all, because the danger was over—the danger existing in the act of raising or lowering. In this dock of Wild's where the expulsion of water was by air in the act of raising, the condition was, to his mind; precisely that of a gasholder. There was a body with air on the top, free communication with air at the bottom, and a body to be raised, which was exposed to the pressure of the wind. If he wished to adapt Wild's arrangement to (say) a hexagon, he should put the apparatus along the six faces. It might be done alternately; he might put three or six. He could not suggest any mechanical difference between Wild's mechanism and that described in the plaintiffs' specification. The mechanism was identical; and it would require no addition or alteration for the purpose of adapting it to a gasholder. He was old enough to remember rectangular gasholders; and if one were to take this thing of Wild's and pump gas into it by an ordinary exhaustor, instead of pumping air, taking care not to blow out the gas, it would be a gasholder. Standfield's patent was for "improvements in hydraulic lifts, floating docks, pontoons, and other floating structures, and in appliances connected therewith." Speaking broadly, he should say Standfield's patent described, in general terms, the chain-and-pulley arrangement such as Mr. Gadd had described in what he called his tensional gearing. Fig. 16 of Standfield was identical with a section of fig. 16 of Gadd. In Pease's arrangement, there was no gearing in the proper sense of the term. There was simply an arrangement of roping by which, if one portion

of the gasholder happened to give off rope, another portion required as much as was given off; and these ropes being doubled, horizontality was preserved. He had seen the gasholder at Manchester; and it appeared to be thoroughly effective. If he had been acquainted with the plaintiffs' provisional specification alone, it would never have occurred to him that Mr. Pease's holder was an infringement of the plaintiffs' patent. What would have occurred to him was that Mr. Pease had, by entirely different means, attained the same end as he found in Mr. Gadd's provisional specification.

Thursday, April 7.

Sir F. Bramwell, in cross-examination, said he first looked into the plaintiffs' and Pease's patents about a year ago, for the purpose of the present litigation. He had not considered Pease's apart from Gadd's. Many of his observations on the question of anticipation would apply to Pease's patent as well as Gadd's. He had had a good deal to do with gas engineering, but had never been Consulting Engineer to a gas company. He had designed a gasholder, and was well acquainted with many large ones. The first big holder without outside framing was the one put up at Manchester for the defendants. That was in the course of last year. Gadd's 1887 patent had not been put into operation to his knowledge before the end of 1888; the only one he knew of was that at Northwich. He had known of pontoons and floating docks for a long time. In the case of a large holder capable of containing (say) 200,000 or 300,000 cubic feet of gas, he could not say whether the saving by doing away with the guide-framing would be 30 per cent., as he had not inquired into that point. Malam's system assumed side posts; and there was nothing to indicate that they might be dispensed with. But they might be, although not so indicated, if one did not require the balance-weights. The main principle was controlled motion actuated by radial shafts gearing into a central wheel. Mr. Gadd described pinions and vertical racks, and they might be arranged as in Malam's plan—a variety of arrangement being alluded to; and special reference was made to radial and tangential gearing. Malam's description referred obviously to a central point where the shafts were geared together; and this was only shown at the top. He did not know that it could be applied to a central lift of three—it would require some arrangement; and it would not be very convenient to put it under the bottom lift. It would occur to any engineer that the horizontal shafts might be placed at an angle, so as not to interfere with the central cone of the tank, if it were left in. Wild's patent was obtained in 1850. The pontoon contemplated by him never rose out of its guides. It had two shafts and pinions, one vertically over the other, gearing into the same rack. This had the advantage of getting the strength of two teeth in the rack to act at once; but practically it had no further advantage in keeping the motion horizontal. There was no indication in Wild's specification that one shaft could be dispensed with. The pontoon had a strong solid bottom. But it was in communication with the external water at certain times; and this had the same effect as if there were no bottom. The water pressure on the bottom would not tend to preserve equilibrium until the pontoon had risen to the surface and was partly above it. In such a case it would. He adhered to the opinion that, so long as the pontoon was submerged, it was in unstable equilibrium. A gasholder had no bottom on which the water pressure could operate; it was like a diving-bell. During part of the rising of the pontoon, there would be freeboard, which would cause stable equilibrium; but in no part of the rise of a gasholder would this be the case. The pontoon would be converted into a gasholder by pumping in gas instead of air. Nothing of the kind had ever been done; and he did not know of Wild's patent having been applied to gasholders before the plaintiffs', except Malam's, which he considered to be the same principle. A pontoon was a strong structure in every way; while gasholders were very fragile and light. The endeavour was to make them as light as possible, consistently with the requisite strength. Turning to Standfield's arrangement, of which he had produced a model made as a gasholder, he did not know of its having been adopted to this purpose. The patent was intended to apply to platforms or pontoons; there was no special reference to any other floating structure.

Justice KEKEWICH remarked that the patentee, in his claim, seemed to refer to floating structures, not *ejusdem generis* with pontoons.

Cross-examination continued: A diving-bell would not be called a "floating structure;" but he should say a gasholder floated on the water in the tank, as shown by the fact that it would sink if the water were removed. There was nothing to show that, by "floating structure," Standfield meant to refer to an inverted bell sustained by fluid pressure. The models produced were made for the purpose of the present case. He understood that Wild's and Standfield's patents were the anticipations chiefly relied on by the defendants. Gasholders had been practically circular since the year 1819; prior to that they were rectangular. The circular form was preferable, on account of offering less resistance to wind pressure; and greater cubical space was obtainable for a given quantity of material. He thought there was no invention necessary in applying to a circle an apparatus suitable to a rectangle. All the plans shown in the plaintiffs' specification involved a vertical rise and fall of the holder, not a spiral motion. It was the first patent with this object that he knew of applied to gasholders. The model illustrating fig. 14 in the specification did not show any opportunity for slip. If chains were substituted for cords, it would operate in exactly the same way; so it would if link chains and toothed or pitch wheels were employed. He should not call that a link gearing which was mentioned in the provisional specification, because it would be an absolutely useless expenditure. Gearing, in his opinion, involved the transmission of power from the driver to the driven being exact, without loss or slip. In the model working with racks and pinions, in the case of wind pressure causing the holder to move, the rack would be the driver, and the pinion the driven. In the model with cords, the driver would be the rope trying to come upwards, which would pull the next rope downwards; and so on alternately round the holder.

Re-examined by Mr. CARPMAEL: The problem of preserving horizontality was, to his mind, the same in a pontoon and a gasholder. The latter was a floating structure; it displaced a bulk of water equal to the weight of gas. In his opinion, there was, strictly speaking, no driving operation in the cord arrangement.

Mr. *J. Imray* was the next witness. He agreed with Sir F. Bramwell entirely in regard to the term "gearing," and to his evidence generally. He said he should not, however, term a nut and screw a mechanical equivalent of a rack and pinion. He did not find any hint in the provisional specification which would lead him to some of the figures shown in the complete specification. Malam's arrangement was included in the plaintiffs' specification, as they specially claimed any possible arrangement of racks and pinions. The Grantham holder was also within their claim, as it maintained horizontally by means of racks and pinions geared together. With regard to the other anticipations, he corroborated the evidence of the previous witness.

Cross-examined by the ATTORNEY-GENERAL: He agreed substantially with the evidence given by Sir F. Bramwell. Worm gearing was different from rack and pinion. One was continuous, the other was not; and the motion was quite different. He had never heard of pulley gearing, but he had of rope gearing, though not of block gearing. He thought Nicholson and Cole's patent was included in plaintiffs' specification. He had never constructed or designed gasholders, and had not considered these patents until he was consulted in connection with this litigation. He had not seen the Grantham holder; but judging from the drawing, it required outside framework. Witness was questioned in the same way on the other anticipations.

Sir H. DAVEY briefly re-examined the witness.

Mr. *R. Bridge*, Gas Engineer to the Corporation of Doncaster, said that before taking his present appointment he was at the Grantham Gas-Works. He was there from 1851 to 1857, and remembered the gasholder then in use (the drawing of which he recognized) but now superseded. He understood it had been at work about 16 years prior to 1851; and he believed it was removed in 1861. The engineers who put it up were Messrs. J. and J. Malam. It had a rack at each column, of which there were four, supporting weights. Pinions worked in the racks, being connected in pairs by shafts across the top of the holder, at right angles to each other. The holder worked satisfactorily. It kept horizontal under all ordinary circumstances; though sometimes in frost and snow the pinions and racks became clogged, and had to be liberated. He was acquainted with Mr. Gadd's torsional arrangement, which would be open to the same objection.

Cross-examined: The Grantham holder was up altogether about 26 years; and he did not remember how often he had to clear the cog-wheels. It was upwards of 40 feet in diameter. The holder erected in its place was an 80-feet one, and worked with guide-wheels against posts, and with balance-weights.

Mr. *J. Fawcett*, Secretary of the Gas Company at Staindrop, near Darlington, said he knew of the gasholder there. It was erected in 1853-4; and his father was one of the contractors engaged in the work. The holder was still in use; and the model produced was correct.

Cross-examined: The diameter of the holder was 30 feet, and the rise about 12 feet.

Mr. *J. B. Terrace* said he was Engineer to the Brechin Gas Company, and had held that office for eight years. His attention had been directed to appliances for preserving steadiness in gasholders; and in November, 1888, he made a drawing of what he considered to be a new device for securing this object. The drawing produced was one of a series he then prepared; but he could not say whether or not it was the first. It had a date upon it in his own handwriting, "17/11/88." The drawing was then in the same condition as now, with the exception of some red marks which had been added.

Mr. *A. Featherstone* was interposed here, to prove the receipt of the drawing in question. He said he was Manager to Messrs. C. and W. Walker, of the Midland Iron-Works, Donnington; and on Nov. 19, 1888, he was at their London office in Finsbury Circus, and received a letter from Mr. Terrace, enclosing the drawing produced. The letter and drawing remained in his possession until February, 1891, when he sent it to Mr. Pease's Solicitors. He replied to Mr. Terrace's letter; and a few days afterwards received another one from him, dated Nov. 28, in which he requested that the plan might not be disclosed, as he thought of patenting it. Nothing further took place on the matter.

Cross-examined: Messrs. Walker had previous to that been in correspondence with Mr. Terrace, whom he did not know personally. He understood the letter of the 17th of November as asking his opinion of the arrangement suggested; and he preferred not replying to it until his principal had been consulted. The second letter said that Mr. G. Livesey had expressed his approval of the invention. He did not know at the time that Mr. Terrace was then in correspondence with his patent agent. In accordance with Mr. Terrace's request, he (witness) kept the matter quite private. Mr. Walker returned to England in December, when he showed him the correspondence; but he did not know that any opinion on the invention was communicated to Mr. Terrace.

Re-examined: He discussed the matter with Mr. Walker about the 17th or 18th of December.

Mr. *G. Livesey* (whose evidence was taken at this point in order to allow him to attend the Board of Trade Committee on Standards of Light) said that about Nov. 24, 1888, he received a letter from Mr. J. B. Terrace, which he answered and destroyed. It contained a drawing which he returned. It described a method of spur gearing for preserving the horizontality of a gasholder. The drawing was identical with the one produced by Mr. Terrace, if it was not the actual drawing. [Witness's reply was read. He said: "Your plan appears to be just as effective as Mr. Gadd's or mine; possibly yours may be the best of the three."] That referred to Mr. Gadd's 1887 patent. On Nov. 28 he had another letter from Mr. Terrace, in which he said he had submitted it to a patent agent in Glasgow. He recommended Mr. Terrace to apply for provisional protection. At the time he was not aware of Wild's or Standfield's patent, or of the Staindrop gasholder; at any rate, they were not then present to his mind. He recollected rectangular gasholders, and saw a small one at Brighton about ten years ago. It was within a building, and had no guide-framing. As far as he remembered, it was suspended from the centre.

Cross-examined: He had been engaged in gas-works all his life. Up to the time of seeing Mr. Gadd's spiral method of guiding gasholders, he thought it impossible to dispense with guide-framing; for he had himself tried to solve the problem. If it could be done, it would save about 30 per cent. on the outlay for a large gasholder; the

cost was about £30 per 1000 cubic feet for the smaller sizes. The South Metropolitan Gas Company were now constructing a very large holder at a cost of £5 per 1000 cubic feet. He knew of Mr. Gadd's 1887 patent in the autumn of 1888; but did not know that Mr. Gadd was working further in the same direction until some time afterwards. Terrace's and Gadd's arrangements were identical. He received many letters—more than he wanted—from inventors, asking his opinion.

Mr. *Terrace* was then recalled, and continued his evidence. He said that prior to Dec. 12, 1888, he had shown the drawings to two of his friends at the gas-works, to his brother Andrew, and to Mr. W. Stewart. His brother was then employed at Brechin; and Mr. Stewart was a clerk in the office. He could not give the exact date; but it was before Nov. 17, on which day he wrote to Messrs. Walker. He thought he showed the correspondence to Mr. Stewart. Messrs. Walker's agent had visited the Brechin Gas-Works during 1887, with the view of getting orders. Personally, he did not know either of the Messrs. Walker. He knew Mr. George Livesey by repute, but not personally. On receiving his reply, he wrote to Mr. E. Hunt, patent agent, of Glasgow, whom he had known before. He also wrote to his brother David, in Glasgow, on Nov. 28, sending him a drawing. The patent was never taken out.

Justice KEKEWICK remarked that a letter to a patent agent would not be a publication.

Examination continued: On Dec. 7 he wrote to Mr. J. Paterson, Warrington, submitting his design with a drawing [produced]. It was a press copy, and was dated Nov. 17, 1888. On the same day he commenced a correspondence with Mr. Gadd. When he received Mr. Gadd's letter on Dec. 11, he knew nothing of what was referred to as his further method. Mr. Gadd returned the drawing sent to him, with a letter, in which he said witness had hit upon the same method as himself, and upon which he had been at work for some months. On Dec. 20 he wrote to Mr. Gadd, saying he had sent a copy of his invention to Mr. Walter King, to see if he would care to publish it in the JOURNAL OF GAS LIGHTING. Mr. Gadd replied on the next day, saying he had been working on his invention for some months, and had obtained legal priority. Further correspondence followed; and in a postscript to one of the letters, Mr. Gadd referred to "torsion" as being treacherous.

Justice KEKEWICK said these letters ought to have been put to Mr. Gadd, if they were to be used to show that he had only torsion in his mind at the time.

Cross-examined by the ATTORNEY-GENERAL: He had been working at this subject for some time; and he wrote to Mr. Gadd and the other Engineers in order to get their opinions. He did not suggest that he had communicated his method to Mr. Gadd before Dec. 12, 1888. He did not remember showing Mr. Gadd's correspondence to his patent agent; he gave up the idea of patenting his invention when he found Mr. Gadd had anticipated him.

Mr. *David Terrace*, Manager of the Middlesbrough Corporation Gas-Works, spoke to receiving a sketch from his brother in November, 1888, when he was at the Dawsholm Gas-Works, Glasgow. He showed it to several persons, and discussed it.

Cross-examined: His brother sent him Mr. Livesey's letter, recommending that provisional protection should be obtained.

Re-examined: He was not aware that there was any secrecy to be observed about the matter.

Mr. *D. McKechnie*, foreman at the Dawsholm works, spoke to seeing the sketch sent to the preceding witness, who showed it to him, and read the letter. His opinion was not very favourable to the idea.

Mr. *A. Duncan*, Chemist at the Dawsholm works, also spoke to seeing the sketch, and discussing the matter. He did not give any opinion upon it, not being an engineer. He thoroughly understood it, however, and could see how it worked.

Mr. *A. Smith*, engaged as draughtsman in the Gas Office, Glasgow, said he remembered seeing the sketch in question, when calling at the gas-works. He had a short conversation about it with Mr. David Terrace.

Mr. *A. Terrace* also stated that he had seen a sketch of his brother's invention; it was before his brother wrote to Messrs. Walker. The sketch was copied in the press letter-book; but before this there were several rough sketches which were destroyed. He was then engaged at the Brechin Gas-Works, and knew of the correspondence with Mr. Livesey and Messrs. Walker. He was not very favourably impressed with the invention himself.

Mr. *W. Stewart*, of Arbroath, remembered seeing Mr. Terrace's sketch before the letter was sent to Messrs. Walker. He knew of the correspondence with Mr. Livesey and Mr. Gadd.

Mr. WARMINGTON said there was only one other witness on this point—Mr. James Paterson, of Warrington; but, unfortunately, a telegram had been received saying he was unable to attend. He might have to ask for a commission to take his evidence.

The ATTORNEY-GENERAL said he would save trouble by allowing Mr. Paterson's proof to be read.

Mr. WARMINGTON accordingly read the proof. Mr. Paterson stated that he received a letter and drawing from Mr. J. B. Terrace on Dec. 8, 1888. It lay on his table for some time, and might have been seen; but he did not show it to anyone. His opinion was not very favourable to the invention.

The further hearing of the case was then adjourned till May 3.

Roasting Shelves for Gas-Ovens.—Messrs. Fletcher, Russell, and Co., Limited, write, in reference to the patent for the above, briefly noticed in the JOURNAL last week (p. 621), that the arrangement is identical with one which has been employed for many years in their quick grill, but which they have not adopted in ovens for general use, for the reason that pies, cakes, &c., will not stand level upon it.

The Liverpool City Council and the Electric Light.—The Liverpool City Council last Wednesday adopted a resolution passed by the Watch Committee, to the effect that, having considered the question of using the electric light in lieu of the present mode of lighting the city, they were of opinion that, having regard to the conditions of rapid development to which the system of electric light was now subject, it was not at present advisable to adopt it in the city.

MISCELLANEOUS NEWS.

METROPOLIS GAS SUPPLY.

The Quality of the Gas in the Past Quarter.

The following is an abstract of the report of the Chief Gas Examiner for the Metropolis (Dr. A. W. Williamson, F.R.S.) as to the quality of the gas supplied by The Gaslight and Coke, the Commercial, and the South Metropolitan Companies, during the quarter ending the 31st ult. :—

I. *With respect to Illuminating Power.*—The average illuminating power, in standard sperm candles, at each of the testing-stations, was as follows :—

The Gaslight and Coke Company—

Fenchurch Street, E.C.	16·2
King Street, E.C.	16·7
Dorset Buildings, E.C.	16·7
Ladbroke Grove, W.	16·4
Devon's Road, E.	16·3
Carlyle Square, Chelsea, S.W.	16·1
Camden Street, N.W.	16·3
George Street, N.W.	16·1
Graham Road, E.	16·5
Kingsland Road, E.	16·4
Spring Gardens, S.W.	16·2
Grove Gardens, St. John's Wood, N.W.	16·1
Hornsey Road, N.	16·5
Lambeth Road, S.E.	16·4
Millbank Street, S.W. (cannel gas)	21·7

Commercial Gas Company—

Parnell Road, E.	16·2
Wellclose Square, E.	16·2

South Metropolitan Gas Company—

Hill Street, S.E.	16·5
Bedford Road, S.W.	16·1
Stoney Lane, S.E.	16·3
Lewisham Road, S.E.	16·4
Blackfriars Road, S.E.	16·2
Burrage Road, S.E.	16·0

It will be seen from these results that the average illuminating power at all the stations has been higher than the parliamentary standard of 16 candles, especially at Millbank Street. At this testing-place, and at King Street, the minimum illuminating power was higher than the requirements; while it was equal to them at the Devon's Road, Camden Street, Graham Road, and Kingsland Road stations of The Gaslight and Coke Company, and the Lewisham Road station of the South Metropolitan Company. Slight deficiencies in the illuminating power were returned during the quarter by the official gas examiners at the Fenchurch Street, Spring Gardens, Grove Gardens, Hornsey Road, and George Street stations of The Gaslight and Coke Company; at the two stations of the Commercial Gas Company; and at the Hill Street, Bedford Road, Hornsey Road, and Blackfriars Road stations of the South Metropolitan Gas Company.

II. *As regards Purity.*—Sulphuretted hydrogen was not present in the gas at any of the testing-stations. The average amount of sulphur in other forms than this was considerably less than the quantity permitted—viz., 22 grains per 100 cubic feet—at all the testing-stations. The following excesses by the South Metropolitan Gas Company were returned by the official gas examiners during the quarter :—

Hill Street, Feb. 17	22·9 grains.
Bedford Road, Feb. 3	24·4 "
" " 11	22·5 "
" " 12	24·9 "
" " 15	25·4 "
" " 22	23·3 "
" March 16	30·3 "

With these exceptions, the limit was not exceeded on any occasion during the quarter. Ammonia was generally present in the gas more or less frequently at all the testing-stations; but only in slight quantities. The amount allowed—viz., 4 grains per 100 cubic feet—was not exceeded on any occasion.

THE WEST BROMWICH GAS UNDERTAKING.

Extension of the Gas-Works—The Gas Profits.

Last Wednesday, Mr. Arnold Taylor, one of the Local Government Board Inspectors, held an inquiry at West Bromwich concerning an application made by the Town Council for sanction to borrow £20,000 for the purpose of extending and improving their gas-works. Among those present were the Mayor (Mr. G. Salter), Alderman Farley (Chairman of the Gas Committee), Mr. T. Hudson (Secretary of the Gas Committee), Mr. W. Littlewood (Gas Manager), and Mr. W. Wayte (Outdoor Superintendent), &c. The Town Clerk explained that the population of the borough at the last census was 59,489. The rateable value for the relief of the poor was £191,209; and for the general district rate, £147,530. The outstanding debt on the gas-works was £110,077. It was proposed to erect a new gasholder, the contract for the ironwork amounting to £5335. Then it was estimated that £6000 would be expended in connection with the construction of the tank; making the aggregate £11,335. The other chief items of expenditure proposed were: Additional purifiers, £2640; scrubbers, £600; stoking machinery, £2500; additional boiler, £320; new condensers, £500; coal-testing apparatus, £200. The cost of a new station meter and sulphate of ammonia plant, with other items, brought up the total estimated expenditure to £23,235. The Council had already borrowed and spent £154,620; but under their Provisional Order they could borrow £50,000 more with the consent of the Local Government Board. Since the year 1880, when the West Bromwich Authorities acquired the gas undertaking from the Birmingham Corporation, upwards of £16,400 had been transferred from the profits of the concern to the relief of the borough rates.

It was anticipated that the gasholder that was proposed to be erected would provide for the increased consumption for another six years. The price of gas varied from 2s. 3d. to 2s. 8d. per 1000 cubic feet. They had accumulated a working capital out of the profits. Mr. Littlewood was called, and stated that during the winter of 1880-81 the daily consumption of gas was 819,000 cubic feet; but in the winter of 1890-91 it was 1,256,000 cubic feet—an increase of 437,000 cubic feet. For twelve months ending March, 1891, 215,102,000 cubic feet of gas were sent out—an increase of 58,354,000 cubic feet as compared with 1882. The works as completed, were designed to meet a daily consumption of a million cubic feet, estimated upon a yield of 10,000 cubic feet of gas per ton of coal carbonized. The retorts were capable of producing 1½ million cubic feet of gas per 24 hours; leaving no retorts in reserve in case of accident or continued foggy weather. There was a great necessity for additional producing power. The two gasholders at the works were each capable of only containing 500,000 cubic feet, or 1,000,000 cubic feet in all. The new gasholder would afford additional storage room for 672,000 cubic feet, and would meet the increasing consumption for the next six years. The sulphate of ammonia plant which it was intended to erect would pay for itself in a very few years. The Committee proposed to make such modification in the retort-house as would enable them to adopt Mr. West's stoking machinery; thus effecting a saving, as compared with hand stoking, of something like £800 a year for the expenditure of £2500. In the course of a discussion with regard to the period over which the repayment of the loan should be extended, the Inspector pointed out that there was a tendency in Parliamentary Committees to shorten the period for the repayment of all loans; and the Local Government Board were bound to follow it. He did not think the Department would grant the loans for more than 30 years. The Town Clerk urged that they should be allowed at least 50 years. Alderman Farley pointed out that Birmingham had long periods for the repayment of their loans, and it placed West Bromwich at a great disadvantage. The Inspector replied that Birmingham borrowed under Special Acts of Parliament. The Town Clerk then asked that the loan should be made repayable over 41 years. The Inspector said he could not hold out any hope that it would be granted for more than 30 years.

At the monthly meeting of the West Bromwich Town Council in the evening, the Gas Committee reported having paid £500 out of the profits of the gas undertaking for the year ending March 31, 1890, to the relief of the rates; and also that they had intimated to the Finance Committee their intention of recommending the Council to transfer £1000 from the profits of the gas business for the year ending March 31, 1892, to the credit of the general district rate fund, to be paid in two half-yearly moieties of £500 each.

RAWMARSH LOCAL BOARD GAS AND WATER SUPPLY.

The Gas and Water Loans—Extensions at the Gas-Works.

Mr. E. P. Burd, one of the Inspectors of the Local Government Board, held a public inquiry at Rawmarsh on the 31st ult., relative to an application by the Local Board for a Provisional Order to amend their Local Acts of 1870 and 1879, to enable them to pay off certain balances of existing gas and water loans, which have been borrowed for short periods and at large rates of interest, and also for extending the period of repayments of other loans. The Clerk (Mr. J. W. Bellamy) explained that the amount it was proposed to borrow, to pay off the loans, was £12,500; and the Board also sought power to increase their capital by £11,000 to enable them to build a new gasholder, a bench of retorts, a residence for the Manager, and other additions at the gas-works. The demand for gas at the present time was so great that the Board were not able to keep pace with it. As to the loans, in consequence of the short periods and the large amount of interest, a considerable amount had each year to be made up out of the general district rate towards the expenses of supplying gas in the district. When the loans were rearranged as proposed, there would be a reduction of the charges on the general district rate, of between £600 and £700 per annum. They suggested that the period over which the repayment of the loans should extend should be 60 years for the gas-works and 50 years for the water undertaking, from the date of the original borrowing; the present terms being from 22 to 30 years. The total indebtedness of the Board was £27,031, of which £17,000 was for the gas, and £10,000 for the water works. They asked for the Provisional Order, because the present Acts were so very contradictory and carelessly framed that the Board were advised the title was not sufficient to enable them to borrow money. Arrangements had been made to take up the loans for the extended period at 3½ per cent.; whereas the Local Board were at present paying as much as 4½ and 5 per cent. Under the Order, they also proposed to take power to sell stock. The estimated cost of the proposed extensions of the gas-works was £7700. In reply to the Inspector, Mr. Bellamy further stated that the maximum charge to consumers of gas was 3s. 3d. per 1000 cubic feet, and 3s. for consumers above 44,500 feet. The maximum charge for water was 7 per cent.; but the charges to consumers at present amounted to 6 per cent., calculated upon the rateable value. He presented a detailed estimate of what was necessary to increase the capital of the Board, saying it was as important to them to increase their capital as it was to rearrange the loans. They had received many applications for gas, including large collieries in the district; and it was necessary to meet these that the Board should at once carry out the extensions at the gas-works. Mr. E. O. Watson, the Manager of the gas-works, said they had 30 retorts; and the average daily make and consumption of gas was 135,000 cubic feet. The consumption was increasing very fast; and he was afraid they would not be able to supply the demand next winter. The proposed new holder was for 200,000 cubic feet, and the present storage was equal to 100,000 feet. The new holder would be placed on the site of the present works, where there was ample room; and the new bench of 24 retorts would be an easy extension of the existing arrangements. They proposed to erect a sulphate plant, which would cost £1000. He then gave particulars as to the extension and renewal of the gas-mains throughout the district. The majority of the mains had been in the ground 22 or 23

years, and had been found insufficient. They were also much damaged owing to subsidences of the land, which had led to considerable leakages. The mains were purchased about ten years ago from the Rotherham Corporation, who, up to October, 1890, when the new gas-works were opened, supplied Rawmarsh with gas in bulk. The working expenses up to that period had been more than the receipts; and the deficiency had been paid out of the general district rate. They were obliged to charge the maximum price for gas; and had they been able to reduce it, they would have had more consumers, and made a profit. Now they had works of their own, they would be able to make a profit. In 1891 the consumption was between 23 and 24 million cubic feet; and when the district was supplied by Rotherham, it was from 17 to 18 millions. This quantity was taken in bulk; but owing to leakages, arising from subsidences and other causes, the sale was between 15 and 16 million feet. They had had no working capital account; and up to 1891 the general district rate had had to bear a charge of £1394, which included the payment of principal and interest on the £6000 borrowed for the purchase of the mains from the Rotherham Corporation. The new works erected in 1890 had cost £13,000. They did not want to borrow any more money for water-works. The payments for water came to about £790 in the year; but the alterations they proposed to make under the Order, would reduce the amount to £368. With regard to the gas loans, the reductions would be from £361 to £242 in the one case, and from £330 to £263; and from £490 to £300 with regard to the respective loans mentioned. Altogether there would be a difference of from £700 to £800 a year in the annual charge to the rates. There was no opposition to the scheme, and the members of the Local Board were unanimously in its favour. Before the proceedings concluded, the Inspector intimated that the Board ought to have made earlier application, and pointed out that the Order would have to be passed by Parliament, and this might not be done before the end of July.

THE RHYL IMPROVEMENT COMMISSIONERS AND THE GAS-WORKS.

Local Government Board Inquiry.

In the JOURNAL for the 29th ult., we recorded the defeat, by a vote at a public meeting of ratepayers, of the opposition to the proposal of the Rhyl Improvement Commissioners to acquire the gas-works in that town, for which the sanction of the Local Government Board has been sought to the raising of £35,000. This application was recently the subject of an inquiry by Major-General Crozier, when a number of ratepayers again raised objections to the scheme. The Town Clerk (Mr. A. Rowlands) opened the proceedings by giving a history of the Company whose undertaking it is proposed to purchase, down to their application to Parliament last year, when they obtained a Bill in which clauses were inserted enabling the Improvement Commissioners to purchase the works; the price agreed upon being £32,000. To this was added £1400 towards the cost of opposing the Company's Bill; for improvements of the works, £816; and for the Commissioners' costs of opposition, £784—making a total of £35,000. They were now in this position: Parliament had sanctioned the purchase and transfer of the gas-works to the Commissioners, but had made it a condition that the borrowing of the money should be subject to the Local Government Board's sanction. The Gas Company not only did not oppose the Commissioners in their application, but were, by their Act, required to afford all reasonable assistance to them in obtaining sanction to the loan which would be necessary to enable them to carry the terms of agreement into effect. The Commissioners had heard that they were to be opposed by some ratepayers; but all he could say was that those who were taking up a position of opposition were making a terrible mistake. He ventured to assert that Rhyl would never have a better opportunity than the present of making a good bargain. Mr. F. J. Collingwood, the Company's Engineer, then gave evidence. He said the works were capable of producing about 127,000 cubic feet of gas per day, and were economically adapted for producing 25 millions per annum. They cost originally, in 1869, £6092. Of this sum, £3000 was for goodwill and the remainder for plant and land. Since then a sum of £13,775 had been expended upon them on capital account. The number of consumers for the last ten years had remained practically stationary; but there had been a considerable increase in the consumption of gas. Mr. M. R. Partington, the Secretary of the Company, produced the balance-sheets since 1885. He said in that year the price of gas was 4s. 2d. per 1000 cubic feet; the quantity sold being 16,811,766 cubic feet. The net profits were £1937; and the dividend was 10 per cent. Last year the price was 4s.; the quantity of gas sold, 20,519,376 cubic feet; the net profits were £1826; and the dividend was 9½ per cent. The price of gas was reduced, on the 1st of November last, to 3s. 9d. per 1000 cubic feet. The reserve fund in 1890 was £1926; previous to that it was £3229. Mr. S. Perks, J.P., Chairman of the Company, having given evidence in support of the statement that £32,000 was the sum eventually agreed upon for the works, with £1400 towards the costs of opposing the Bill, Mr. Joseph Hepworth, M.Inst.C.E., Gas and Water Engineer of the Carlisle Corporation, was called. He stated that, after careful inquiry, he had come to the conclusion that the sum of £35,000 which the Commissioners proposed to borrow, was sufficient for their immediate purposes. He understood that the gas-works were now producing something like 107,000 cubic feet of gas per day; and Mr. Collingwood had told them that the maximum quantity they were capable of making was 127,000 cubic feet a day, or 25 millions a year. He, however, was of opinion that the works were equal to turning out 160,000 cubic feet per day by simply improving the retorts. On the whole, they were now in good working order. In addition to the gas-making plant, there was also apparatus for the manufacture of sulphate of ammonia. This ought to be valuable. There was sufficient surplus land to permit of further extension of the works, whenever it was found necessary, for many years to come. The price proposed to be paid by the Commissioners for the undertaking was rather less than 20 years' purchase of the Company's profits. This was not only very reasonable, but considerably below what had been recently awarded

in the case of the transfer of the undertakings of gas companies to local authorities. What the Commissioners were going to pay for the works was about the value of the undertaking of an unincorporated company. Mr. P. Mostyn Williams, the Chairman of the Committee having charge of the matter, said that, taking Mr. Hepworth's calculation that they could produce gas at 2s. per 1000 cubic feet, they might expect a profit of 1s. 9d. They found that the annual charge at 3 per cent., including the redemption of capital, would be £1359 16s. 6d.; while the profits would be £2187 10s.—leaving a margin of £827 for the reduction of the price of gas, or for lowering the rates. If they based their annual charge at 3½ per cent., it would amount to the sum of £1491 17s. 6d.; and this would leave a margin of £695 12s. 6d. In addition, at the end of 50 years, they would make a present of the works to the town. Thus, while they would be able to work the undertaking at the present time to advantage, they would hand to their successors a concern that would yield them at the very least a profit of £1500 a year. This was the view they took of it as a local authority; and they recommended the ratepayers to adopt it, and the Local Government Board to sanction it. Mr. Cartwright then put before the Inspector, at some length, the views of the opponents of the scheme, who, he said, represented property to the value of £80,000. He maintained that the whole superstructure of the application was based on the foundation that the money could be borrowed for 50 years. Was it, he asked, right or proper that posterity should be taxed for such a period, in a town like Rhyl, over a purchase of this kind. Everybody, he thought, would agree that it was not. He went on to show that, taken on the basis of 30 years, the annual charge would be £2771. As the profits of the gas-works were only £1487, this left a deficit, to be repaid out of the rates, or by an increased price for gas, of £1284 a year. Other speakers having addressed the Inspector in support of the application, the inquiry closed.

EAST LONDON WATER-WORKS COMPANY.

The Half-Yearly General Assembly of the Proprietors in this Company was held last Tuesday, at the Offices, St. Helen's Place, Bishopsgate Street, E.C. Mr. GEORGE BANBURY occupied the chair; Mr. A. W. Gadesden (the Chairman of the Company) not being sufficiently recovered from his long illness to preside over the meeting, at which, however, he was present.

The SECRETARY (Mr. I. A. Crookenden) having read the notice convening the meeting, the report and statement of accounts were taken as read. The latter showed that the revenue for the half year ending at Christmas last was £147,301; being an increase of £3137 on that for the corresponding period of 1890, when it was £144,164. The expenditure was £57,664, as compared with £54,443—an advance of £3221. In their report, the Directors said they considered the increase in revenue had been fairly satisfactory; and the extra expenditure they attributed to the higher price of materials and the carrying out of exceptional repairs. The quantity of water pumped in the six months was 8,282,237,730 gallons; being 375,304,578 gallons in excess of that of the corresponding half of the previous year. The new services laid on numbered 1818, against 1620 before; the total being now 172,310. Reference was made to the Bills introduced by the London County Council and the City Corporation with regard to the Water Supply of the Metropolis; and a hope was expressed that these measures would be either withdrawn, or suspended during the inquiry into the whole subject by the Royal Commission. The Directors recommended a dividend at the rate of 18 per cent. per annum, the payment of which will absorb £68,810 of the amount available, and leave a balance of £12,566.

The CHAIRMAN, in moving the adoption of the report, said he felt sorry the meeting should be deprived of listening to the Chairman of the Company, whose words would carry far more weight, and would prove more interesting, than those of a substitute. He thought the proprietors would be altogether satisfied with the working of the Company in the past half year, for the Directors proposed to pay a dividend at the rate of 8 per cent. per annum, and carry forward more than £12,000 to the reserve. The receipts would have been a little better had there been the usual returns from road-waterings; but the season was a wet one, and consequently there was a decline in this branch of the revenue. The shareholders might naturally ask how it was that, while there was a falling off under this head, there should be an increase of 375 million gallons in the quantity of water pumped. This arose mainly from there being an extra week brought into account in the half year, which naturally enhanced the total bulk of water pumped, as well as the amount expended on maintenance. They had, in fact, had to deal with 27 weeks against 26 weeks. As regarded the expenditure, the increase was chiefly owing to this extra week, to the higher price of coals, to some special repairs to one of the filter-beds, and to some improvements made at Lea Bridge. They had bidden a final adieu to the Old Ford station; and the concentration of the works at Lea Bridge was an accomplished and successful fact. The three new triple-expansion engines at Lea Bridge were now most satisfactorily performing the duties of their old-fashioned predecessors at Old Ford, which had been sold, and were in process of demolition. The proprietors would be glad to hear that the new engines had more than fulfilled the most sanguine expectations as regarded their pumping capabilities and their economical consumption of fuel. Mainly owing to the knowledge, skill, and forethought of their Engineer (Mr. W. B. Bryan, M.Inst.C.E.), these powerful engines, capable of pumping 36 million gallons of water a day, had been erected and finally set to work without a single mistake or mishap. While rearranging the trunk mains, consequent upon the abandonment of the Old Ford station, they came across a 36-inch main put down about 50 years ago. It was found that the pipe made from the cold-blast iron of those days was of such superior quality that it was most difficult to cut out and make the connection, owing to the toughness of the metal, which was almost as good as wrought iron. He might say that the old pipes were fully equal, if not occasionally superior, to those they now obtained from the best manufacturers under the present system. The Directors had lately acquired 89 acres of

land adjoining the present Walthamstow reservoirs, in order to increase their capacity. With this addition to the present large storage of 220 acres, they would have a most valuable amount of reservoir capacity to be used as needed. They had arranged that a new pumping-engine was to be erected at Walthamstow, in order to meet the demands of the Essex district, and to improve the supply throughout. With regard to the wells, which must play so prominent a part in the present and future prospects of the Company, he was happy to say that matters looked very cheering, and that these sources of supply had been more successful than the Directors had anticipated. In fact, putting the question of their wells into brief and commercial language, he might say that they had a large amount of liquid assets, with power to add to their number. They still maintained their good character for purity of supply, as testified by Dr. E. Frankland, the Government Analyst, in his last report. He (the Chairman) desired to pay a passing tribute of respect to the memory of Dr. Tidy, who was with the Company for so many years, and knew their case intimately. Dr. Tidy was very distinguished in his profession, and his death was a loss to them and to science generally. The shareholders were aware that for some years past the Company had given a constant supply of water throughout their Metropolitan area, and to 96 per cent. of their country district. This was doubtless very satisfactory from a sanitary point of view, especially in respect of the poorer localities, but not so satisfactory as regarded the revenue, owing to the large amount of waste thereby incurred. The Company really pumped more water than their customers could reasonably require, as they gave them nearly double the supply per head of that afforded in Manchester and Liverpool. Carelessness, wilful waste, and bad fittings were the causes of this large amount of pumping. They had strengthened their staff of inspectors with a view to saving this waste; and this would practically augment the supply available at the other end. As regarded the Company's parliamentary position, the proprietors were no doubt aware that the Royal Commission on Water Supply had commenced their sittings. He believed that it was not the intention that the Water Companies should be represented by Counsel; and they heard that most probably the inquiry would be held in private. He did not think the Companies had much to apprehend from the Royal Commission. Their case was a sound one; and they now had a fair opportunity of presenting it to a competent and impartial tribunal. The Subways Bill brought forward by the London County Council might have done them considerable harm as it originally stood; but, thanks mainly to Mr. Hollams, they had obtained provisions far more acceptable to the Companies. It would doubtless be remembered that last year the Parliamentary Committee presided over by Sir Matthew White Ridley declared that nothing had been adduced against them which called for any defence on their part, and that the preambles of the Bills brought forward by the London County Council and the Corporation were not proved. Notwithstanding this report of the Committee, which was duly accepted by the House, these Bills, or, rather, two identically the same, had been again brought forward; and that of the County Council was shortly to be read a second time. It did seem hard that, although the Royal Commission was now sitting, the Companies should again be harassed with expensive inquiries, after all the numerous investigations which had already taken place regarding them. In fact, it seemed to some people that the deeds of the London Water Companies were so dark, and their ways so inscrutable, that nothing but annual inquiries could bring them to light. They apparently forgot, however, that the Companies were neither autocrats nor free agents, but that they were very properly and very efficiently controlled at every step by Acts of Parliament and by Government officers; so that all they did was open, legal, and under the direct sanction of officials specially appointed. It was no doubt owing to the confidence in these Acts of Parliament that such large sums of money had been invested in the water undertakings from the days when their prospects were low and their dividends either small or non-existent. This continued commercial confidence in the acts of the Legislature was further shown by the numerous small investors who had looked upon water stocks as a first-rate security, and by the fact that nearly one-third of their stock was held by trustees, mainly for widows and children. There seemed to be an impression abroad that they had benefited considerably by the late quinquennial valuation, and that they had thus acquired a large unearned increment; but this was altogether erroneous. In their own case, the rateable value of one-third of the houses had been reduced, in one-third it had been left unaltered, and in one-third it had been augmented by very small amounts. The increase in the quinquennial valuation had fallen not upon houses, but upon corporate bodies, such as dock, railway, and gas and water companies. From this, of course, they derived no benefit whatever. The proprietors might not, perhaps, be aware of it, but the rateable value of numerous properties in their district was so small that they were furnishing supplies to the poorer tenements at an actual loss. This sounded as if they were doing something philanthropic; but, of course, it was all in the day's march, and they must take the bad with the good. With regard to the Company's staff, both in the office and in the district they worked diligently and successfully. Mr. Bryan maintained his pre-eminently high reputation as an engineer, and did so much for them that he (the speaker) sometimes feared for his health. They knew Mr. Bryan's value, however, and took great care of him. Their Secretary was a very good administrator, and had the knack of smoothing over any difficulties that might arise with the consumers; and when he (the Chairman) told them that their customers numbered nearly a million and a quarter, and that complaints and summonses were of rare occurrence, he thought they might safely assert that they exercised with consideration and moderation the powers which had been given to them by the State. He might say that the condition of the works was excellent, and the intrinsic value of their property higher than it had ever been. He saw no cause for apprehension as to the future; and they must remember that not only had every water undertaking which had hitherto been acquired been purchased upon a fair and just basis, but also that this same course was recommended last year by the Select Committee in regard to the London Companies. Only the other day, the *Daily News*, in a leading article, advised that the London water-works should be bought at a fair price. They

might also feel reassured when they remembered that the final decision of the question rested with Parliament.

Mr. F. TENDRON, in seconding the motion, said they had met to consider the work carried on by them during the past half year, which had been attended with very satisfactory results; but at the same time, he did not suppose that any gentleman present had entered the room without feeling that it was a source of extreme unpleasantness to know that the market value of his property had so greatly depreciated during the last few months. This might not be a proper subject for discussion at their meeting; but it was well if anything could be said which should to a certain extent disabuse the minds of the proprietors that their property had fallen in any way in its intrinsic value. A most mischievous speech was made not long ago at the London County Council; and he could not understand how a man of the position of Sir Thomas Farrer could rejoice over the depreciation of stocks held by those who had put their money not in casinos, in places of public entertainment, or in beer, but in one of the first essentials of life, being thus general benefactors. He said most plainly that it was the sentiment of an anarchist—a man who hated property—which animated those who were enemies to order and enemies to confidence in just rights. The Water Companies were carrying on their business not by any violation of rights, but in accordance with the powers conferred upon them by Parliament; and, as the Chairman had said, they were under control, and could never do a single thing for which they were not amenable to justice and to the public if it were wrong. If they made any mistake, the newspapers, unfortunately, made the very most of it; and they seemed to triumph over any indiscretion on the part of any one of the numerous servants employed by the Water Companies. As to the fall in their stocks, the intrinsic value of their property could never be shaken, for it was not a question of the capital value of their undertaking, but of the income they were earning; and if there was to be respect for property and for law, it was impossible that the property of the Water Companies could be taken by force without giving every shareholder the income he was then enjoying. If his property were taken from him, it would be for what was called the public good. No Parliament would dare to say that they took it in order that the ratepayers might pay less. It must therefore be taken for the public good; and if so, it could not be said that the shareholders should lose by such a proceeding. They must give the shareholder the income he was receiving, and also something for what he had done with respect to the future. Therefore, he maintained that, intrinsically, their property could never be taken from them by force at a less value than that which they were receiving at the time it was taken. What could be done, however, was that shareholders might be harassed and made uneasy; and their property might thus be made to fall in value, and they themselves be alarmed into accepting terms. Of course, if either Directors or shareholders were weak, and would accept less than they were entitled to, Parliament had nothing to do with it. He maintained that, if any negotiations were entered into at any time, it should be on the basis he had indicated. If not, they were in the hands of Parliament, who would not take the responsibility of removing their property from them without their consent without giving them the income they were receiving at the time. He hoped that the shareholders would watch the proceedings of the Royal Commission, and the introduction of any Bills into Parliament.

Mr. ROKEBY PRICE said he thoroughly appreciated the speech which had been made from the chair; and he felt sure that their interests were safe in the hands of the Directors. With reference to the valuable remarks which had been made by the last speaker, he thought it was right that a protest should be made against the wilful and shameful depreciation which had been made in the stocks of the Water Companies. There was no doubt that this was owing to what had taken place at the London County Council, and to the high position which Sir Thomas Farrer held in the world. Had the remarks made by that gentleman emanated from a person of less consequence, it would not have mattered; but for such a man to have made the speech he did, almost surpassed belief. The Chairman had referred to their doing something philanthropic in connection with their supplies to poor tenements; but was it not rather unwise to supply their water at a loss? It was difficult to draw the line as to who was to have charity and who not, and it might be said that they felt that they did not give sufficient accommodation to their poorer customers, and that therefore they made them no charge.

The CHAIRMAN, in reply, stated that, with regard to their supplying certain houses at a loss, they were bound by the Act to do so. They however, got the benefit of those houses that were of a higher rateable value. It happened in their district that there were so many poor tenements that, when the rating fell below a certain value, the collections from them were so small that they did not pay them for furnishing the water. Of course, they benefited by the better class of houses; and that was part of the whole scheme—just as a house in Belgrave Square was rated higher than one at Hackney. With reference to the fall in the market value of their stock, he thought it might be owing to some apprehension as to the mode in which any question of purchase might be proposed. The market was also very sensitive, and there were not many buyers; but anyone wishing to buy, he thought, would have to give a great deal more than the price now quoted, for any stock that he purchased.

The resolution was then carried unanimously.

On the motion of Mr. G. ILSLEY, seconded by Mr. ROKEBY PRICE, the retiring Directors (Messrs. H. Barnard and R. B. Fenwick and Captain Hugh Davis) were re-elected; and subsequently the retiring Auditor (Mr. Walter Bird) was also re-appointed.

The CHAIRMAN afterwards proposed, and Mr. TENDRON seconded, a cordial vote of thanks to the Engineer (Mr. Bryan), the Secretary, and the staff.

The SECRETARY, in acknowledging the resolution, stated that Mr. Bryan and himself acted together with the greatest unanimity; and they felt that no matter what questions might arise, or what form any inquiry might take, they would be quite prepared in their respective departments to put before a Commission, or anyone else, a statement which would be highly creditable to their Company.

A vote of thanks was afterwards passed to the Chairman, and also to the Directors.

The CHAIRMAN, in reply, assured the shareholders again that the Company had a strong case; and they might rely upon it that the Directors would do their utmost to protect them. He then went on to say that, from what one could gather from the Press, the public feeling towards the Water Companies was something to this effect: We have grumbled at you, and we have used very uncomplimentary language towards you; but, on the whole, you have served us well, you have acted up to the requirements of the day, and you have readily carried out the orders and suggestions of Government. But the prevalent opinion now is that you are out of date, and must give way to some municipal body. We have no desire to deal hardly or unfairly with you in the matter of purchase, as we remember that, by your energy and your enterprise, you have constructed from small beginnings the present gigantic system of satisfactorily supplying 5 million people with 200 million gallons per day, and have, as the *Morning Post* says, rendered London "one of the healthiest cities in the world, especially free from diseases arising from consumption of polluted water."

The proceedings then terminated.

THE LONDON COUNTY COUNCIL AND THE WATER QUESTION.

At the Meeting of the London County Council on the 29th ult., Sir Thomas Farrer took the opportunity of reviewing the position of the Council, which had just been re-constituted, with regard to the Metropolitan Water Question. He said the effect of the late election was excellent; showing as it did that the ratepayers honestly approved of the entire policy of the previous Council. Turning to the effect of that election upon the shares of the Water Companies, he said they had fallen from $2\frac{1}{2}$ to $17\frac{1}{2}$ per cent., the average depreciation being from 8 to 10 per cent. Practical unanimity existed in London upon this subject; and all parties were forced to adopt the Council's policy. The Progressives were unanimous; and he believed the Moderate section had raised no objections. The Council would therefore lose character if they did not do their best to realize the ends they had in view. But this was no easy matter; for the difficulties in the way were considerable. The sources of the future supply of London had not been determined; and it was obvious that the Home Counties would have much to say on the subject. Certain assumed rights of the present Companies would be disputed to the death—and that, too, with a great deal of justice; and it would be madness to purchase these supposed rights without the fullest investigation. The position of the counties affected would have to be considered; and the legal powers of the Companies with reference to their charges must be inquired into. Serious doubts existed as to the legality of the present charges; but the Council had yet no power to ask the Companies a single question, to examine their books, or to get information from them. The hands of the Council were tied; and they had no means of ascertaining the facts. They had applied for the necessary power; but Mr. Ritchie made it a condition of proceeding with the Bill that this clause should be struck out. This was an example of the fairness of the Government towards that Council. He did not blame the Government, because the members representing London did not enforce the views of their constituents and of the Council, as he hoped they would do after the next general election. There were also the questions of a constant supply and the increase of the Companies' rates and dividends; and he thought he had stated enough to show what a very little way they had got in the investigation of the water supply. The foregoing remarks attracted considerable attention; and, as will be seen by the report of the proceedings at the meeting of the East London Water Company which appears on the preceding page, as also by the remarks of Colonel Makins in the House of Commons last Thursday, given in our "Parliamentary Intelligence," they drew upon their author some adverse criticism. At the meeting of the Council last Tuesday, it was agreed, on the recommendation of the General Purposes Committee, as follows: "The Special Committee shall prosecute and conduct all needful inquiries and negotiations relative to the supply of water, or to companies supplying water, in or near London, and shall consider the steps to be taken for acquiring the undertakings now supplying London, or for providing a new supply. The Committee shall conduct any negotiations with the Water Companies, for purchase or otherwise, which may be authorized by the Council. The Committee shall take the necessary steps for the purpose of promoting and conducting, conjointly with the Corporation of London, the Water Bill of the Council; and the Committee shall conduct the case of the Council before the Royal Commission appointed to inquire into the subject of the London Water Supply."

KIMBERLEY WATER-WORKS COMPANY, LIMITED.

The Annual Meeting of this Company was held last Wednesday, at the Cannon Street Hotel, E.C.—Mr. A. J. MACDONALD in the chair.

The SECRETARY (Mr. W. Vincent) read the notice convening the meeting; and it was agreed to take as read the report and accounts, a few figures from which were given in the *JOURNAL* last week.

The CHAIRMAN said the past year had again showed a considerable decrease in the consumption of water. This was attributable almost entirely to the very unusual rainfall, which furnished both the towns and mines with water which the Company would otherwise have supplied. As to the working expenditure, this had diminished; and the Manager believed it would continue. Besides this the cost of fuel used for pumping might be considerably reduced when the new railway between Kimberley and Bloemfontein was finished. Although the dividend recommended this year was low, he thought he could safely say they had now reached the bottom point; and they might look forward even this year to an increased consumption of water. He then quoted some statistics which had been collected with regard to the rainfall during the past few years. In 1891, the rainfall was 31.1 inches, which was as much as fell in England. The average rainfall of Kimberley and the district was 17.5 inches. Respecting the diminution in the working expenditure, it was interesting to see that in almost every item

they had a reduction. The difference in salaries and wages at the Kimberley office and stations had not been very much—£8700, as against £8590; but there was a large decrease in the cost of pumping, owing to there having been a smaller quantity of water consumed (£6400, as compared with £10,651). The maintenance repairs were £2689, against £3000; and the carriage and transport was £983, compared with £1100. Altogether the expenditure showed a diminution of £5700. Their Manager estimated that the relative gain in the total expenditure would be about £2600. The London charges had also been reduced. Proceeding, the Chairman said he had taken the trouble to work out the total amount of dividend that had been paid by the Company; and the figures were really surprising. Including 1891, the total sum paid as dividend was £217,175; and the depreciation written off was £82,810—making together about £300,000 in ten years. Considering the opposition and difficulties the Company had had to contend with, he thought this was not a bad statement. The two last years had been the worst they had had; and in those they had only been able to pay a dividend of 5 per cent. Having pointed out that in the first three months of the current year, there had been a substantial increase in the consumption of water, he concluded by moving the adoption of the report and accounts, and the declaration of a dividend of 5 per cent.

The SECRETARY then read a report which had been received that morning from Mr. D. Macdonald, one of the Directors, who had gone out to Kimberley to inspect the works. He stated that these were in good order; and that the prospects of the Company were very encouraging.

Mr. G. F. SMITH seconded the motion.

A long discussion ensued, in the course of which one shareholder stated that ever since the Company had bought out the Griqualand Public Works Company, the profits had been diminishing. Another proprietor thought the reduction of the profits was due to three causes: (1) The permanent reduction of the tariffs which had been forced upon the Company from time to time; (2) the bad business, which had been general, throughout the mining districts; and (3) the very wet seasons. A shareholder elicited from the Chairman that the fees of the Board amounted to £2000 a year; and this led to two or three gentlemen expressing the opinion that, while the dividends were as low as at present, the Directors ought to be contented with £1000.

The motion was carried *nem con.*

The retiring Directors and Auditors were re-elected; and the proceedings then terminated.

NOTTINGHAM CORPORATION WATER PROVISIONAL ORDER.

The Water Supply of West Bridgford.

A Local Government Board Inquiry was held at Nottingham last Tuesday, by Mr. ADRIAN, one of the Inspectors, into an application by the Nottingham Town Council for a Provisional Order to vary, repeal, alter, and amend their Water Act of 1879, so as to provide that the limits of the water supply, as defined by section 3, might be extended to include the district of West Bridgford. There was a strong opposition by certain ratepayers, who objected to the confirmation of the Order.

The TOWN CLERK (Mr. S. G. Johnson) and Mr. HARRIS appeared for the Corporation; and Mr. APPLETON for the West Bridgford Local Board, in support of the application. Mr. DALY represented the opposing ratepayers.

The TOWN CLERK, in opening the proceedings, referred to the reasons which had induced the Corporation to ask the Local Government Board to amend a section of the local Act of 1879. The early supply of water to the borough and the surrounding district was by a private Company; but in 1879 the Corporation purchased the undertaking. There were many large and populous districts in the vicinity of Nottingham; and some of these places were supplied with water at the same rate as the burgesses. Other places which had been added since 1879 had not been so supplied; but had been charged a differential rate from those originally included, for very sufficient reasons. The water which the Corporation of Nottingham supplied was not a gravitation or surface supply; but it was reputed to be one of the best supplies to be found in the kingdom. In 1882, the Corporation agreed to supply West Bridgford; and they extended their works and mains at considerable expense. From time to time deputations from the parish waited upon the Corporation asking for a reduction of the differential rate; and in 1888 the Water Committee placed them upon the same terms as other outside places. The parish continued to grow; and the Corporation, after expending about £2500 in the works necessary for supplying the increased demand, thought it was time they were placed in a more secure position. A Local Board was afterwards established; and the Corporation approached them on the subject. The result was that a provisional agreement was drawn up between the Corporation and the Board; and he considered the latter obtained extraordinarily good and liberal terms—terms which bound the Corporation to supply water to them in perpetuity if they so desired; while, on the other hand, the agreement gave the Board the opportunity at any moment they liked to terminate the contract. Had the Corporation known the kind of treatment they were going to receive from West Bridgford, they would never have undertaken to supply them with a gallon of water. By the provisional agreement, the Corporation were to continue to supply West Bridgford with water at a differential rate of 25 per cent.; and the Board were to be clear of any management expenses. This was a clever agreement on the side of the Board; but it was somewhat detrimental to the Corporation.

Mr. APPLETON said the Local Board had come to the conclusion that the agreement which they had made with the Corporation was the best that could be secured in the interests of the ratepayers. It was obvious that a small parish of 2500 inhabitants, in setting to work to obtain a supply of their own, would be under a great disadvantage, and that was the reason the Board had entered into this contract. Roughly speaking, if they provided an independent water supply, there would be a loss on the year's receipts over expenditure of from £400 to £500 a year.

Witnesses were then called, on behalf of the Local Board, in support of the Order—one of them (Mr. J. Rushworth) stating that, at the lowest

possible figure, it would cost £13,050 to construct works for the parish; and he calculated that about £500 would be lost on the undertaking, which would have to be taken out of the rates.

Mr. DALY argued that, in the interests of West Bridgford, the Nottingham water ought not to be forced upon the ratepayers. Briefly, they opposed the Order on these grounds: (1) Because good water in equal abundance could be obtained in West Bridgford; (2) and at a cheaper rate than from the Nottingham Corporation; (3) that local control of the water supply was desirable; (4) that the majority of the ratepayers of West Bridgford desired to secure a local supply; and (5) that the majority (of one) on the Local Board did not represent the majority of the ratepayers on this question. He believed that they could supply the water for themselves at 20 per cent. less than the price at which they were served by Nottingham.

Evidence was then called on behalf of the opposition.

Mr. W. H. Radford said he had been consulted by certain gentlemen at West Bridgford with respect to the supply of water. Boring operations were carried on under his directions; and he found a very good supply of water—far beyond the requirements of West Bridgford. The cost of establishing works would be about £7000. The working expenses he estimated at £250 a year; and the sinking fund would be about £385. He denied the accuracy of Mr. Rushworth's figures; but said that, even on those figures, he would strongly recommend the adoption of the scheme.

Dr. Percy F. Frankland deposed that the water taken from the trial boreholes at West Bridgford was very suitable for drinking purposes; but it was unfortunately rather hard, although the hardness was not so great as that of the water supplied by the Kent Company to a part of London.

Mr. Matthew Doubleday stated that a memorial was in course of preparation to the Local Government Board in opposition to the Provisional Order; and it already contained 318 signatures of owners and occupiers. The syndicate formed for carrying out the boring for water included 48 persons; and they raised money by subscription amounting to £149. If the Local Board were not prepared to undertake the water supply, the syndicate would. It was estimated that they could supply the district with water at 20 per cent. less than Nottingham.

Other evidence of a similar character was given.

Mr. JOHNSON and Mr. APPLETON having replied, the proceedings terminated.

Shanghai Water-Works Company.—A balance dividend of £1 2s. 6d. per share is announced by the Directors; making, with the interim dividend already paid, a total of £1 14s. 6d. for the year 1891.

Extensions at the Leeds Corporation Gas-Works.—At a meeting of the Gas Committee of the Leeds Corporation last Friday week, it was agreed that the manufacturing plant at the Meadow Lane works should be extended, and that a gasholder should be erected on vacant land in Dewsbury Road.

Stoppage of a Gas-Works.—An unusual occurrence is reported from Weardale. Owing to the high price of coal in that town (23s. per ton), the gas-works at St. John's Chapel have been closed till further notice. There will now be no light for the Town Hall and places of worship except by oil-lamps.

Southampton Corporation Water Supply.—According to a report presented at the last meeting of the Southampton Town Council by the Water Engineer (Mr. W. Matthews), on the operations of the Water Department during 1891, the total quantity of water pumped was 830,500,000 gallons, as against 805,500,000 gallons in 1890; the cost of pumping was £2219, as compared with £2102; and the total working expenses were £4487, as against £4339.

Tipton Local Board Gas Supply.—At the last monthly meeting of the Tipton Local Board, the Gas Committee reported that, during the year ending the 25th ult., 96,778,000 cubic feet of gas had been made; being an increase of 10,066,929 cubic feet on the previous year. A vote of thanks was accorded to the Manager (Mr. Vincent Hughes), for the foresight exercised by him in providing a sufficient quantity of coal to meet all requirements during the recent crisis. The report was adopted.

Proposed Purchase of the Wrexham Electric Lighting Works by the Corporation.—It having come to the knowledge of the Wrexham Town Council that the local Electrical Company would not be unwilling to sell all their interest in the undertaking, Alderman Jones, at a recent meeting of the Council, moved a resolution expressing the opinion that it was desirable to become possessed of such a property, and instructing the Town Clerk to write to the Company inquiring at what price the purchase might be made. In support of his motion, the Alderman said the growth of electric lighting had been remarkable, as was shown by the fact that one London Company in 1889 had 6000 lamps, and in 1891 60,000; while another in 1889 had 11,000 lamps, and in the next year 25,000. Much, too, he believed, was expected from the discovery that electricity could be used for cooking. The Mayor (Mr. F. W. Soames) seconded the motion, which was carried.

The Dangers of Paraffin and Spirit Lamps.—One of several fires which occurred in Liverpool at the close of the week ending on the 2nd inst. took place in the upper room of a house in a court in Great Howard Street. On the arrival of the police with fire-extinguishing appliances, they heard that two children were in the burning room, and two constables bravely entered the apartment and brought out the children, aged seven and five respectively. They were dead, the bodies being fearfully burnt. The parents had gone out—leaving the children in bed; and the fire is supposed to have had its origin in an accident to the paraffin lamp left burning in the room. A fire occurred half an hour after midnight last Tuesday morning at 14, Albert Road, North Woolwich, in a private house occupied by Patrick O'Connor, a gas stoker. A spirit-lamp was accidentally upset in the back bed-room on the first floor, and O'Connor, his wife, and a child became overcome with the flames and smoke. A police sergeant and two constables did good work in rescuing the unfortunate people, but not until Mrs. O'Connor had been so badly burnt as to necessitate her removal to the nearest hospital. The premises were considerably damaged.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Glasgow Town Council on Thursday resolved to purchase the land, buildings, and plant of the Glasgow Alum and Ammonia Company at the price of £9000, and to take over the stock and moveable plant at a valuation. The Company is in liquidation, and its works have been advertised in the JOURNAL and elsewhere as for sale by public auction. The works adjoin the Tradeston Gas-Works; and when the offer of Mr. T. M'Lintock, the Liquidator, was submitted to the Gas Committee on Wednesday, they were unanimously of opinion that the acquisition of them would be of great advantage to the Corporation. At their Dawsholm works they have abundance of space; and the residuals are treated on the spot. At the Tradeston works, space is limited; and were it for nothing else, the land which they acquire by the purchase is valuable. But in addition to prospective uses, the works will enable them to have the treatment of residuals carried on upon the spot under the most favourable conditions. In recommending the purchase of the works to the Town Council, Mr. Ure said he thought it was a question of policy as well as cheapness. He considered the purchase was at a cheap rate—£2 per yard, whereas the Cleansing Committee had paid £2 10s. per yard for ground in the neighbourhood without any works at all. In the interests of the Gas Trust, it was necessary that they should acquire these works; but they would not be used, as at present, as alum and ammonia works except in a case of emergency. The purchase is a most fortunate one for the Corporation; and the Gas Committee deserve congratulations for their prescience and tact in carrying it through.

It goes without saying that there are people on all public bodies who are not up to date; one of these is Mr. Starke, a Glasgow councillor. When the amount of the gas revenue for the portion of the financial year which has expired was reported to the Town Council to have been £287,126, he wanted an explanation as to how it came about that it was £47,621 above the amount at the same period last year. Poor man, he must surely have been asleep while the recent annexation scheme was being carried through. The explanation given by Mr. Ure, the Convener of the Gas Committee, was short, but to the point; and it was that they had acquired the gas-works of Maryhill, Pollokshaws, and Dalmuir.

The electric lighting venture of the Glasgow Town Council was considerably advanced at their meeting on Thursday. Acting on the recommendation of the Gas and Electric Lighting Committee, they fixed the charge for electricity at 7d. per unit to all customers; and several contracts for furnishings in connection with the central station in Waterloo Street were let. The supply of engines, dynamos, &c., has been entrusted to Messrs. Latimer Clark, Muirhead, and Co., of London, at a cost of £10,900. The London firm was selected on the recommendation of Professor Kennedy, as being the most successful makers of engines for electric light installations. The contract for the supply of cast-iron troughs, covers, service-houses, &c., has been secured by Messrs. Robert Maclaren and Co., of the Eglinton Iron-Works; and for the supply of boilers, by Messrs. Lindsay, Burnet, and Co., both Glasgow firms. Some little cavil having been expressed at the Committee's sending work to London when there was so much engineering in Glasgow, the Council were assured by Mr. Ure that five-sixths of the work would be done in Glasgow. It is the intention of the Corporation to proceed at once with the work of introducing the plant; and it is the desire of the Committee that the lighting of a number of the streets by electricity shall be in operation in November next. They propose to start with a series of streets in the form of a cross, with a long tail to one of the legs. One of the lines will be from the Cross along the Trongate and Argyle Street; and the other will start at Broomielaw Bridge, proceed up Jamaica Street, at the top of which it crosses Argyle Street, and will then go up the hill by Union and Renfield Streets to Sauchiehall Street, along which it will be turned at right angles, and the whole of that street, to its further end at Charing Cross, will be lighted. Sauchiehall Street is a mile and a half long; and it is proposed to place 20 arc lamps in the thoroughfare, which will provide a lamp for every 132 yards, or, the lamps being on alternate sides, 264 yards will intervene between the lamps on any particular side of the street. This cannot be said to be overdoing the matter of lighting.

An important letter from the Secretary to the Board of Trade has been submitted to the Glasgow Gas and Electric Lighting Committee, to the effect that the Board propose to limit their approval of the high-pressure system of the supply of electricity to one year. This shows that the Board of Trade are but feeling their way in the matter of electric lighting—a circumstance which should make corporations cautious in adopting the high-pressure system; because, should the Board make up its mind the other way, high-pressure plant might suddenly be thrown out of use.

The Edinburgh Merchants' Association—the body whom I mentioned some weeks ago as having employed Dr. Ivison Macadam to analyze the Edinburgh and Leith gas, with a view to backing them up in the belief that the gas was bad, but who, on obtaining a report from Dr. Macadam that the gas was of good quality, changed their tune—had the matter before them again on Wednesday night. Having sent Dr. Macadam's report to a Committee, the Committee appointed Mr. J. M. Turnbull, one of their number, to prepare a report on the whole subject. Mr. Turnbull is a chemist, with a good theoretical knowledge of gas manufacture; and he produced an exhaustive report which is to be printed and circulated before adoption. He brought out that the present high price of gas—4s. 6d. per 1000 cubic feet—is owing to too high a price being paid for the gas undertakings, by which a burden is entailed of 7½d. per 1000 cubic feet on the gas consumption, and to the high price of coal, which has advanced from an average of 12s. per ton in 1889 to 20s. per ton in 1892. In connection with the latter, he condemned the existing system of contracting for coal as being behind the age. The coalmaster, he said, not knowing what changes might ensue, puts on 15 to 20 per cent. to cover his risks. He therefore advocated that a store of coal to last six weeks or two months should be laid in; and that then contracts should be either abolished or reduced to one or two months. The rise in the price of coal, he showed, had in one year put £42,000 into the pockets

of the coalowners; and he believed that very little of that sum went to the miners. In order to avoid paying such a high price for coal, he strongly advocated the reduction of the illuminating power of the gas from 26 to 22 candles, by which the price might be reduced to 3s. or 3s. 3d. per 1000 cubic feet. He deprecated the proposed expenditure of £44,000 upon additions to the Edinburgh works, and favoured the extensions being made to the Leith works, or preferably, that new works should be erected either upon a site to be reclaimed from the sea between Leith and Portobello, or upon land in the same neighbourhood which is known as the Craightinny irrigated meadows. His most important suggestion was that the Gas Commissioners should introduce the oxygen system of gas purification, which Mr. W. A. Valon, Assoc.M.Inst.C.E., of Ramsgate, has done so much to bring forward. By its use, he maintained, a saving of 2d. per 1000 cubic feet of gas would be attained, the saving being made up of a revenue of £5208 in the increased illuminating power of two candles, and of £4683 less being spent on coal. The Committee recommended that a petition in terms of the report should be presented to the Gas Commissioners; and also that the Commissioners should be asked to recommend to consumers the burners which would be suitable for producing the best results from the gas supplied. The members received the report very favourably; but, as stated above, resolved to take a month to consider it. The report is welcome as containing a criticism by an outsider upon the policy of the gas undertaking. It is an easy matter to criticize; the value of the criticism is quite a different matter. If all criticism were couched in as respectful a tone as Mr. Turnbull's, and were as generally intelligent, it would be an easy matter to deal with it; and there is no doubt that when this document reaches the Gas Commissioners, it will receive every consideration. If I were to criticize Mr. Turnbull's views, I should say that no one can take exception to his proposals to reduce the illuminating power except on the ground that the Commissioners are about to experiment on the enrichment of gas by oil, of which he is probably not aware. Neither can exception be taken to his proposal to introduce oxygen purification, unless it may be that he seems to proceed on the assumption that the Engineers to the Gas Commissioners have not applied their minds to it, which can hardly be the case. On the subject of coal contracts, he was not so sound. A much larger store than two months' supply would be necessary to enable the Commissioners to abolish coal contracts; while one or two month contracts might be expected to give admirable facilities for the formation of rings and corners among coalowners. The question is, however, a debateable one. He was altogether wrong in the proposals as to a new site for the gas-works. To carry out such a scheme would mean an addition to the price of gas; and it cannot be thought of till more propitious times arrive. Meanwhile, the Commissioners must stick to the works they have and make the most of them.

Passing from Mr. Turnbull's report, there was quite a refreshing little incident in a short statement which the Chairman made. The Chairman was one of the guests at the annual dinner of the Gas Commissioners, which was held in private in the middle of last month; and though he did not disclose what went on there, he said that if he had had occasion he would have borne out every word that the Lord Provost said regarding electric lighting. His Lordship spoke of the electric light engineers who promised them everything, and of the people who hoped for everything from the electric light. He (the Chairman) could have come in as a *savant*. On a recent occasion, on opening a new warehouse in Bradford, seeing that the Corporation had brought out the electric light, he thought he would be abreast of the age, and he introduced it. He was paying three times for electric light in the one warehouse what he was paying for gas in the other in Bradford. The 200-candle power lamps were costing him 4d. per lamp per hour; the 100-candle lamps, 2½d. per lamp per hour; and the smaller lamps, 4d. each per 14 hours. He expected to have a pretty sum to pay at the end of the winter six months. He granted that they had a most beautiful light, and everything was clean; but if the difference in price were put before the citizens of Edinburgh, they would not adopt it. Subsequently, Mr. Turnbull said he had calculated out the Chairman's figures; and he found that, light for light, the cost was as 1½d. or 1¾d. for gas to 4d. for electric light. This from Bradford, the great pioneer of corporation electric lighting, is very instructive; as it points to the probability that, when the three-year contracts with customers expire, there will be a general return to gas, and the vaunted profit on electric lighting will then disappear.

West's patent coal breaking and stoking machinery, which has been fitted up in the Aberdeen Corporation Gas-Works, was formally taken off Mr. West's hands by the Town Council on Monday. It was stated that, whereas it previously took ten minutes to draw and charge a retort, 18 retorts could now be dealt with in that time. The estimated cost of the plant was £6000, and the actual cost had been £6244. Of this sum only £1513 had been charged to capital. There are two sets of machines, worked by the overhead wire-rope system. A report by Mr. A. Smith, the Manager, showed that during October, November, and December the quantity of coal carbonized was 1300 tons more than in the same period of the previous winter, and that the cost of the working was £600 less. The saving of cost was at the rate of 1s. 0½d. per ton; and upon a gross yearly quantity carbonized of 40,000 tons, the saving by the machinery is expected to be £2000. If that is realized in working, the plant will repay its cost in three years.

The Dundee Gas Commission last Wednesday, acting on the advice of Mr. M'Crae, the Manager, resolved to advertise for a supply of coal for six months, so that it would seem they are inclined to adopt a short-contract system. Other stores are to be contracted for for twelve months. The Commission also approved of Mr. M'Crae's proposals, already referred to in these "Notes," for the execution of alterations and extensions at the gas-works.

There was another lively meeting of the Dunbar Gas Commissioners on Monday night; some of the members complaining that they did not get notice to attend the inspection of the gas-works which Mr. Foulis, of Glasgow, recently carried out. It was explained that Mr. Foulis's visit was intended to be of the nature of a surprise one; and thereafter the talk descended into twaddle about who had communicated an account of Mr. Foulis's visit to the *Glasgow Herald*. It is difficult to say what is at the bottom of all the hubbub; but one thing is certain,

that while the members of the Corporation wrangle over such small matters as this, the work of the gas-works cannot be efficiently carried out. Mr. Foulis, it appears, directed that a record of weights, &c., should be kept; and meantime he declined to make a report on the working of the undertaking.

The attempt by the Board of Supervision to interfere with the working of the Fraserburgh Gas Company's works, mentioned in my last week's "Notes," has not been long in being disposed of. The medical officer whom the Police Commissioners asked to report on the works has reported that, in his opinion, they are not conducted so as to be a nuisance in the sense of being prejudicial to public health. It is true that the Board of Supervision may yet send a special officer from Edinburgh to examine the works and report direct to themselves; but if they had been going to take that step, it is likely they would have done it at first.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, April 9.

Sulphate of Ammonia.—The market is entirely without change; and the finer weather has not stimulated the demand to any great extent. Consumers are pressing for their deliveries; and there are a few fresh orders. But on the whole the state of trade is disappointing, and not at all what it should be. The worst feature of the situation is that the slackness of demand impresses buyers with the idea that they must be able to buy sulphate at their own prices, though they are quickly disillusioned when it comes to actual business. Quotations remain unchanged; and as there is little offering, there seems to exist no danger of lower prices in the near future. Nitrate is weak; but still prices of good qualities have given way very little, and 9s. to 9s. 1½d. is quoted. Sulphate is £10 5s. at Hull, £10 3s. 9d. at Leith, and £10 2s. 6d. at Liverpool.

LONDON, April 9.

Tar Products.—There is absolutely no new business being done in this market; and sellers are becoming extremely anxious as their stocks are going on increasing. Even pitch, which was a sort of backbone to the trade, is participating in the weakness which characterizes all other products. Low prices are reported in several instances where tar contracts have been received. In one case where tar is extremely bad, as low as 10s. has been accepted. The following prices must be considered only nominal, with the exception of tar: Tar, 10s. to 12s. 6d. Pitch, 29s. 6d. Anthracene, 30 per cent., "A" quality, 10½d.; "B," 7½d. Benzol, 90 per cent., 1s. 10d.; 50 per cent., 1s. 6d. Toluol, 1s. 4d. Solvent naphtha, 1s. 3d. Crude benzol naphtha, 30 per cent., 10½d. Creosote, ¾d. Naphthalene salts, 20s.; pressed, 45s. Carbolie acid, crude, 60's, 1s.; 70's, 1s. 4d.; crystals, 4½d. Cresol, 8d.

Sulphate of Ammonia.—A little better feeling has imported itself into this market; and it looks as if sulphate has taken a turn for the better. More inquiry obtains, and there is just a shade of improvement in values. Business is reported as having been done as low as £10, less 3½ per cent.; but £10 2s. 6d. or £10 3s. 9d. may be taken as a fair average value. Gas liquor (10-oz.) is nominally priced at 5s. to 6s. 6d.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The coal trade of this district has again relapsed into a very quiet condition; and, with very few of the collieries working, more than five days per week, stocks are accumulating, especially in the lower qualities, to a considerable extent. The better qualities of round coal suitable for house-fire purposes are still moving off fairly well at about late rates. Best Wigan Arley still averages 12s. 6d.; Pemberton four-feet and second qualities of Arley, 10s. to 10s. 6d.; and common house-fire coals, 9s. to 9s. 6d. per ton, at the pit's mouth. The depression in the iron trade of this district is necessarily materially affecting requirements for the lower qualities of round coal; and these are hanging upon the market with prices easier—good, ordinary descriptions not fetching more than 8s. 6d. per ton. Engine classes of fuel are also again plentiful, and surplus lots have been pushed at low figures; while the threatened lock-out in the cotton trade gives anything but a hopeful outlook for the immediate future. Good qualities of burgy are still fetching about 6s. to 6s. 6d., and the best qualities of slack, 5s. to 5s. 6d.; but common sorts can be bought readily at about 3s. 6d. to 4s. per ton, at the pit's mouth. The shipping demand continues very limited; and with plentiful supplies again offering at the ports on the Mersey, ordinary steam coal has been readily obtainable, delivered at the Garston Docks or the High Level, Liverpool, at 10s. per ton, or even less.

Northern Coal Trade.—The coal trade is on the whole easier, the local consumption having been reduced, and there having been more coal brought from other parts. Best Northumbrian steam coal is in abundant supply, at from 10s. 9d. to 11s. per ton, f.o.b. There is also plenty of small steam coal, at from 4s. 9d. to 5s. per ton. The small quantity of gas coal that is being produced is very nearly all taken up on old contracts; but a little is being sold at about 12s. per ton, f.o.b. It is, however, significant that, while some gas companies bought in the early weeks of the strike, they are now refraining from doing so—which looks as if a speedy end were expected. A little coal is being imported, however, but the cost of carriage makes it dear. Bunker and manufacturing coals are dull, in consequence of the large number of steamers laid idle and of works laid off. Household coals are flat in price, the mild weather having limited the consumption. Coke is difficult to obtain locally, and as much as £1 per ton is asked for best blast-furnace kinds; but very little is made, and one or two users are drawing supplies from Yorkshire. Gas coke is rather steadier; and at Darlington the price has been put up, in consequence of the fuller demand. At the town named, a considerable increase in the consumption of gas is taking place.

Tarapaca Water-Works Company.—The Directors have declared a second dividend of 5 per cent., less income-tax, on account of the year ended Dec. 31 last.

The Weights and Measures (Purchase) Bill.—By this Bill, which was introduced by the President of the Board of Trade (Sir M. Hicks-Beach) on Monday last week, Parliament is asked to authorize county and borough councils to purchase the "franchise of weights and measures." This expression is defined as the authority which any court-leet, jury, or other person may now possess for inspecting, examining, regulating, verifying, stamping, adjusting, seizing, breaking, or destroying any weights or measures or any weighing or measuring instrument. It is proposed that county councils shall be enabled to borrow money for the purposes of the Act, in accordance with the Local Government Act, 1888; borough councils being empowered to borrow in accordance with the Public Health Act, 1875.

The Water Question at Mansfield.—Yesterday week a special meeting of the Mansfield Town Council was held to consider the best means of furnishing the town with a good water supply. At the last meeting it was resolved that Mr. Hodson, C.E., should modify his estimate so that the expense incurred in providing an additional supply should not exceed £20,000. A memorial from the Mansfield Owners' and Ratepayers' Association was, however, presented, protesting against the expenditure of so large a sum; and stating that, being dissatisfied with the decision arrived at, they had engaged the services of Mr. W. H. Dalton, F.G.S., who forwarded a report to the effect that, by deepening the present well, and driving headings in the direction indicated by the geological structure of the district, an ample supply of good and pure water could be obtained to supply the developments of the borough for years to come. After hearing the above report, the Mayor, (Mr. G. H. Hibbert) was requisitioned to call a special meeting to further consider the question.

Electric Lighting for Huddersfield.—Mr. R. Walton, M.Inst.C.E., held an inquiry at Huddersfield, last Thursday, relative to an application by the Huddersfield County Council for sanction to borrow £50,000 for electric lighting purposes. The Town Clerk (Mr. H. Barber), in support of the application, stated that the population of the borough was 95,417; the rateable value, £422,873; and the total indebtedness, £2,057,069. The Board of Trade issued two Electric Lighting Orders for the borough in 1890; and by the second one, it was provided that the Council should commence the works in the compulsory area within two years. The area of supply was the whole of the borough, with the exception of one portion, which was added after the Order was made—viz., the extensive district of Longwood. Mr. A. B. Mountain, the Electrical Engineer, produced plans of the generating house, in which he said provision would be made for 6660 8-candle incandescent lamps. Three dynamos on the Brush principle would be employed. There was no opposition.

Exhibition of Gas Appliances.—Last Tuesday, an exhibition of gas cooking and other apparatus supplied by the Davis Gas-Stove Company, Limited, was opened at the Central Hall, Walsall. During the afternoon and in the evening, Miss Ida Cameron gave lessons in cookery; there being a good attendance of ladies each time. Under the auspices of the Swansea Gas Company, Messrs. Thomas Fletcher, Russell, and Co., of Warrington and London, held an attractive exhibition of their various gas appliances in the Albert Hall during the past week. Fletcher's well-known patent cellular cast-iron "Indestructible" cooking-ranges took a prominent place; and round the hall were heating-stoves, coffee-roasters, water-heaters, smoothing-iron heaters, burners, &c., all in full working order. In the afternoon and evening of each day, Mrs. Wilkinson, late of the National School of Cookery, South Kensington, gave practical demonstrations on cooking by gas, before large audiences. A successful exhibition of gas appliances has just been held at Haslingden, at which Messrs. C. Wilson and Son and Messrs. John Wright and Co. showed various samples of their cooking and heating stoves. The exhibition was held under the auspices of the Gas Company, who had a stand of meters, samples of residuals, &c. Free lectures on cookery were delivered by Mrs. C. F. Pitcher.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.
(For Stock Market Intelligence, see ante, p. 658.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.					£ s. d.
GAS COMPANIES.								
590,000	10	15 Oct.	10½	Alliance & Dublin 10 p. c.	10	16-17	..	6 3 6
100,000	10	"	7½	Do. 7 p. c.	10	11½-12½	..	6 0 0
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105-107	..	4 13 5
100,000	20	27 Nov.	8	Bahia, Limited	20	12-14	..	11 8 1
200,000	5	12 Nov.	7½	Bombay, Limited	5	6½-6¾	..	5 11 6
40,000	5	"	7½	Do. New	4	4½-5½	..	5 14 1
380,000	Stock.	26 Feb.	12½	Brentford Consolidated	100	205-215	..	5 14 1
150,000	"	"	9½	Do. New	100	157-162	+2	5 14 2
220,000	20	11 Mar.	11½	Brighton & Hove Original	20	39-41*	..	5 12 2
888,500	Stock.	11 Mar.	5	Bristol	100	95-100*	..	5 0 0
320,000	20	15 Oct.	11½	British	20	43-45	..	5 0 0
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	10	19-20	..	5 15 0
51,510	10	"	8½	Do. 7 p. c.	10	14-15	..	5 13 4
328,750	10	"	—	Buenos Ayres (New) Limited	10	6-7	..	—
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	93-96	..	6 5 0
150,000	20	26 Feb.	8	Cagliari, Limited	20	24-26	..	6 3 1
550,000	Stock.	15 Oct.	13½	Commercial, Old Stock	100	242-247	-2	5 5 3
165,000	"	"	10½	Do. New do.	100	190-195	..	5 2 7
130,000	"	30 Dec.	4½	Do. 4½ p. c. Deb. do.	100	118-123	..	3 13 2
800,000	Stock.	30 Dec.	13	Continental Union, Limited	100	221-226	..	5 15 1
200,000	"	"	10	Do. 7 p. c. Pref.	100	185-195	..	5 2 7
75,000	Stock.	30 Mar.	10	Crystal Palace District	100	185-195*	..	5 2 7
486,090	10	29 Jan.	10	European, Limited	10	19-20	..	5 0 0
354,060	10	"	10	Do. Partly paid	7½	14-15	..	5 0 0
5,470,820	Stock.	12 Feb.	12	Gaslight & Coke, A, Ordinary	100	212-217	..	5 10 7
100,000	"	"	4	Do. B, 4 p. c. max.	100	94-97	..	4 2 5
665,000	"	"	10	Do. C, D, & E, 10 p. c. Pf.	100	245-250	+1	4 0 0
30,000	"	"	5	Do. F, 5 p. c. Prf.	100	116-121	..	4 2 9
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	169-174	..	4 6 2
1,300,000	"	"	7	Do. H, 7 p. c. max.	100	153-156	+2½	4 9 9
463,000	"	"	10	Do. J, 10 p. c. Prf.	100	241-246	..	4 1 3
476,000	"	"	—	Do. K, 6 p. c. Prf.	100	146-150	+½	4 0 0
1,061,150	"	11 Dec.	4	Do. 4 p. c. Deb. Stk.	100	113-116	..	3 9 0
294,850	"	"	4½	Do. 4½ p. c. do.	100	118-123	..	3 13 2
908,000	"	"	6	Do. 6 p. c. do.	100	163-168	..	3 11 5
3,800,000	Stock.	12 Nov.	12	Imperial Continental	100	223-227	+1	5 5 8
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4-4½	..	6 13 4
560,000	100	1 Apr.	5	Met. of Melbourne, 5p. c. Deb.	100	106-108*	..	4 12 7
541,920	20	27 Nov.	6½	Monte Video, Limited.	20	14½-15½	..	8 7 8
150,000	5	27 Nov.	10	Oriental, Limited	5	8½-8¾	..	5 14 3
60,000	5	30 Mar.	7	Ottoman, Limited	5	4-5*	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited.	10	2½-3½	..	—
People's Gas of Chicago—								
420,000	100	3 Nov.	6	1st Mtg. Bds.	100	100-105	..	5 14 3
500,000	100	1 Dec.	6	2nd Do.	100	100-105	..	5 14 3
150,000	10	15 Oct.	10	San Paulo, Limited	10	9-10	..	10 0 0
500,000	Stock.	26 Feb.	15½	South Metropolitan, A Stock	100	267-272	+1	5 14 0
1,350,000	"	"	12	Do. B do.	100	220-225	..	5 6 8
200,000	"	"	13	Do. C do.	100	235-240	..	5 8 4
725,000	"	30 Dec.	5	Do. 5 p. c. Deb. Stk.	100	140-145	+2	3 9 0
600,000	Stock.	11 Mar.	11½	Tottenham & Edm'ton, Orig.	100	—	..	—
WATER COMPANIES.								
729,331	Stock.	30 Dec.	10	Chelsea, Ordinary	100	243-248	+15½	4 0 8
1,720,560	Stock.	15 Oct.	8	East London, Ordinary	100	195-200	+4	4 0 0
544,440	"	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	136-140	..	3 4 3
700,000	50	11 Dec.	8	Grand Junction	50	95-98	+1	4 1 8
708,000	Stock.	12 Feb.	10½	Kent	100	240-250	..	4 4 0
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max.	100	210-215	+2½	4 8 4
406,200	100	"	7½	Do. 7½ p. c. max.	100	180-185	..	4 0 0
260,000	Stock.	30 Mar.	4	Do. 4 p. c. Deb. Stk.	100	120-123*	..	3 5 0
500,000	100	12 Feb.	12½	New River, New Shares	100	320-330	..	3 13 6
1,000,000	Stock.	29 Jan.	4	Do. 4 p. c. Deb. Stk.	100	125-128	..	3 2 6
902,300	Stock.	30 Dec.	6½	S'thwk & V'xhall, 10p. c. max.	100	155-140	+2	4 12 10
126,500	100	"	6½	Do. D 7½ p. c. do.	100	125-135	..	4 16 3
1,155,066	Stock.	11 Dec.	10	West Middlesex.	100	237-242	+1	4 2 8

a Next dividends will be at this rate.

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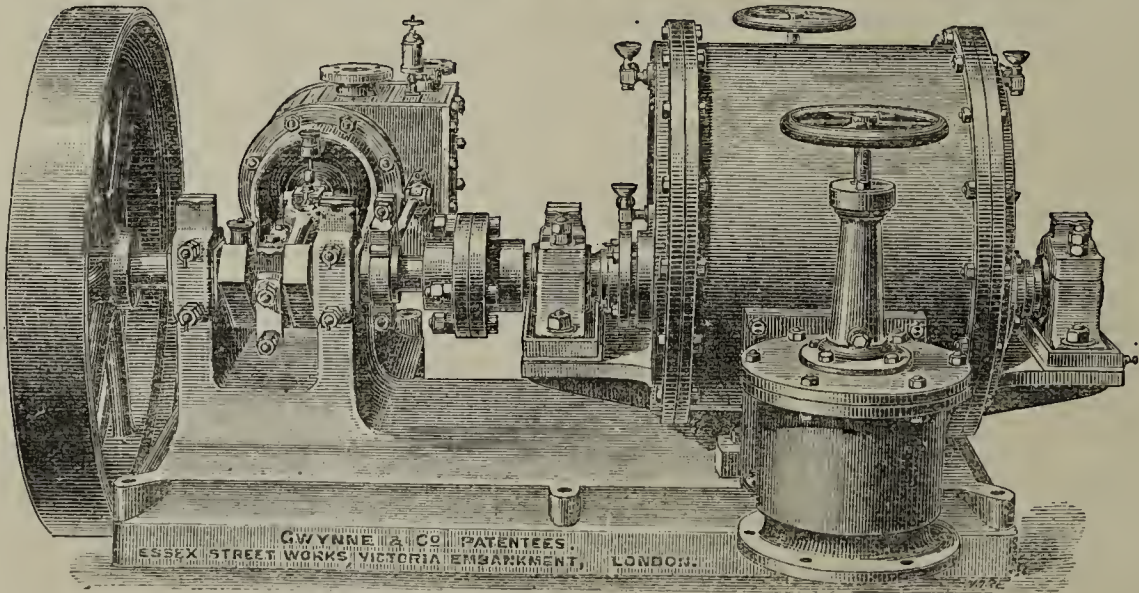
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THE

**JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.**

TUESDAY, APRIL 19, 1892.

The Gas Supply of London in 1891.

IN another column will be found our usual annual summary of the accounts of the Metropolitan Gas Companies. These figures convey many instructive lessons in respect of the manner in which the great undertakings to which they apply have struggled through another year of trading difficulty. The gas supply of the Metropolis is a growing industry, in which fact lies its main strength. By the end of the year, the gross amount of share capital and borrowed money sunk in the enterprise of supplying London with gas had reached the respectable sum of £15,736,254; being an increase for the year of £614,403. Of this increase, the Chartered took the lion's share—amounting to £432,900; but the South Metropolitan had the very large increase, for them, of £146,503, and the Commercial required £35,000. By the employment of this large capital, a gross revenue of £5,107,205 was earned, of which gas sold by meter accounts for £3,444,128; gas used for public lighting and sold under contracts returned £221,312; stove and meter rental amounted to £99,166; and residuals brought in £1,322,626. On the other hand, coals cost altogether £2,277,152; salaries and wages for gas manufacture amounted to £548,023; purifying came to £113,532; wear and tear in manufacture involved an expenditure of £435,027; rents, rates, and taxes reached £212,080; and distribution cost £205,347. None of the other entries runs into six figures. Altogether the year's expenditure upon revenue account amounted to £4,063,077; leaving a gross profit of £1,044,127, which did not exceed, on an average, £6 12s. 8d. per cent. on the whole amount of capital of all descriptions invested in the business. The proportion of profit to the gas-rental was less than 28½ per cent.

Leaving these general statistics, and coming to the engineering data of income and expenditure reduced to the

unit of a ton of coal carbonized, it will be seen that the capital burden for all the Companies averages £5 5s. 5⁴⁴d. per ton. The Chartered Company's load is the heaviest, being £5 13s. 8⁶²d.; while the Commercial are down to £3 14s. 0⁹⁸d., and the South Metropolitan stand at £4 10s. 9⁵⁶d. The average gas-rental per ton works out at £1 4s. 6⁷⁶d.; and residuals average 8s. 10³⁶d. per ton. The average cost of coal is 15s. 3¹²d. per ton. The Chartered pay highest, with 15s. 7⁹⁸d. per ton; the Commercial come near the mean, with 15s. 1⁷⁴d.; while the South Metropolitan, as usual, get their coal cheapest, for 14s. 0⁸⁰d. per ton. The Chartered spent most money upon purification, which cost them 9⁷⁰d. per ton, as compared with the South Metropolitan's 7³⁴d. Manufacturing salaries and wages, on the other hand, fell heaviest on the Commercial, who paid 3s. 10⁷⁶d. per ton; the Chartered figure being 3s. 8⁶⁰d., and the South Metropolitan's, 3s. 5⁵⁴d. Wear and tear was heaviest in the case of the Chartered, with 3s. 0⁶⁹d.; the South Metropolitan coming second with 2s. 7⁴³d.; and the Commercial lowest, with 2s. 6⁰³d. Rents, rates, and taxes fall very heavy upon the Chartered, who paid 1s. 6⁹³d. per ton under this head, as compared with 1s. 1⁰⁸d. in the case of the South Metropolitan, and 11⁸⁹d. for the Commercial. Salaries (management) are dearest for the smallest Company, but not lowest in the case of the largest. Under the head of "stationery, "printing, and general charges," the South Metropolitan lead with 3⁰⁷d. per ton; the Commercial coming second, and the Chartered being lowest. Directors and auditors only cost the Chartered Company 0⁶⁹d. per ton; whereas the South Metropolitan paid 1³¹d. and the Commercial 2⁷⁹d. for these necessary luxuries. Distribution runs heaviest in South London, and lightest in the Commercial Company's district. Under the heading of "repairs and "renewals of meters and stoves" there is evidently room for much diversity of practice; for whereas the Chartered spent 9³⁴d. per ton in this way, the South Metropolitan managed with 5²³d., and the Commercial got off with only 4²²d. per ton. Circumstances also affect the different undertakings very diversely under the heads of "law and "parliamentary charges," and "bad debts and extra-ordinary expenses."

The last table of the summary shows the increases and decreases under the various headings of the accounts for the past year as compared with the year before it. Variations in the price of gas, of course, largely affect these figures. The most instructive lines in the abstract are perhaps those which refer to the increased cost to the Companies of coal and labour, and the discrepancy between the former and the value of residuals. For it appears that, whereas they spent £211,958 more for coals in 1891 than they did in 1890, they could not realize an addition of more than £15,780 to their income from residuals. And residuals, be it understood, are beyond the power of the sellers to improve in value, although bad management may easily depress them in the accounts. Wages, again, cost the Companies—or rather two of them—considerably more, albeit there was no ostensible increase of the rates of daily pay.

Finally, in the following table we are able to show, as nearly as possible, what the carbonizing practice of the different Companies resulted in for the year:—

TABLE of the Residuals and Gas made, per Ton of Coal carbonized, by the Metropolitan Companies in the Year 1891.

Name of Company.	Coke per Ton of Coal, in Bushels.	Breeze per Ton of Coal, in Bushels.	Tar per Ton of Coal, in Gallons.	Ammoniacal Liquor per Ton of Coal, in Gallons.	Gas Made, Cub. Ft. per Ton.
CHARTERED . . .	46·56*	3·29*	10·45	30·71	9,955
COMMERCIAL . . .	47·06	4·65	9·71	34·98	9,811
SOUTH METROPOLITAN	49·25	3·71	9·73	34·63	10,063
Mean per Ton . .	47·21	3·42	10·23	31·93	9,969

* The returns of coke and breeze are given in *tons* in this Company's accounts. These have been reduced to bushels on the Company's basis of 9½ cwt. of coke to the chaldron, and 50 bushels of breeze to the ton.

Remarks.—In working out the results shown in the above table, as well as those in the second table on p. 702, the bulk of *solid* raw material only was taken. It should be mentioned that, in addition to the coal and cannel carbonized by The Gaslight and Coke Company, 2378 tons of oil were used in the manufacture of gas in the first half of last year, and oil equivalent to 14,631 tons of cannel in the second half. In the same periods, the South Metropolitan Gas Company used 91,000 and 136,253 gallons of oil.

No exact comparison of these figures with those relating to previous years is possible, because last year witnessed

a marked extension of the gasification of mineral oils in London in lieu of cannel coal, as shown in the remarks appended to the table. The figures must therefore be taken as they stand. It is to be noticed, however, that there has been a considerable falling off in the rate of gas made per ton by the Chartered and the Commercial Companies, both of which were once noted for high yields, by which they used to explain their high payments for coal. The South Metropolitan Company, on the contrary, was formerly understood to favour a policy of restricted makes and low-priced coal. The tables were turned last year, with the result that the cheapest coal made the most gas, as well as the greatest quantity of coke. Upon this head, it may be as well to recall the fact that the Chairmen of both the Chartered and Commercial Companies have publicly complained of the inferior character of coal for which they had to pay so dearly; while the Chairman of the South Metropolitan Company has stated that the coal supply of this undertaking has been all that he could have desired. With these few comments, we will leave our readers to extract their own "morals" from the figures now submitted for their examination.

The South-West District Meeting.

THE members of the South-West of England District Association of Gas Managers met last Tuesday in Bristol, under the presidency of Mr. D. Irving, Superintendent of the Stapleton station of the Bristol Gas Company. There was a very substantial programme to be disposed of; and the visitors were to be treated to something altogether novel, in the shape of an inspection, under competent guidance, of the Severn Tunnel. In these circumstances, Mr. Irving did not deliver the usual presidential address, but reserved this part of his official duty for the next meeting, when he may have less general business to get through. The tunnel was ably described in an interesting paper by Mr. Charles Richardson, M.Inst.C.E., who not only initiated the scheme, but supervised it while it was being carried out. It would be superfluous to dilate here upon the nature of this monumental work, or to expatiate upon the effect it is calculated to exert upon the coal markets of the South and West of England. The other technical fare offered to the meeting was a paper by Mr. E. C. Riley, of the Great Western Railway Works, Swindon, upon the lighting of railway carriages by gas-lamps, according to the practice of that Company; and one by Mr. F. Clark, upon the employment of fluid hydrocarbons in carburetting coal gas in bulk. It will therefore be understood that the time of the South-Western managers was fully occupied. Indeed, there was more than enough business for one day; and the discussion of the two essentially gas papers was left over. It is very annoying when there is not sufficient business for a gas managers' meeting; but on the present occasion there seems to have been a plethora rather than a void. The second day of the meeting was spent in inspecting, under his guidance and that of the Resident Manager (Mr. Hoskin), the work so fully described by Mr. Richardson.

Budget Matters.

THE speech which ushers in the yearly Budget is one of the events of the parliamentary session that transcend in general interest the most exciting passages of party politics. Whether the British subject, whose most obvious connection with the constitution of the realm is through the tax collector, happens to be in sympathy with the Administration, or whether he ardently desires that the Ins should change places with the Outs, he nevertheless awaits, with curiosity enlivened by hope, the Budget statement of the Chancellor of the Exchequer for the time being. If he is an income-tax payer of sanguine temperament, he looks year after year for that "penny off" which he fondly thinks is due to him the moment the national accounts of revenue and expenditure show a balance on the right side. If he belongs to the larger class of those who pay their footing indirectly, as consumers of excisable and dutiable articles, he hopes that the price of something which he regards as more than a mere necessary of life will be lightened by a substantial remission of taxation. It would be taking a very sordid view of the subject, however, to assert that all the interest with which the National Budget is received is referable to such very narrow pocket considerations as these. Payers of income-tax, at any rate, are becoming reconciled to the reflection that they are almost the last order of contributories to the national revenue to attract

the commiseration of Chancellors of the Exchequer of any shade of party politics. It is the "masses" now-a-days who possess the greatest voting strength, and are consequently uppermost in the thoughts of the parliamentary tactician. Consequently, income-tax payers of moderate means may as well resign themselves to the necessity of contributing proportionately more to the revenue of the country than anybody above or below them in social station, and may read Budget speeches for the light they throw upon the finances of the nation, rather than with any expectation of finding therein much to their individual advantage. Perusing Mr. Goschen's statement of yesterday week from our own peculiar standpoint, we notice two topics which may fairly be commented upon here. The first is the evidence, supplied by the falling off of the returns from stamps, of the dulness of the "City" which has been in other ways so notorious during the past year. Joint-stock speculation has been practically non-existent. The whole tribe of "promoters," as the Chancellor of the Exchequer observed, have been experiencing hard times; and the financial tipster, the journalistic blackmailer, and the rest of the horde of blood-suckers who form the camp-followers of the armies of modern commerce and industry, have had to "make believe" to be busy—their usual occupation being wanting. We hear of no such things as Lothammer Gas Companies now-a-days; but the worst of it is that money is hard to get, even for really good undertakings. The other point to be noticed is the concession which is to be made to patentees in the matter of the reduction of renewal fees. The Chancellor of the Exchequer has not much to give away; but of that which he has the patentees are to benefit to the substantial amount of £50,000 a year. At present the fees for the renewal of patents for the second period of four years are £10 a year. They will be reduced to £5, £7, and £8 respectively. For the fifth and six years they are at present £15; and they will be reduced to £9 and £10. For the next and last four years, instead of being £20 a year they will be £11, £12, £13, and £14. We notice that some Patent Agents are already rushing into the newspapers with the usual cry on behalf of those who have received remission of taxation—that the reduction does not go far enough. It is difficult to sympathize with this plea. The principle of progressively increasing renewal fees is a highly valuable one; effecting as it does the service of killing off the mass of useless patents. In order to do this, the amount of the fees must be large enough to be felt by patentees; and for the patentee's own sake it may be argued that if, at the end of eight years, a patent is not worth as many pounds per annum, it had better be dropped. In the general interest of the arts and manufactures of the country, we could even have wished that the old fees had been retained for a few years, and the revenue now given up applied to the building and equipment in London of a really worthy Institution of Patents, and also to the subsidizing of local branches of such an Institution in the larger manufacturing centres.

A Hard Lesson.

IN a recent number, our contemporary the *Engineer* had a leading article, entitled "The End of the Holiday," which contains one of the best and most pertinent of all the homilies bearing upon the abortive miners' "play-week" that have come under our notice. It is an article which ought to be well studied by every workman with a soul superior to the follies of the brass band and banner style of suasion, and who really desires to learn something of the reason why the Federation experiment, which cost so much, resulted so badly. It can hardly have escaped the observation of the least intelligent coalie that the "play-week," of which his half-educated leaders expected so much, has turned out a most disastrous failure, so far as his interest is concerned. He has lost his money, and everybody else engaged in the handling of coal seems to have profited at his expense and at the cost of the consumer. Many people prophesied that this would be the result; and they have been proved to have been in the right. Were they prophets, these diviners, wise beyond their fellows, or possessed of special information? By no means. They simply rested their predictions upon knowledge, which anybody may share with them, of certain generalities from experience and observation of what are called, for the sake of convenience, Economic Laws. The word "law," when used to mean deductions from indubitable facts, is a misnomer. Half-instructed persons,

knowing that laws made by Parliament may sometimes be defied with impunity, and are often found to be mistaken, and consequently repealed, are misled by the use of the same term in the other, and totally different sense. They are apt to think that Economic Laws can be as cavalierly dealt with as "General" Booth treats the Eastbourne Improvement Act. The origins and sanctions of the so-called "laws" being different in the two cases, however, so are the consequences of transgressing them. As our contemporary points out, the first lesson of the play-week is the sufficiently striking one that "unanimity of action for one week can be "had in an army of over 300,000 men, on whose actions "this country very largely depends for its commercial "prosperity." The next thing to be noticed is that this unanimous action signally failed of its only object, while it had a number of quite unexpected and extremely undesirable results. The second lesson of the late *fiasco* is this: "The miners are entirely unable to fix the "price of coal by any action which they can take." The reason for this is the simple one that coal, while it is a necessary of life to many consumers, is merely an article of trade use to so many more, that it is they who fix its value. Coal may be conceivably priced between two values—the maximum at which householders would buy it to keep body and soul together withal, and the minimum at which it would not pay to get it out of the ground. It is the needs of the former which give exaggerated local values to coal in times of scarcity, which may be caused by the blocking of a railway as well as by a miners' strike; and the premium which, in such circumstances, the local coal dealer puts in his pocket in either case never finds its way to the producer. Meanwhile, the purchasers of coal from the same local dealer for trade purposes cannot pay the enhanced price asked for fuel; and so they shut up shop. It would be the same thing if the local dealer were a mere commission agent for the miners. These might order him to charge any fancy price for coal; but they could not compel the purchaser to buy on their terms, and so the matter would rest. These are very simple considerations; but until all the labour agitators throughout the country take to qualifying themselves for their self-appointed task of abolishing poverty by undergoing a course of study in Economics, the spectacle will still be seen occasionally of masses of men sacrificing, under their guidance, hundreds of thousands of pounds in imperfectly learning lessons that are clearly explained in many a handbook to be purchased for a few pence. How true it is that the obvious and simple things of life are the most difficult to learn!

The Masonic Charities.—A circular has been issued in the matter of the nomination of Henry Reeves Harris for election into the Royal Masonic Institution for Boys, thanking those who were good enough to send votes for this deserving case at the recent election. Although 1149 votes were polled for the child, he was not successful; and as the next election in October will be his *last* chance, it is hoped that all Masonic friends will again support the case with votes, and thus make his election a certainty. Bro. Ely, of the Abingdon Gas Company, will again be glad to receive any votes, whether for the Boys, Girls, or Bevevolent Fund (May Election), in order that they may be used for the advancement of this case.

Society of Engineers.—At the meeting of this Society on the 4th inst.—Mr. J. W. Wilson, jun., the President, in the chair—Mr. Reginald Bolton read a paper on "The Application of Electricity to Hoisting Machinery." The author dealt with various methods of distributing power to cranes and hoists, and cited instances of steam, water, and compressed air, ropes and belts, shafting and gear; indicating the comparative advantages of electricity, among which were, he said, handiness, cleanliness, quietude, and economy. Some description was next given of the peculiarities of the electro-motor, which converts the electrical energy into rotative movement, and its distinctive characteristics as applied to the duties of lifting and hauling; and the machine was described as admirably effective, simple, and useful, with the minimum of working parts and extraordinary efficiency. The author contended that the success of the application depended largely upon mechanical considerations, with certain electrical conditions; and he mentioned several unsuccessful instances where these had been neglected. He next proceeded to give a description of simple mechanical gear fulfilling all the requirements laid down. A safety device forming part of the apparatus, was described in detail; and it was shown how this prevented the overloading and consequent stoppage of the motor—overcoming in the simplest automatic manner the chief danger to its use. Several successful installations were described; and finally the question of first cost was dealt with.

WATER AND SANITARY AFFAIRS.

SIR THOMAS FARRER's letter in *The Times*, replying to the remarks of Colonel Makins in the House of Commons, has been followed by further correspondence. It is a little amusing to find that, Sir Thomas having referred to a fall in the Stock Exchange quotations of water stock, as proving that the ratepayers are in agreement with the policy of the County Council, the quotations have since been rising; the upward tendency being in some cases remarkably strong. If the market value of the shares affords any test of public opinion, the Companies may now turn the tables on Sir Thomas. The latter has seen fit to argue that "the just claims of the ratepayers, as insisted "on by the City and the Council, are having some effect even "on the Stock Exchange." There are "just claims" on the other side; and these appear to be having some effect also, though Sir Thomas may not be disposed to accept the sign. But his letter is important, as proving what we have previously asserted—that the Council has a notion of acquiring the water undertakings on terms involving a loss of income to the shareholders. The Corporation is said to agree with the Council in this respect. We are not quite so sure on that point; and we shall not be surprised if some difference of opinion shows itself in course of time. One form of the attack is, that the dividends paid to the shareholders are not fairly earned. Yet there is not the slightest proof to this effect. It is asserted that some of the charges made on the consumers are illegal. If they are, the fact can be made plain, and the law can be invoked to terminate the abuse. We shall hear, by-and-bye, what the Royal Commissioners have to say in respect to allegations of this nature. Colonel Makins has made an excellent rejoinder to the letter by Sir T. Farrer, and has pointed out that while a very large number of water undertakings have been purchased by municipal authorities under parliamentary powers, in no instance, where agreement has been wanting, has the property been compulsorily acquired in the absence of a reference to arbitration. Neither have Stock Exchange prices formed the basis on which payment has been made. The usual plan, in buying out the Companies, has been to create perpetual annuities "to represent their income as ascertained, and then to extinguish the capital of the Companies." This simple plan, or one equivalent to it, settles the whole affair. The County Council, obtaining the property of the Companies on such terms, will immediately find a revenue equal to the sum it has to pay. The fact that no such plan is acceptable to the Council, shows at once the cloven foot. Even arbitration is denounced, unless based on conditions of such a nature as would certainly cause the value of the property to be largely under-estimated. The principle laid down by Colonel Makins is perfectly just—that the property of the Water Companies is to be acquired either by agreement or by arbitration, such arbitration to be free and unfettered. Yet the Council is seeking to lay down a mode of valuation of its own devising, and on this basis to acquire the undertakings compulsorily. That such exceptional treatment as this, for which no precedent can be cited, will ever be sanctioned by Parliament, is something incredible. The Council must know this; and hence there is the attempt to intimidate the Companies by the talk of a competing supply, together with all the farrago about seeking a new source in Wales or Devonshire. The position of the County Council before the Royal Commission is a little peculiar. A request has proceeded from the Commissioners that the Special Water Committee will furnish them with information bearing on the subject of the inquiry. A statement is accordingly being prepared, to be forwarded to the Commissioners before the end of the month. But it is the wish of the Committee that this should be backed up by expert evidence, to be given before the Commission. This will cost money; and the Committee having spent the £5000 placed at their disposal, now ask for more. Parliamentary authority is required for this purpose. But the Council is a species of Parliament in itself, and has now voted £2000 to the Committee, without having any statutory power to do so. All may come right by-and-bye; but there is a wonderful degree of haste about this water question, and everything relating to it is "special."

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 720.)

THE week just concluded was naturally a quiet one for the Stock Markets. The Jewish Passover in the earlier part, and the Christian Easter at the other end of it, effectually lightened labour; and when the operation of the settlement was got through, it was scarcely worth while going in for fresh business with the holiday interval impending. However, prices remained on the whole pretty steady; and though there was little active support, yet the undercurrent of feeling was favourable, and better times are anticipated when business is resumed. The Money Market continues in the same easy condition. The Gas Market has been quiet like the rest; but there have been more variations in quotation than the average of recent weeks. Gaslight "A" have fallen away slightly. It opened with a rather weaker tendency, and receded 1 on Tuesday, and 1 the next day; being done at 211 two or three times. The final mark, however, was 213—the same as it opened at. A couple of bargains were done in debenture and preference issues at undiminished rates. The demand for good investment stocks, which must proceed from the abundance of cheap money seeking a resting-place, is pretty certain to send up the choice debenture stocks. South Metropolitan remain as they were—that is, very quiet and steady. In Commercial, one or two transactions were marked. The new stock was steady and unchanged; but the old receded 4—business being marked at 232 *ex div.* Probably a holder is under the necessity of realizing some of this stock; and buyers accordingly make the terms as good as they can for themselves. Hardly a transaction has been effected in any of the Suburban or Provincial Companies; and the only changes in quotation are in Brentfords—the old rising 2½; and the new, 1. Alliance and Dublin and British are *ex div.* at corresponding figures. The Foreign Companies exhibit more variety. Imperial Continental was strong at an advance of 1, and looks like going better still; but the other Continentals were featureless. Chicago Bonds, of both issues, made the liberal advance of 4 each; but nothing was done in them. Of the South Americans, Buenos Ayres and Monte Video were steady; the former making an improvement of ½. San Paulo, however, fell ½, the report for the last half of 1891 showing that, although the business had largely increased, the profit had been entirely swallowed up by the cost of coal and labour, and by the loss on exchange. The Water Companies were quite active; and the recovery in prices proceeds steadily.

The daily operations were: Very quiet business was the rule in the Gas Market on Monday. But prices were steady; and a rise of 2½ was made in Brentford old, and of ½ in Buenos Ayres. In Water, Kent advanced 2½; Lambeth, 2; Southwark, 3; and West Middlesex, 1½. There was rather more business doing in Gas on Tuesday; the course of prices being irregular. Imperial Continental rose 1; but Gaslight "A" receded 1; and Commercial old, 4½. New River debenture rose 1. Wednesday was an extremely quiet day in Gas. Gaslight "A" fell 1 more; but the few transactions marked in other stocks were at good figures. East London Water rose 1. On Thursday, the general tendency in Gas was rather better. Chicago bonds rose 4; and Brentford new, 1; but San Paulo receded ½. In Water, Kent advanced 2; Lambeth, 1; ditto, 7½ per cent., 2; Southwark, 2; ditto "D," 2½; and West Middlesex, 1½.

ELECTRIC LIGHTING MEMORANDA.

The Approaching End of the Crystal Palace Exhibition—A Brush Advertisement—The Last of the Maxim-Weston Companies.

THE signs of approaching dissolution are gathering thickly at the Crystal Palace Electrical Exhibition. Some of the exhibitors are endeavouring to push sales of the more marketable articles shown in their stands, while others are content with chaining down, roping off, or otherwise protecting their goods, and sparing themselves the expense of attendants. By far the best thing now worth seeing at the Exhibition is the series of high-tension experiments conducted daily and nightly by the Siemens Company in the Pompeian House, which has been given up to them for the purpose. The electrical cookery display is still kept on; but the child's-play character of the show is fully recognized by most visitors to the Palace. The Siemens experiments, on the other hand, are really interesting. They are much improved from what was shown when these displays were first given; several of Mr. Tesla's Royal Institution experiments being now repeated by the representatives of the great Charlton firm. It cannot be claimed, however, that the tricks gain anything from the manner of the performers, who go through their work in a perfunctory and dismal way, taking little pains to explain the phenomena to their audience. In point of fact, electricity is inexplicable; but perhaps for this reason it is a most fascinating study. A lecture upon electricity is easily made striking and interesting, even with the ordinary appliances of the lecture-room; and where, as at the Palace at the present time, a lecturer

can have the use of 50-horse power of energy, he ought to make the best of his opportunity.

We are in possession of a neat little pamphlet issued by the Brush Electrical Engineering Company, Limited, and circulated from their large stall at the Crystal Palace. This publication contains several interesting statements respecting the history of electrical engineering. Due allowance must, of course, be made for the necessity under which the compilers laboured for showing that the Brush interest was at the beginning of everything, and is now at the top. Among other things, we are told that "the Brush Company was formed to gather together some of the threads of electrical discoveries, and weave them into an organized industry of electrical engineering." We always thought that the object of the Brush Company was primarily to make as much money as possible by the promotion of concessionary companies bound down to pay exorbitant premiums for the right of purchasing Brush machinery, which subsequently turned out to be worthless; but there is no corroboration of this impression in the new pamphlet. The nearest approach we can find to any reference to the time when "Grandfather Brush" was in his hey-day is an almost pathetic remark that "an undue inflation of prices found its inevitable reaction in equally uncalled-for disappointment and depression." But did not the greedy walrus in Lewis Carroll's immortal ballad weep over the fate of the oysters he had eaten? There is something very touching in the hearty way in which the Brush people tell how "buoyed up by confidence in the future"—to say nothing about the cash taken from their concessionaries—they "struggled against the adversity which proved fatal to so many of the other pioneers in the business." A good man struggling against an adverse Fate is, as we all know, a spectacle which affords mingled pleasure and grief to the gods; but one need not be so very good to survive trouble in the way the Brush Company did it—at other people's expense. Most of us would be well content to do a deal of struggling upon the same terms. The pamphlet cites the "fact that upwards of half-a-million incandescent lamps are nightly lighted in London" as sufficient evidence to refute the prevailing impression as to the costliness of electric lighting. The same thing might be remarked of bottles of dry champagne; yet it has never been argued that this is a low-priced beverage. But when they come to the subject of the danger associated with the use of the electric light, the Brush Company assert that "there is no single case on record of any member of the public having been injured by the electric current within his own premises." Loop-holed with openings for evasion as this statement is, it must be pilloried as an audacious falsehood.

Another of the old electrical companies which has had to do a great deal of struggling, but without the compensations that have enabled the Brush Company to pull through, is the Maxim-Weston venture, in connection with which the name of Mr. Hugh Watt, M.P., once figured so conspicuously. It is worthy of notice that the last meeting of the shareholders in this unfortunate concern was held on the 8th inst., to receive the accounts of the Liquidators. There were two Maxim-Weston Companies, old and new; and the liquidation of the first left a credit balance of £414, while that of the latter showed a credit balance of £1273, which is all that remains of the capital. So much litigation attended the liquidation of the old Company that a great portion of the salvage seems to have gone to the lawyers. After certain gratuities had been voted to the Liquidators, there was sufficient money left to return to the proprietors a very small fraction of a penny per share. This is more than the majority of the Brush Companies left behind them. And not the least deplorable thing about the lamentable history of the Maxim-Weston speculation is the fact that the system of electric lighting which the Company took over from the inventors (Messrs. Maxim and Weston) was at least as good as any other known at the time. There was no "swindle" in the scheme of the Company. The whole venture was simply cast away through bad administration, rash trading, and the inherent weakness of electric lighting, regarded as the basis of a business, in the early years of the last decade. If Messrs. Maxim and Weston had kept their inventions until now, they might have had a better fate; but it has yet to be proved whether, with some well-understood exceptions, electric lighting is capable of paying very much better than it did ten years ago.

Imperial Continental Gas Association.—The Directors of this Association will recommend, at the half-yearly meeting of the proprietors on the 3rd prox., a dividend of 5 per cent. and a bonus of 1 per cent. (both free of income-tax), for the six months ending Dec. 31 last, on the £3,800,000 stock of the Association.

A Cookery-Book in German.—Under the title of "Das Gas in der Küche," Madame Alting-Mees, the well-known lecturer on cooking by gas, has reproduced in German the series of useful recipes which she has already presented to her numerous English and French audiences in their respective languages. In its new form, the little book will increase the reputation of its authoress as a thorough advocate of the use of gas, whether from a hygienic or an economical standpoint, in the exercise of all those culinary arts of which she is so accomplished a practitioner.

FURTHER WORK FOR THE STANDARDS OF LIGHT COMMISSION.

WHEN we last dealt with the subject of the labours of the Standards of Light Commission (*ante*, p. 572), we could only discuss the one question of the candle standard, and refer to the different standards recognized by European science under this name. It is obvious, however, that the work of the Commission will not be completed by the adoption and definition of the standard unit of light; they will also have to prescribe the manner in which this unit shall be produced and embodied in a practical photometric light, and to pronounce upon the form of photometer which is in accordance with the statutes regulating the testing of the gas supplied to London, and is at the same time fair to all parties. Let it be supposed that the Commission have ascertained the mean value of the parliamentary standard candle, and have satisfied themselves that this amount of light can be exactly reproduced under certain conditions, by a flame of a particular description of air gas, prepared by mixing atmospheric air with the vapour of a specified grade of petroleum spirit. (It may be parenthetically remarked that, although there is no prospect of this substitute for the actual spermaceti and wax candle, failing while the world's store of petroleum lasts, it will be as well to provide for the possibility of a future revision of the standard, by procuring and storing in a safe place a sufficient stock of the present make of candles.) The next question that arises is, Will it be found necessary or desirable to employ the absolute candle standard itself in all photometrical examinations of gas; or will some relative or derived standard be found more convenient for every-day use?

It is by no means certain that the air-gas equivalent of the standard candle is easy to produce or convenient to use in a photometer. A pentane-gas flame representing a candle light can doubtless be made very exactly under proper conditions; but what are these conditions? There is considerable difference of opinion respecting this matter. Some experts contend that the problem is an easy one to solve, having regard to the average skill and trustworthiness of photometrists; others argue that, in questions of this kind, the possibilities of going wrong are more to be considered than the chances of correct performance. There are those who argue that, for the exhibition of a flame standard of light, there should be the utmost simplicity in the apparatus. They will have the naked flame, pure and simple, just as the flame of a candle is naked. No instrumental refinements, such as the cutting off of the top or the bottom of a flame, or both, by an opaque screen, will be endured by these purists; because, they say, everything of this kind introduces chances of error. Now the steadiness of a flame in brilliancy depends, so far as the power of controlling its supply of fuel extends, upon the height of the flame itself, or the rate at which it burns the fuel. We can agree to regard a flame as standard when it is of standard dimensions, or when burning its fuel at a standard rate. French and German technicians have applied the former rule to their candle units, while the British practice has hitherto been to rely upon the latter exclusively.

To burn a pentane-gas flame of equivalent illuminating power to one candle, taking the whole of the flame, no more than one-half of a cubic foot per hour of the air gas is required. If this very small flow of gas is to be measured by a meter and controlled by a governor, after the usual manner of illuminating gases, the mechanical difficulties in the way of securing precision of discharge are by no means inconsiderable. If, on the other hand, the height of the flame is to be relied upon, what guarantee is there of the correctness of the "boning" at any time? We speak now, of course, upon the assumption that the single candle pentane-gas flame is employed in every-day photometrical work. Again, supposing these initial objections to be removed, who would care to use a one-candle standard in an ordinary photometer? The manufacturers of the gas to be tested against such a small unit of light would have several reasons for protesting. The difference in the lineal distances between the gas-flame and the unit respectively and the screen, would be so great that, in the not uncommon condition of foggy or smoky air, the loss of radiant light by the former would be much larger than that of the latter. Moreover, the disturbing influences of varying atmospheric density and temperature must differently affect flames so differently constituted and of such inequality of power.

It has been suggested, as a way out of the difficulties last mentioned, that the standard to be actually used in photometrical work should be some multiple of the candle, and that for London gas of nominal 16-candle power it should be a 16-candle pentane-gas flame. This would have the effect of bringing the screen midway between the standard and the flame to be tested, so that any thickness of the atmosphere would affect both alike. But there are grave objections to the plan. The brightness of the screen when illuminated both sides by two 16-candle flames at either end of a 60-inch, or even a 100-inch photometer-bar, militates against exact balancing of the lights; for it is a truth of physiology that the sensitiveness of the retina to degrees of lighting is much greater in the lower than in the higher ranges of illumination. And this difficulty in exactly balancing the lights is coexistent with increased demand for extreme precision in observation; for the range of the screen for a difference of one

candle is, with 16-candle lights, very small even on the 100-inch and dangerously so on the 60-inch bar. Mr. John Methven has long ago dwelt upon this point; and his criticism cannot be overlooked by the Commission.

Moreover, it appears preferable that a photometrical standard should always be under the lowest conceivable limit of illuminating power of the flame to be tested, in order to avoid troublesome *minus* measurements. Thus it might be more reasonably argued that a 16-candle standard should be used for 20-candle gas, than that the standard should be the exact equivalent of the statutory illuminating power of the gas under examination, whether 14, 15, 16, or 20 candles. Such a system would lead to an undesirable multiplication of standards; while it cannot be pleaded that it would tend to improve the precision of photometrical measurements, or ease the labours of the examiners of gas. Regarding this part of the subject generally, it appears to us that the necessities of the case for a more powerful standard than either the single or the double candle would be met by a 10-candle working standard, which would answer for all qualities of coal gas the world over, and possess a decided fascination for the decimalizing men of science of the day. At any rate, we fail to see why the real advantages of the proposed 16-candle standard do not also belong, in nearly the same force, to the 10-candle standard; while the latter is not without recommendations of its own which are not shared by the larger one. We believe that if they could only get it in a convenient form, all the gas managers of the country would be glad of a 10-candle standard.

Here, upon the subject of convenience, we stumble once more upon the real *crux* of pentane. Is it convenient in any shape; and, if so, to what point is the convenience carried? The new forms of pentane lamp are handy enough for most practical purposes; but they do not satisfy the purists who want their standard whole and unscreened, and they are of small illuminating power. It seems probable that, in order to produce a reliable standard of anything more than a couple of candles intensity, there must be a regular preparation of pentane gas in a gasholder. Not even by carburetting air or gas on its way to the burner is a reliable standard flame to be produced—so the story goes. There is nothing for it but the mixing gasholder. If this should turn out to be the ultimate recommendation of the Commission, it is to be feared that the gas industry in general will leave the fruit of their labours to those who are compelled by law to make use of it. Gas managers have heard of pentane holders that required to be kept warm by steam-pipes; and if a little more precision in photometrical measurement is only to be obtained at the cost of very disproportionately increased trouble and expense, the gas managers who have other things to do besides spend their time in photometer-rooms will even go on as they are going—using candles when they cannot help it, but working with the Methven slot for choice.

It may safely be understood, however, that the majority of the members of the Commission will keep in mind the existence of the "personal equation" of photometrists, and will not endorse any counsels that would impose upon technicians something by way of a standard of light which is "too bright and good for human nature's daily food." They will remember the awful example of the Violle standard, and let common sense overrule their deliberations. There are two ways of looking even at this point. One sometimes hears references to errors or shortcomings of manufacturing processes as being negligible because the results "fall within the limits of error in testing." Similarly, it may be argued that, having regard to the fallibility of photometrists, it is useless to strive after too high perfection in the appliances which they must use—and use, as a rule, with only an approximation to certitude. As against this contention, it may be replied that the possible carelessness of the operator is an additional reason why his prescribed methods and apparatus should be as perfect in every way as they can be made.

The questions of photometer design and the best method of burning the gas to be tested, whether at constant rate of consumption or constant dimensions or brilliancy of flame, will occupy the attention of the Commissioners after all the problems arising out of the standard of light are disposed of. Some of the Commissioners are believed to entertain strong opinions respecting these matters; and it is quite possible that the existing practice may be found susceptible of improvement. There is much to be said for the proposition that coal gas should be burnt in such a manner as to permit of its developing the utmost effect which it is capable of producing in the Argand burner, and with the chimney draught most suited for it. We have always had a little weakness for the French style of valuing the luminosity of gas in terms of the consumption capable of yielding the standard illuminating power. It is a system that tends, at least, to show up in strong relief the performances of various kinds of burners. We must leave the subject for the present, however; only repeating the hope expressed in our earlier article, that every aspect of the important question of the photometry of gas may be properly ventilated while the Commission is sitting.

Dr. Merryman has resigned the chairmanship of the Cranleigh Gas Company, and has been succeeded by Admiral Maclear.

ACCOUNTS OF THE METROPOLITAN GAS COMPANIES FOR THE YEAR 1891.												
	Chartered.			Commercial.			South Metropolitan.			All the Companies.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Capital and borrowed money	11,795,400	0	0	845,000	0	0	3,095,854	0	0	15,736,254	0	0
Income—viz.:												
Sale of gas by meter	2,518,401	14	9	227,328	18	8	698,397	11	11	3,444,128	5	4
Public lighting, including lighting under contracts . . .	144,459	18	3	18,490	16	8	58,362	1	8	221,312	16	7
Rental of meters and stoves	71,427	9	10	5,210	6	0	22,528	13	5	99,166	9	3
Residual products	929,556	11	6	100,171	3	0	292,898	10	11	1,322,626	5	5
Miscellaneous, including old materials	13,226	4	6	614	15	10	6,130	10	6	19,971	10	10
Total income from all sources	3,677,071	18	10	351,816	0	2	1,078,317	8	5	5,107,205	7	5
Expenditure—viz.:												
Coals, including carriage and dues	1,621,831	12	10	172,747	13	4	479,573	11	8	2,277,152	17	10
Purifying materials, including labour	83,843	11	0	8,845	5	4	20,843	10	1	113,532	6	5
Salaries and wages—manufacture	385,550	1	10	44,451	9	1	118,021	19	9	548,023	10	8
Wear and tear—manufacture	317,194	4	8	28,542	9	1	89,230	10	4	435,027	4	1
Rents, rates, and taxes	163,616	18	10	11,304	8	6	37,159	7	5	212,080	14	9
Salaries—management	16,677	2	5	2,182	16	6	3,991	14	3	22,851	13	2
Collectors' salaries and commission	29,340	17	5	2,913	8	2	9,499	2	10	41,753	8	5
Stationery, printing, and general charges	11,510	4	3	1,981	10	1	8,711	5	3	22,202	19	7
Directors and auditors	5,900	0	0	2,650	0	0	3,725	0	0	12,275	0	0
Salaries and wages, wear and tear—distribution . . .	138,088	14	4	13,191	0	3	54,067	15	10	205,347	10	5
Repair and renewal of meters and stoves	80,685	13	0	4,011	14	5	14,859	4	1	99,556	11	6
Law and parliamentary charges	6,880	19	4	267	19	1	4,130	14	4	11,279	12	9
Bad debts and extraordinary expenses	33,924	1	6*	3,140	19	8	19,928	19	6†	61,994	0	8
Total expenditure on revenue account	2,903,044	1	5	236,230	13	6	863,802	15	4	4,063,077	10	3
Gross profit	774,027	17	5	55,585	6	8	214,514	13	1	1,044,127	17	2
Do. per cent. on capital and borrowed money	6	11	3	6	11	7	6	18	7	6	12	8
Do. do. gas-rental	29	1	4	22	12	3	28	6	11	28	9	9
* Including £20,265 6s. 4d. annuities. † Including £11,400 6s. 10d. profit-sharing for twelve months to June 30, 1891.												

TABLE showing the Capital, Income, Expenditure, and Profit, per Ton of Coal carbonized, in 1891.												
	Chartered.			Commercial.			South Metropolitan.			All the Companies.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Capital and borrowed money	5	13	8·62	3	14	0·98	4	10	9·66	5	5	5·44
Income—viz.:												
Total gas-rental	1	5	8·07	1	1	6·61	1	2	2·35	1	4	6·76
Rental of meters and stoves			8·27			5·48			7·93			7·98
Residual products	8	11	5·4	8	9	3·9	8	7	0·9	8	10	3·6
Miscellaneous, including old materials			1·53			0·65			2·16			1·60
Total income from all sources	1	15	5·41	1	10	10·13	1	11	7·54	1	14	2·70
Expenditure—viz.:												
Coals, including carriage and dues	15	7	9·8	15	1	7·4	14	0	8·0	15	3	1·2
Purifying materials, including labour			9·70			9·31			7·34			9·13
Salaries and wages—manufacture	3	8	6·0	3	10	7·6	3	5	5·4	3	8	0·7
Wear and tear—manufacture	3	0	6·9	2	6	0·3	2	7	4·3	2	10	9·9
Rents, rates, and taxes	1	6	9·3			11·89	1	1	0·8	1	5	0·6
Salaries—management			1·93			2·30			1·41			1·84
Collectors' salaries and commission			3·40			3·6			3·34			3·36
Stationery, printing, and general charges			1·33			2·08			3·07			1·75
Directors and auditors			0·69			2·79			1·31			0·99
Salaries and wages, wear and tear—distribution . . .	1	3	9·8	1	1	8·8	1	7	0·3	1	4	5·2
Repair and renewal of meters and stoves			9·34			4·22			5·23			8·01
Law and parliamentary charges			0·79			0·28			1·45			0·91
Bad debts and extraordinary expenses			4·50			3·31			7·01			4·99
Total expenditure on revenue account	1	7	11·86	1	5	11·65	1	5	4·04	1	7	2·74
Gross profit	7	5	5·5	4	10	4·8	6	3	5·0	6	11	9·6

TABLE showing Increase or Decrease in each Item during 1891 compared with 1890.								
	Chartered.		Commercial.		South Metropolitan.		All the Companies.	
	Inc.	Dec.	Inc.	Dec.	Inc.	Dec.	Inc.	Dec.
	£	£	£	£	£	£	£	£
Capital and borrowed money	432,900	..	35,000	..	146,503	..	614,403	..
Income—viz.:								
Sale of gas by meter	204,959	..	13,699	..	79,151	..	297,809	..
Public lighting, including lighting under contracts . .	3,722	..	289	..	1,247	..	5,258	..
Rental of meters and stoves	5,504	..	358	..	2,186	..	8,048	..
Residual products	28,383	..	..	4,863	..	7,740	15,780	..
Miscellaneous, including old materials	1,154	..	144	..	..	1,629	..	331
Total income from all sources	243,722	..	9,627	..	73,215	..	326,564	..
Expenditure—viz.:								
Coals, including carriage and dues	134,413	..	32,202	..	45,343	..	211,958	..
Purifying materials, including labour	9,722	..	1,464	..	2,680	..	13,866	..
Salaries and wages—manufacture	14,943	..	4,635	..	..	6,433	13,145	..
Wear and tear—manufacture	2,896	..	2,168	..	..	6,168	..	1,103
Rents, rates, and taxes	1,145	..	781	..	..	5,191	..	3,265
Salaries—management	948	..	4	..	..	213	739	..
Collectors' salaries and commission	194	..	..	161	..	882	..	850
Stationery, printing, and general charges . . . . .	..	136	252	..	..	320	..	204
Directors and auditors . . . . .	..	..	..	..	..	..	..	..
Salaries and wages, wear and tear—distribution . . .	5,791	..	..	2,669	5,499	..	8,622	..
Repair and renewal of meters and stoves.	3,963	..	..	727	396	..	3,630	..
Law and parliamentary charges . . . . .	..	2,983	..	105	1,482	..	..	1,612
Bad debts and extraordinary expenses	1,050	..	..	487	..	19,714	..	19,151
Total expenditure on revenue account	171,940	..	37,357	..	16,479	..	225,775	..
Gross profit	71,782	..	..	27,730	56,736	..	100,789	..
Do. per cent. on capital and borrowed money	£0 7s. 8d.	..	..	£3 14s. 2d.	£1 11s. 7d.	..	£0 7s. 11d.	..
Do. do. gas-rental	0 9 1	..	..	13 6 6	5 0 5	..	0 8 7	..

COMMUNICATED ARTICLE.

COAL GAS: ITS MANUFACTURE, DISTRIBUTION, AND CONSUMPTION.

A Series of Articles for Gas Students.

(Continued from p. 619.)

THE PASSAGE OF THE GAS FROM THE ASCENSION-PIPE TO THE CONDENSERS, ETC.

From the retort the gas issues up the ascension-pipe to the hydraulic main. The joint of the pipe in the socket of the mouthpiece may be made of well-rammed dry fire-clay. It is a mistake to have the ascension-pipe too small; it should not be of less diameter than 6 inches for the retorts in use at ordinary-sized works.

In some works, great trouble is experienced by the occasional choking of the ascension-pipes, chiefly owing to a formation of pitch, into which a portion of the tar has been converted by the heat of the pipe. The liability to choking is much obviated by keeping the ascension-pipes cool. This may be done by placing the pipes some 6 inches from the front wall of the bench, and building the latter 14 inches thick. A bent auger should be run up the orifice of the mouthpiece into the ascension-pipe at every charge. When stoppages do occur, they may be removed by taking off the top cap, to allow of heated currents of air passing upwards through the pipe. A simple plan, and one which is usually effective without having to put the retort out of action, is to place a bucket of water in the mouthpiece, directly under the ascension-pipe, and leaving it there during the working off of a charge.

The ascension-pipe communicates with the hydraulic main by means of an H-pipe, an arch-pipe, a bridge-pipe, or other arrangement that may suit the fancy of the engineer. The back vertical pipe passes down inside the hydraulic main, and dips into the liquid therein contained; hence its name, the "dip-pipe." The two latter arrangements are the most commonly used; but a modified form of H-pipe, in which the cross-pipe sharply rises from the ascension-pipe to the dip-pipe, commends itself for simplicity, facility of access for cleaning or opening the ascension-pipe, and for *the free passage of the gas*. The two verticals are surmounted by flanged plugs, cemented into position, and readily removable. Perhaps the principal advantage of the arrangement is that, owing to the inclination given to the cross-pipe, any condensations or dirt that may be deposited must pass into the ascension-pipe, whence it is easily removed, instead of into the hydraulic main.

The hydraulic main, as its name implies, is a hydraulic seal, whereby the gas, allowed to go forward, is prevented from passing back to the retort. In its ordinary form, it consists of the U-shaped pipe, supported on standards, and containing a quantity of liquid (tar and ammoniacal liquor) which is maintained at a constant level by an overflow arrangement. Through this liquid the gas bubbles as it arrives from the retort; flowing away by the outlet-valve. The dip-pipe just referred to passes into the main to such a distance below the water-level as may be decided upon by the engineer; but usually it will not exceed $1\frac{1}{2}$ to 2 inches.

The hydraulic main is made in several shapes; a modified form of U section being most commonly used. It is now generally constructed of wrought iron, which is preferable to cast iron on account of its lightness as compared with the latter. The main is supported on cast-iron standards. A better plan, and one which is now being largely adopted, is to place the main on transverse girders, which are themselves held up by the buckstaves, over the retort-bench. The main is thus not only removed from the excessive heat of the top of the bed, but is also independent of any settlement or alterations that may take place in the brickwork owing to the heat of the bench. The main is usually constructed in sections extending the length of one or two ovens, with a separate valve to each section.

There are certain troubles often incidental to the working of the dip-pipe and the hydraulic main, which must be mentioned here. If the main should be exposed to great heat, in consequence of being fixed either too near the front of the retort-bench, or not sufficiently raised above it, the tar at the bottom of the main will be converted into pitch, which, gradually accumulating, will stop up the dip-pipes. Mr. George Livesey is of opinion that it is the heated gas itself, operating on the comparatively stationary tar at the bottom of the liquid, which does the mischief, by evaporating its volatile constituents. He therefore not only guards against radiated heat from the bench, but makes his main of a very shallow form, with the bottom elliptically shaped. By this means the gas bubbling through keeps the whole of the liquid constantly agitated; and the volatilizing process of the tar is completely obviated. Some engineers arrange for running into the hydraulic main a constant stream of ammoniacal liquor, with this same object in view—viz., preventing the stagnation of tar and the formation of pitch.

It has been urged that the use of dip-pipes promotes the deposition of carbon in the retorts. While this may be true to some extent, there are undoubtedly contributory circumstances beyond the hydraulic main which have far more to do with this troublesome formation. There have been many proposed substitutes for the dip-pipe, and, indeed, for the hydraulic main

altogether—automatic in working and otherwise. Some of these are highly ingenious, but impracticable, while others are found to work well. Among the latter class, White's automatic valve for dispensing with the hydraulic main may be here described. The main which carries the gas from the ascension-pipe passes into a rectangular chamber containing a faced flap-valve, which, freely suspended, rests when closed against a seating, also faced, which is slightly inclined from the vertical. When the retort is charged (thus giving a pressure of gas) the valve, readily yielding to a pressure of 2-10ths of an inch, remains open; when the retort is opened, the pressure is relieved, and the valve falls on its seating by its own weight—the back pressure behind it tending to keep it gas-tight.

One of the most recent inventions in this connection is the slide-valve anti-dip devised by the late Mr. Niel Meiklejohn, and described and illustrated in the JOURNAL for May 6, 1890 (p. 837). This appliance is not automatic, but is so simple in construction as to render any derangement of the working parts almost impossible. Moreover, being self-contained, none of the moving parts are exposed to the dust, steam, &c., which are always present in the retort-house. The dip-pipe is enlarged to constitute a chamber resting on the hydraulic main, from which it is separated by a cast-iron plate or diaphragm. This diaphragm, truly planed and faced, is pierced to give two gas-ways—the one passing down into the hydraulic seal in the ordinary way, and the other opening into the hydraulic main direct without the intervention of the seal. Either of these passages or ports may be opened or closed by a loose valve, also faced, which freely slides over the faced diaphragm mentioned, and is actuated by a lever working on a rotating spindle, which, passing through a stuffing-box, can be regulated at will by hand. The "seal" can thus be utilized or dispensed with as desired. A turn of $\frac{1}{4}$ inch on the spindle is sufficient to fully open or close the valve.

There are two principal classes of anti-dips in use—first, those designed to do away altogether with the dip-pipe and hydraulic main; secondly, those which provide an independent and free gas-way when the retort is closed and distillation is proceeding, and bring the hydraulic seal into operation when the retort is open. The two inventions just described may be taken as typical of these two classes. For other inventions in connection with the subject, the reader should consult "King's Treatise on Coal Gas."

When proper precautions are taken as already suggested, and particularly when provision is made for constantly changing the tar in the hydraulic main, thus to prevent undue evaporation and the formation of pitch, and also to maintain a constant water-level and consequently an even and regular seal of the dip-pipe, the hydraulic main and dip-pipe are undoubtedly among the most simple and useful of gas-works appliances; and many engineers do not see any occasion for dispensing with them in favour of the most approved form of anti-dip.

It is an advantage to seal the dip in ammoniacal liquor, which offers less resistance to the passage of the gas, and does not rob it of its light-giving hydrocarbons as tar would do. This latter matter brings to the writer's consideration another question which has of late come well to the front—viz., the desirability or otherwise of the early separation of the tar from the gas. It is now generally acknowledged that if the tar be allowed to travel forward with, and cool with the gas, the latter will be impoverished in its illuminating power, owing to the absorption, by the heavy hydrocarbons in the tar, of the more volatile hydrocarbons which should be retained in the gas; and it is now considered best to arrange for the early removal of the bulk of the tar. On the other hand, it has been found that if the gas and tar be kept in contact at a high temperature, the conditions just described may be reversed, and the tar forced to give up, in the permanently gaseous form, some of the heavier hydrocarbons, which, readily condensing by a mere lowering of temperature, are ordinarily retained by the tar. The advantage of this process is a higher yield of gas. There must, of course, be a reduction in the market value of the tar; but this latter consideration is perhaps not of much moment in the present day of low prices for this and other residuals.

The Dinsmore Process.

The principle just referred to is the basis of the Dinsmore process now at work at Widnes and elsewhere. The invention was described in detail by Mr. Isaac Carr, the Manager of the Widnes Gas-Works, in a paper read by him before the Manchester District Institution of Gas Engineers in 1889,* and from that paper the following particulars are culled: The plant utilized at Widnes consists of an ordinary setting of six retorts (heated on the generator system), and fitted with mouthpieces and doors, ascension pipes, dips, and hydraulics as usual. The retorts are set in two vertical tiers of three each. Between the two top retorts is placed a central chamber or duct, made of fire-clay, similar in section to the retorts, and also fitted with mouthpieces and doors at either end. The mouthpieces of the six retorts are provided with two sockets—one for the ordinary ascension pipe, the other for a pipe which communicates directly with the inlet mouthpiece of the central chamber. These latter pipes are provided with valves. The central chamber is heated towards the front or inlet end to a bright

* See JOURNAL, Vol. LIV., p. 1040.

cherry-red heat of from 1700° to 1800° Fahr., and towards the back it is cooled down to a dull red of from 1200° to 1300° Fahr. The graduations of temperature are provided for by means of air chambers at the back of the setting. At the back or outlet end of this duct there are a second mouthpiece, an ascension-pipe provided with a water-jacket to prevent the deposition of pitch, an H-pipe, and a connecting-pipe, fitted with a valve, to the foul main; suitable arrangements being made for cleaning out the pipes when required. When the process is in operation, the valves referred to are open. The gas issuing from the retorts flows, in preference to overcoming the water pressure of the seal in the hydraulic main, through the communicating passage into the central duct. Here a portion of the tarry vapours in suspension with the gas are, by the influence of the intense heat of the duct, fixed as permanent illuminating gas, which, with the gas in bulk from the retorts, passes up the back ascension-pipe, and on to the foul-main direct. Mr. Carr prefers six-hour charges; and, in order to ensure a regular and even flow of gas through the duct, the work is so divided that a portion of the retorts may be drawn every hour. This system of work is, however, one that may with very great advantage be applied to all works where the ordinary processes of carbonization are in use. The gas, thus enriched and supplemented by light-giving hydrocarbons from the tar, is caused to pass on direct to the condensers without the intervention of the hydraulic main, and consequently without coming into direct contact with the cooled tar. When it is required to open the duct, or for any other reason to temporarily suspend the process, the valves on the connections with the retort mouthpieces are closed, as well as the valve on the connections between the duct and the foul main; and the gas passes up by the ascension-pipes in the ordinary way through the dips and the hydraulic main.

The advantages claimed for the process are: (1) Higher make per ton; increase of illuminating power—thus obviating the necessity for using cannel. (2) Proportional decrease in the cost of production as regards material, labour, and productive plant. The gases which have been obtained from the tar are said to be satisfactorily permanent under the varying temperatures to which gas in the holders must be subjected. No difficulty has been experienced by the deposition of naphthalene.

This last matter has given much trouble to almost all gas managers at some period or other of their experience. The direct cause of the deposit is not even now fully ascertained; but it is found that if the gas be carefully and most gradually cooled, from the hydraulic main to the outlet of the condensers, and the bulk of the tar removed at an early stage, there is not likely to be any trouble from this cause. In this connection, the writer is strongly of opinion, too, that the matter of arranging for an even and regular delivery of gas from the retorts, by drawing a portion of the charges every hour, has also much to do with allaying the difficulty, by preventing the periodical rushes of immense volumes of gas through the condensers which must be incidental to the more usual method of dividing the retort-house work.

As already noted, the hydraulic main is now generally constructed in sections, each being usually provided with a hydraulic valve. The gas passes through the valve into the foul main. This main, which is by preference circular, and constructed of wrought iron, is often carried entirely round the retort-house; suitable provision being made for getting away the tar and ammonia water from the hydraulic, and such other condensable matters as may deposit while the gas cools.

In Livesey and Tanner's patent hydraulic main, provision is made for the removal of the tar as it is produced, while hot; there being thus practically no tar in the main. The liquor passes off by a separate pipe, by which also the level can be adjusted as desired. A perforated screen is provided, which prevents oscillation of the liquor, and allows of working with the minimum of seal.

(To be continued.)

The Chairmanship of the Rotherham Gas Committee.—Mr. Stoddart has been elected Chairman of the Rotherham Corporation Gas Committee in place of Mr. Cox, who recently resigned under circumstances reported at the time.

Death of Mr. W. T. Callow.—We regret to record the death, on the 9th inst., in his 83rd year, of Mr. William Tyrer Callow, who for about 30 years filled the position of Gas and Water Engineer at Birkenhead. Something like half-a-century ago, the deceased managed the Athol Street works of the Liverpool Gas Company; and in 1853 he was appointed Engineer and Manager of the Birkenhead Gas and Water Works, which were then private property. The works were purchased by the Birkenhead Improvement Commissioners in 1853; and Mr. Callow remained with them until 1877, just before the incorporation of the borough, when he retired, owing to ill-health and advancing years. He was succeeded by Mr. Wood, who, however, soon retired; and the offices were then divided—Mr. T. O. Paterson being selected as Gas Engineer, and Mr. W. A. Richardson as Water Engineer, which positions these gentlemen still hold. Soon after Mr. Callow's retirement, he was presented by the officials with an illuminated address, together with a timepiece, as a mark of their appreciation of his uniform kindness and impartiality. The funeral took place last Tuesday.

TECHNICAL RECORD.

SOUTH-WEST OF ENGLAND DISTRICT ASSOCIATION OF GAS MANAGERS.

The Half-Yearly Meeting of this Association was held last Tuesday, at the Canon's Marsh Offices of the Bristol Gas Company, under the presidency of Mr. D. IRVING, the Manager of the Company's Stapleton station. Beautiful weather prevailed throughout the day; and there was a numerous attendance. Among the visitors were Mr. W. A. Valon, President of The Gas Institute, and Mr. H. Wilmhurst, Secretary of the Eastern Counties Gas Managers' Association. Previous to the meeting, the Canon's Marsh works were inspected by several of the members, who were afterwards provided, by the kindness of the Directors, with light refreshments in the Board-room. The Association received every possible attention from Mr. J. Phillips, the new Secretary, and from Mr. W. Fiddes, the Company's Chief Engineer.

AN OFFICIAL RECEPTION.

Before the general business commenced,

The PRESIDENT introduced to the members the Vice-Chairman of the Company (Mr. G. K. Stothert, M.Inst.C.E.).

Mr. STOTHERT said, on behalf of himself and brother Directors, he had to give the Association a hearty welcome to Bristol. They were all very glad to see the members. The Chairman (Mr. Alderman Dix) was extremely sorry that he could not himself be present to receive them; but he had been compelled to go to London on important business connected with the Company. He would not take up their time with more remarks, as he saw they had plenty of business to get through; and he hoped the proceedings would be very successful.

Mr. T. W. R. WHITE (Sherborne) observed that the members were greatly obliged to Mr. Stothert for welcoming them, on behalf of the Directors of the Company, to Bristol that day under such favourable circumstances. The Association had always been anxious to get to Bristol. They had assembled there in the past; but up to the present, they had not met with any welcome, or at all events with a welcome like this. Their hearty thanks were due to Mr. Stothert, and his co-Directors, for so cordially receiving them; and he (Mr. White) hoped that this was an earnest of good things to come. They had thought of having Bristol as a sort of centre for the Association; and they hoped to make Mr. Stothert's acquaintance again at some future time.

Mr. H. F. WILLEY (Exeter), in seconding the motion, remarked that the members were very pleased to be at Bristol that day, and they heartily reciprocated the kind wishes Mr. Stothert had expressed.

The motion having been passed,

The PRESIDENT said he had much pleasure, on behalf of the members, to convey to Mr. Stothert their thanks for the kindness of the Directors in welcoming them. It was the intention of the Chairman to be present; but he, as already stated, had been called away to London. The Mayor had also promised to attend; but he was then engaged at a Council meeting.

Mr. STOTHERT briefly acknowledged the vote.

MINUTES OF LAST MEETING.

The HONORARY SECRETARY and TREASURER (Mr. Norton H. Humphrys, of Salisbury) having read the notice convening the meeting, it was agreed to take as read the minutes of the meeting held at Weymouth in September last.

NEW MEMBERS.

On the motion of the PRESIDENT, seconded by Mr. W. A. PADFIELD (Exeter), the following gentlemen were elected members of the Association: Mr. W. J. Fuller, of Bournemouth; Mr. F. W. Johnston, of Stapleton, Bristol; Mr. W. Sainsbury, of Salisbury; Mr. S. B. Darwin, of Portsea; and Mr. G. B. Irons, of Gosport.

PLACE OF NEXT MEETING.

The PRESIDENT invited suggestions for the place at which the next meeting should be held.

Mr. S. W. DURKIN (Southampton) moved that the September meeting should be held at Bournemouth.

Mr. J. LOWE (Weymouth) seconded the proposition; and it was unanimously agreed to.

PRESIDENTIAL REMARKS.

The PRESIDENT said he was sure the Committee of the Association were to be congratulated upon the agenda that had been prepared for the meeting; and, in considering it over, he had come to the conclusion that it was inevitable that some part of the programme must be omitted altogether. Therefore, entirely on his own responsibility, he had determined to postpone his Inaugural Address, in order that the members might have the full advantage of the instruction that was to be derived from the papers to be read, and the discussions that would doubtless follow. The formal business and the subjects that would be submitted would, he felt satisfied, demand their

patience and attention. One of the papers was long; but its length was more than counterbalanced by its great value, and the real pleasure and interest it would afford, not only to all the members of the Association, but to everyone who would have the opportunity of hearing or reading it. Before calling upon Mr. Richardson to read his paper, he should like to congratulate the members upon the fine weather with which they were favoured that day. The number of members who were ill in March rendered it absolutely necessary that the Committee should postpone the meeting until a later date. He was very glad indeed that during the past half year the Association had not suffered in membership by death; but yet he regretted to say that they had lost a friend in the death of a gentleman who was well known to most of them. He referred to Mr. Leslie Cloudsley—a gentleman who was endeared to them all by his kindly disposition, by his generosity, and by the deep interest that he always took in the affairs of the Association; and he (the President) knew that the sympathy of the members was with his brother and his family in their bereavement. Continuing, the President further congratulated the members upon having passed successfully through a very trying time during the past winter. They had witnessed, quite recently, one of the largest combinations of labour—one of the largest stoppages of work—that the world had ever known. To him it was a most remarkable thing that men who had hitherto been considered advanced politicians, radicals, and freetraders should have combined together to carry out one of the most extreme forms of coercion and protection. However, he thought the results proved that the miners were altogether in error, and that trade could not be so controlled. He was certain the members, as gas managers and coal users, wished the miners to have ample pay for their arduous labour; and they also desired that their own workmen should be well paid. Yet it would be most disastrous not only to the gas industry, but to national prosperity if such combinations were to triumph and to rule, though co-operation and goodwill were doubtless necessary in every industry, for its ultimate success. He believed that the gas industry, with all its competitors, had a future yet before it. The electric light and the competition of oil ought merely to stimulate gas managers to make greater efforts to cheapen and improve the production of gas. The chief aim and object of their Association was, by conference and mutual exchange of opinions, and a comparison of experiences, to promote the industry in which they were all so deeply interested. He had much pleasure in seeing the large gathering of members that had that day assembled. He was pleased, too, to notice the presence of the President of the Incorporated Gas Institute (Mr. W. A. Valon), whom he had great pleasure in welcoming to their meeting. He mentioned, in conclusion, that they had received letters of apology, among others, from the Ex-President of The Gas Institute (Mr. J. Hepworth, of Carlisle); Mr. Corbet Woodall, whom business had called to the Continent; Mr. C. E. Jones, of Chesterfield; and Mr. A. Dougall, of Tunbridge Wells.

Mr. J. LOWE (Weymouth) observed that, while appreciating the President's remarks as to his Inaugural Address, he thought it ought to be incorporated in the published transactions of the Association.

The PRESIDENT said that he would leave the matter with the Committee. If they considered it desirable to take it as read and publish it, he should be most pleased to fall in with that arrangement.

Mr. CHAS. RICHARDSON, M.Inst.C.E. (Bristol), then read the following paper:—

THE SEVERN TUNNEL.

At the very earnest request of your President, I have undertaken to read to you an account of the construction of the Severn Tunnel.

The idea of constructing a tunnel underneath the Severn occurred to the writer in 1862, when engaged upon the New Passage Ferry Piers, which were then being constructed for the Bristol and South Wales Union Railway. The idea having once entered his mind, he could not help being struck with the different local facts, which all appeared to have a most favourable bearing on the scheme. The facts were these: At the point where he proposed to cross, it was manifest, in the first place, that, out of a high-water breadth of $2\frac{1}{4}$ miles, two miles of the river bottom were dry at low water, and could be walked over; secondly, that the strata along these two miles of low-water rocks were horizontal, and of a water-resisting character, and altogether most favourable for tunnelling purposes; thirdly, that the deep channel of the Shoots had been cut through a very hard and close rock; and, lastly, but not least in importance, that the Severn waters are heavily charged with mud, and also—as the writer had the means of positively knowing, and will presently show—with very large quantities of solid matters, varying in size from a large coarse gravel downwards to fine gravel, sand, and mud—due, no doubt, to the great rise and fall of the tides in this river, which amount sometimes to 50 vertical feet in one tide, and to the powerful currents thereby generated.

The portion of the River Severn near to the New Passage Ferry is very remarkable, because of these half-tide rocks, which end abruptly at the Ferry channel, in a line nearly square across the river. These rocks, called on the English

side the "English Stones," reach all the way across the river, with the exception of the Shoots channel; and their abrupt ending is one cause of the existence of a Ferry channel—the other being the peculiar set of the tidal currents there. They are also the reason why all the Severn water below half-tide level has to pass through the Shoots channel, which is only 400 yards wide, for there is then no other outlet.

All these waters rushing down this narrow channel of the Shoots, naturally cause a very powerful current (10 knots an hour, sometimes), which no doubt gave this channel its name. Again, the Shoots channel, as you ascend the river, points towards the Welsh shore; so that the inflowing tide presses against the Welsh shore, while, on the other hand, the main stream of the ebbing tide is flung towards the English shore by the projecting point of St. Tecla's Chapel Rock—thus leaving an intermediate sandbank, called the Dun Sand, in the middle of the river, between the up and the down currents. The ebbing tide, thus thrown on to the English side, passes over the English Stones, so long as the tide is high; but as half-tide is approached, the waters, having no longer an outlet that way, rush along the head of the English Stones down to the Shoots, and thus have to cut through the great bank of sand which had been deposited there by the flood-tide, and at that time formed part of the Dun Sand. This is the reason why deep water is always to be found there for the Ferry Passage. This process is repeated during every spring-tide, as the writer had reason to know; for on one occasion on measuring and sounding across this channel, the bow of the boat was run aground upon the Dun Sand. The man at the bow jumped out, and shoved the boat off again. In doing so, he made two steps on the sand; but the third, from which he meant to spring on board again, went into deep water, and he would have disappeared altogether had he not held hard to the boat.

It was found that the sand was being washed away so fast that it formed an upright face deeper than the length of an oar. This fact was afterwards frequently observed during ebb tide. The Ferry channel there is washed to a depth of 42 feet below the lowest water of a spring tide. The Dun Sand, without doubt, joins on to the English Stones during the flow of the big spring tides, and the Ferry channel is washed clear again by the English lake current every time at half-ebb. This proves the enormous quantity of sand that is moved during every one of these big tides. Then, as to the quantity of gravel moved during such tides, there was a good illustration when the foundations of the Portskewet Pier were being got in. A base of brickwork, 4 feet deep, had to be put in to form a footing to which the framed wooden legs of the viaduct were to be bolted. When the men got to those near the low-water mark, it had to be put in during the low water of big spring tides; and they found much trouble in excavating a level foundation for the brickwork out of the very hard marl, by reason of the large quantity of very coarse gravel that every tide washed into the excavation. So that some time was always lost in clearing the foundations of the gravel before work could be started again. The gravel nearly half filled the holes every tide, and was of a size sometimes equalling that of a man's double fist. Now, as these holes were well above the low-water mark, while the Shoots channel in the main current is 70 feet lower, and as the bulk of the gravel, particularly the larger stones forming it, must run in the deepest channels, it was evident that very large quantities of heavy gravel must run up and down these channels with every spring tide. It thus became clear to the writer that, supposing only the strata were hard enough to resist the scouring action of the water, any joint or fissure in the rock must be choked with this gravel, sand, and fine mud so completely, that no Severn water could possibly get down to any workings below, and that therefore the deep low-water channel of the Shoots (which is, without doubt, in rock more than sufficiently hard for the purpose) might be tunnelled under with perfect confidence. This has since been entirely borne out by the facts; and there is now positively no leakage whatever of Severn water.

Having thus convinced himself of the perfect practicability of a tunnel under the Severn, the writer mentioned his idea at the time to Mr. Leonard Bruton, the able Secretary of the Ferry-railway then being constructed. He told him that he thought a tunnel might be made under the Severn for half-a-million sterling, exclusive of the in-shore approaches. Mr. Bruton's reply was: "Then that is the right scheme." From that time the writer began to make further investigations, by taking very numerous soundings in the Shoots, and by putting down trial borings, all of which fully confirmed his previous observations. He was, of course, greatly encouraged in this by his friend Mr. Bruton, and by the Directors of the Bristol and South Wales Union Railway, who all highly approved of the scheme.

After the writer had made the necessary levels, soundings, and surveys, he prepared the original plans of the Severn Tunnel Railway, which are, with trifling alterations to be explained further on, those on which the work has been carried out. These plans were first deposited in Parliament in the year 1863, in opposition to Mr. Fowler's "Great Western and South Wales Direct" scheme; but it fell through for lack of pecuniary support. Mr. Fowler, however, obtained his Bill; but the work was never carried out. The Severn Tunnel plans were again deposited a year or two later; but they failed, from

the same cause. The writer had in the meantime, however, written full and careful reports of his tunnel scheme; giving in detail all his reasons for knowing that it was quite practicable. He had also shown and explained his plans to Mr. George Wythes, the great contractor, who confirmed his opinion. Mr. Brassey, also, to whom Mr. Wythes had shown and explained the plans, told the Directors of the Great Western Railway that he considered it a great work, and that he should like to do it, but that he should want half-a-million more for contingencies in passing under the Severn.

Though the writer was unable to persuade local people to back up the scheme with their money, he had reason to know that he had convinced the Great Western Railway authorities that it was practicable, and the best for their purposes. Accordingly, in 1872 he again deposited the Severn Tunnel plans under their authority. The tunnel scheme, however, was opposed by a bridge scheme of Mr. Fowler's at the same place. This proposed to cross the half-tide rocks by spans of 100 feet, and the navigable channel of the Shoots by an opening of 700 feet, for the support of which two piers were to have been erected in the deep water of the Shoots. But the Directors preferred the tunnel; so that was the scheme adopted.

In going to Parliament with such a novel undertaking, the Directors wished to have the support of an engineer of the highest standing. The writer, therefore, asked Mr. Thomas Harrison to give evidence in favour of the scheme. But, after talking it over, he could not convince him that there might not be, somewhere in the rock forming the bottom of the Shoots, such an open fissure as would make the tunnel impracticable. He, therefore, declined to give evidence in its favour. The writer then applied to Sir John Hawkshaw, who considered the scheme feasible, and accepted the position.

After the Act had been obtained, Sir John Hawkshaw was appointed Consulting Engineer. The first object then was to ascertain, by the most accurate soundings, the exact form of the rock at the bottom of the Shoots for the whole distance within the limits of deviation, which had there been made 300 yards in width, in order to give the opportunity of deciding upon the best place under which to carry the tunnel. The taking of these soundings was a matter of some difficulty; for, in order that they should be of any real value, it was imperative that the exact position of each sounding should be positively fixed, and that the true levels of the bottom should be at the same time determined. As the soundings had to be taken off a boat which was floating on water having an ever-varying level, the securing of these results required some contrivance and a good deal of care in carrying them out. They also occupied much time, because they could only be taken at the turn of the tide, when the water was comparatively quiet. During this time the sounding went on rapidly for about 20 minutes; but, after that, the lead was carried away by the force of the current, and no bottom was felt. "No bottom" was then called; and the work ceased for the day. Thus 20 minutes only was a day's work.

The mode of operation was as follows: First, a base-line had been carefully pegged out, with numbered iron bars drilled into the rock at every 30 feet along a line, square to the line of railway, on the rocks forming the edge of the Shoots. A line of soundings was taken across the Shoots at every iron bar—that is, at every 10 yards. When, therefore, a particular line of soundings had to be taken, a pole was fixed at the proper iron bar, and a second, carrying a cross-bar near the top, at some distance behind, in a line parallel to the line of railway. These two poles gave the exact line for the soundings. Then a third pole, carrying a large globe on the top, was fixed in the base-line, but 80 yards to the right of the first pole. All was then ready for the boat. The sounding-boat, which carried four oarsmen amidships, with two engineers at the bow and two astern, carried also a sounding machine fastened to the bow of the boat. This machine was made for the purpose. It had a reel, on which was evenly coiled a fine sounding wire, having a heavy leaden weight at the bottom end. The reel was controlled by a light hand-brake by which the wire was kept sufficiently taut as the lead went down, and by which the reel was stopped the instant it struck the bottom. The reel also worked an index round a dial-plate, which was divided into feet and tenths, so that the depth could be read off in a moment with precision. At the end of the reel there was a handle, by which the wire could be reeled up again rapidly ready for another sounding.

The first engineer at the bow stood over the sounding machine with a sextant in his hand, got the boat into line with the two poles, and called out "Now!" taking at the same time the angle to the lateral pole. The second engineer, with the sounding machine, immediately let down the plummet. The third engineer, with the tiller in one hand and his watch in the other, called the exact time; and the fourth noted the figures in a book ruled for the purpose—the angle first, the time second, and the depth third—as they were called out. At the same time a man on shore was noting the heights of the water at every minute, from a gauge that had been fixed there for the purpose. The soundings were afterwards reduced to the correct water-levels; and the height of each sounding above Severn Tunnel datum entered in its proper column. By these means, really correct sections of the Shoots' bottom were obtained. The soundings were taken as close together as possible; and when two soundings happened to be taken on

the same spot, they always tallied. When all the line of soundings had been taken, and the results plotted, they were found to differ so little, either in the form of the bottom or in the depth of the water, that one point of crossing was practically as good as another. When the centre line had been decided upon, very numerous additional soundings were made upon that line; so that ultimately they were hardly two feet apart all the way across. Yet in no place was any fissure found; but the bottom was ridged—something like the ridge and furrow of a ploughed field—as might have been expected from the nature of the wearing away, by gravel running longitudinally up and down. The permanent centre line of the tunnel was now fixed and set out, and the surveys made on both sides of the river.

Where the tunnel emerged in-shore, deep and extensive cuttings had, of course, to be made on both sides of the river. These cuttings, at the gradient of 1 in 100, ran for a long distance before they got above high-water level; that on the English side—being 60 feet below the Severn alluvium—had to be carried 6000 feet through the Severn Marsh before it got out of cutting, and involved heavy bridges and other works to carry the roads and streams across it. But it also involved another important work, as may now be explained. From some facts he had before observed, it became plain to the writer of this paper that it would be absolutely necessary to make high sea-banks round the tunnel-mouth cuttings—on both sides of the river; because the present sea-banks by the river side are not high enough to keep out very high and exceptional floods, which must occur when great storms take place upon very big spring-tides. His attention was first called to this subject in a striking manner soon after the opening of the Ferry Railway in 1863. On the occasion alluded to, there was a great gale of wind from the south-west, accompanied by a low barometer. It occurred on a spring-tide, though not a very big one; and the tide was blown up to a height of 8 inches above the highest tide he had recorded at the Pier, to which the waves also did considerable damage. This tide was blown up to a height of within 8 or 10 inches of the top of the marginal sea-banks of the Severn, as measured in a quiet place in Chessell Bill, where there were no waves. Now, on referring to the tide-table, the writer observed that the tide of this day, though the biggest in that set, was still 4 feet lower than the big springs just 14 days sooner or later. The question then naturally occurred to him, What would have been the result had this same gale occurred just fourteen days sooner or later? It would undoubtedly have risen above the marginal sea-banks, and have flooded the whole of the Severn marsh lands to a depth of 7 or 8 feet; and if the Severn Tunnel cuttings are never to be flooded, it will be necessary that they should have sea-banks around them of much greater height than the marginal sea-banks of the Severn. It then became necessary to decide what this height ought to be. The writer first tried to find out the greatest height to which any tides, whether spring or neap, had ever been known to have been blown up. After full inquiry, he came to the conclusion that 8 feet might be taken as the extreme limit. Then, taking 3 feet 6 inches above the alluvial level as the height to which the biggest spring tide would ever rise, if it came in quietly in calm weather, he obtained 11½ feet above the alluvial lands at the New Passage as the greatest possible height of the storm floods. To this he added 4 feet more as a margin of safety against the possible wash of the waves in such floods, and made his sea-banks round the cuttings in these meadows 16 feet high.

In 1883, on the occasion of a visit of the Directors to the Severn Tunnel works in the middle of September, the Chairman laughingly remarked that he thought these high banks could hardly be necessary, for the South Wales line had now been opened 39 years, and the rails had never yet been flooded; the sea-bank there being some 9 or 10 feet above the rails. The writer's reply was that he was quite confident that they would be wanted; and that, at any rate, they cost nothing, for they were made by barrow work, and the saving in the cost of the earthwork more than paid for the additional land. And there the matter dropped; but on the 18th of October following, a heavy S.S.W. gale occurred on a big spring-tide, and blew the water to such a height that it flowed over the Commissioners' sea-bank and flooded the marsh lands to such a depth as to run over the South Wales line of rails eighteen inches deep, and at the same time to flood the Marsh shaft, and pour down it in a great cascade. There were fifty men below at work. They all ran to the cage to be hoisted up; but the water had put out all the engine fires. Three or four of them then went to an upright ladder against the shaft wall; and all but one succeeded in getting up, in spite of the water falling upon them, the other fell off and was killed. The rest of the men below went back to the higher workings, and climbed up on the centering. The water then poured in until it had risen to within 3 feet of the crown of the arch. This occurred at 8 o'clock at night. The contractor's engineers above were trying to devise some means of getting the men out; but could do nothing to rescue them until early the next morning, when they got a boat from the pier. This they let down the shaft end on—for the shaft was not wide enough to take it when level—and then they had much trouble to float it on the water. They had to make it dive first, and afterwards to bale it out. There was just room to paddle it under the crown of the arch; and in this way they

got to the men about noon, after they had been there about sixteen hours in the dark. This was a narrow escape; for a very little more Severn water would have quite filled up the length of tunnel then completed. These sea-banks round the tunnel-mouth cutting are therefore clearly necessary, in order to prevent the tunnel from being flooded at some future day—a dreadful catastrophe if it ever did occur; and they were provided for in the original setting out of the line.

After the soundings had been completed, and the centre line and works set out, the time had come to start upon the actual work. The Directors had wisely decided that the first work undertaken should be the heading under the Shoots. In this way the nature of the ground and the full practicability of the whole scheme could be actually proved before the great outlay upon the remaining works was incurred. The intention at that time was to sink a shaft on the low-water rocks, close to the edge of the Shoots, and from thence to drive the heading.

The Sudbrook shaft was started on shore in March, 1873. It began in new red rock and marl, in which a good deal of water was found, and then passed through a 4-foot bed of magnesian conglomerate. Down to this, 91 feet from the surface, the strata was horizontal. The shaft then went through Pennant sandstone, 19 feet; clay shale, 24 feet; coal shale, 10 feet; millstone grit, 11 feet; fire-clay, 9 feet; mountain limestone lumps in fire-clay, 15 feet; and fire-stone, 26 feet. All these dipped towards the river at the rate of 1 in 7. The river heading was begun in December, 1874, and passed again through the dipping beds into the Pennant. The bed of coal shale was very heavy ground, which had to be double timbered and floored, which made the heading small and low at that point. The Pennant was at first of a red colour, and full of backs, or open joints, from which flowed a good deal of water. This water at first was of the colour of weak porter, and had a very salt and bitter taste; but after a few days, it ran clear. What was tapped first had no doubt been lying there for ages undisturbed—the colour showing probably the presence of iron. Some copious springs were afterwards found in the Pennant; so a flood-door was built in the Pennant 340 yards from the shaft, to prevent the flooding of the pumps in the event of a breakdown, which it did on two or three occasions. This door was very strong, and large enough to let the trolleys pass through; it also had a 12-inch sluice-valve.

And, now, seeing that this heading would have to be driven two miles under the river from this one shaft, it became of great importance to adopt the most correct means possible of getting the lines of the tunnel down the shaft and along the heading. The usual way has been to drop a plumb-bob down each side of the shaft; but this was found to be not nearly accurate enough for the purpose. The plumb-lines could only be got 13 feet apart; and though the bobs were large, and dropped into buckets of water with the view to steady them, they could not be made really steady, for a pendulum 200 feet long vibrates slowly. It has a beat of nearly eight seconds each way; and when the extent of the vibration is less than an eighth of an inch, it appears to the eye to be steady. But when the cross-hairs of a transit below are fixed on the wires, first one and then the other appears to leave the line; and you may, as the writer did, spend an hour in the vain endeavour to fix them, until your handkerchief is wet through with mopping up your tears, but you are never sure of accuracy. In addition to this, there was a considerable jar in the bottom at every stroke of the big pump, which shook the wires and kept them in a nearly constant tremor. So this plan was abandoned, and a new one adopted. A good transit instrument was obtained for the purpose from Messrs. Troughton and Simms, with a 4-inch hole in the bottom plate, through which the telescope could be pointed vertically downwards, and a large block of stone was built solidly into the shaft wall on top to carry the transit. The heavy end of the stone was built into the wall; but a lighter end projected 2 feet into the shaft. On this lighter end, the centre line of the tunnel had been marked, and an 8-inch peep hole cut through it. This formed the apparatus for the shaft top. For the bottom, a pianoforte wire about 250 feet long was procured; and a couple of fine-threaded screws, made each about 6 inches long, and mounted on a bed-plate, which could be firmly screwed down to a beam of timber. Then a beam was strongly fixed across the back of the shaft bottom furthest from the heading, which was then only being driven towards the river; and another beam across the heading within a foot or two of the full length of the wire. The adjusting screws were fixed upon these beams in their proper places—for the position of the centre-line was known very nearly at the shaft bottom, and pretty nearly at the 250 feet along the heading, which was then perhaps 200 yards in. The wire was then carefully uncoiled off its reel, so as to leave no kinks; and each end was passed simply over the thread of the screw at each end with a 28-lb. weight suspended from it. This kept the wire clear of the heading floor all along. The screws were well oiled; and they worked by a simple hand-wheel at one end.

All was now ready below. The new transit was fixed over the hole in the top stone, and adjusted in true position and level. It was then turned upon a flagstaff on the other side of the Severn and clamped there, being now in the true centre-line of the tunnel. When this had all been accurately done, the telescope was pointed down the shaft, where the screw and the wire passing over it could be plainly seen. A few turns of

the screw brought the wire into exact position. This being fixed, the telescope was then directed to the furthest point of the wire that could be seen before it entered the heading; and that point was then brought into true line by means of the screw in the heading 250 feet away. This, of course, took a little more time, because it had to be done by signalling. This having been accomplished, the readings were a second time observed, to make sure that there was no error of observation. Electric lamps had to be used below, in order to get a distinct view of the wire; and then the cross-hairs of the transit could be made to bisect the wire with great accuracy. The wire now gave 250 feet of base line very correctly set out. The engineer below, with a smaller transit, then fixed his instrument in the line and about 10 yards further in than the end of the wire, and adjusted it until he could exactly cut the wire correctly at both ends. He was then in a position to fix correct marks in the roof-trees all along the heading as far as he could see.

These lines were checked throughout by the same process several times afterwards; and when the heading became very long, the transit was taken below to continue the lines more correctly under the Severn. After they had been run through a first time, and the points marked, the telescope was turned over in its Y's, and the whole line set out a second time to see if there was any instrumental error. It was then found that there was a slight instrumental error; for the two lines gradually diverged in a very flat curve, and were nearly 2 feet apart at the end of a mile. The true centre line was consequently just half-way between the two; and thus the permanent centres were fixed. The heading was then carried forward under the Shoots, where the Pennant was of a grey colour, and so hard and close that no joints were visible, until the Shoots had been passed. The heading then began to rise again, according to the gradient, and after a time emerged from the top of the Pennant into the upper coal shales, where it passed through two beds of coal, 10 and 12 inches thick, until it came to a vertical fault 2180 yards from the shaft, where it suddenly entered the new red sandstone. This rock was very hard to drill (machine drills were used, driven by compressed air); and when blasted, the dynamite only blew out a round hole, and blew the sandstone into powder. This powder was of a singular nature. After it had been filled into the iron trolleys, in passing along the heading, it got shaken down so tightly that all the water was driven to the surface; and the sandy material below was wedged in so fast that when the trolley was run to the tip it would not come out, but carried the trolley with it rolling over and over down to the bottom, where it was found still tight in the trolley. The men had afterwards to set the trolley up on end, and get the stuff out with a pickaxe. The writer never met with any material like this before, except in "Kellaways Sand," in Wiltshire. If you there dug a hole in the ground, the stuff that came out would not fill the hole again. A man of his there had to fix a big gate-post; and after the post was in he had not stuff enough to fill the hole again, but had to fetch another barrow-full. The stuff afterwards set almost like mortar.

After the heading had passed through some 50 yards of this material, it came into an open vertical joint, 2 feet wide, which was full of water under pressure. When the first drill that went into it was withdrawn, the water spurted out with such force as to knock down the ganger flat upon his back, as he was standing four or five yards from the face looking on. The men said it flew 50 yards along the heading before it struck the ground, and caused great alarm amongst them at the time; but the pumps took it all, and in a day or two the quantity of water had dwindled down to a moderate-sized spring.

This wide fissure is traceable on the English stones over head; but it is quite filled up there. After the heading had been driven under the whole breadth of the Shoots, and had thus demonstrated the extremely sound character of the rocks there, the other shafts were sunk, and headings were started in the line of the tunnel from all of them. A heading was at the same time begun landwards from the Sudbrook shaft; and it was in this heading, when it had attained a length of 354 yards from the shaft, that the spring was first tapped, and flooded the works on the 16th of October, 1879. The heading under the river had then reached a length of 3370 yards, or nearly two miles from Sudbrook shaft, and was within 138 yards of joining the heading from the other side. It may be mentioned here that, when the headings met some two years or so afterwards, the engineer-in-charge reported them as meeting "dead true, both in lines and levels."

The flooding of the works was a severe and alarming blow to the Directors. They asked Sir John Hawkshaw to take on himself the full responsibility; and thereupon made no joint engineers, with Sir John as chief. From that time, the writer could *advise*, but Sir John could *decide*; and he persuaded the Directors to let the completion of the whole work to Mr. Thomas A. Walker, the very able and energetic contractor who has since completed the undertaking. At the time, and in order to master the big spring, new shafts were sunk on both sides of the spring—two at Sudbrook, and two about half-a-mile further in-shore. In these powerful pumps were fixed; and when they were got to work, the head of water was gradually lowered until it was only about 40 feet deep at the bottom of the shaft. In addition to the water of the big spring, it was known that a large quantity came from the river heading and through the flood-door that has been mentioned. In order to get rid of this for the moment, it was of much importance to shut this door, if possible. The

house-wall, and yet arches have been so built for many years. There must be some reason why brick arches in this country should have been built in this unscientific manner. It can hardly be to avoid the cost of the special radial bricks needed to form the vertical bond; for they can be bought for 8s. per 1000 more than common bricks, and as 1000 will do 3 yards, and the vertical bond only requires half special with half common bricks, the additional cost of the special radial bricks would therefore be only one-sixth part of 8s., or 16d. a cubic yard; and 9-inch work with the vertical bond is as strong as 18-inch work in rings, and sometimes stronger, as will appear further on. This being so, it is difficult to imagine how the building of arches in rings of brickwork can have originated. It may, however, have taken its rise from the imposition of the excise duty upon bricks—a very injurious and also an unfair tax which was levied upon bricks and not upon stone quarried for building purposes. Under this duty it was forbidden that bricks should be made of any size or shape other than the common brick. They could not, therefore, be made of the wedge form suitable to arch building, so as to form a bond between the rings—a vertical bond, as it has been called. The duty was also very oppressive, because it was levied upon bricks in the “hack,” before they were dried and burnt; so that bricks spoilt by bad weather while still in the hack, or afterwards in the burning, had already paid the excise duty, which could not be recovered.

This may probably be the reason why it became the custom in England to build brick arches in $4\frac{1}{2}$ -inch disconnected “rings” (a method not practised on the Continent), and why brick arches of wide span could not be built with any degree of safety, notwithstanding that brickwork, built with a full vertical bond, makes practically the strongest arch that can be built. That bricks properly bonded will make a stronger arch than stone, may be understood when it is considered that good brindle bricks can be made to carry as great a pressure as any stone, and that bricks, being handy, can be bedded in the cement better than any stonework can; for stonework is always too large to be handled with one hand, and is never squared all round, back as well as front. Thus, as the cement is always the weaker material, the ultimate strength of the arch must depend upon that of the cement; and the strongest arch will be formed by that material which can be the most easily and completely bedded in the cement. That material is unquestionably brickwork. In the Severn Tunnel, the brickwork was put in, as a rule, 27 inches, or three bricks, thick, both in the arch and in the invert and side walls. Also, as the work proceeded, the Chief Engineer decided to invert the whole length of the tunnel, instead of the half, as included in the contract. This involved an additional cost of £80,000. As the greater part of the tunnel is in hard ground, when no invert is otherwise needed, this two miles of additional invert was probably added to keep out the water.

And now as to the effect of water pressure. The River Severn is naturally the lowest drainage-level of the district. In any works going below that level, the water met with must either be pumped out or forcibly kept out under pressure. In a land tunnel, the water runs out of itself at one end or the other, and is of no further trouble after the work has been completed—the brickwork having only to support the weight of the ground overhead. But in the Severn Tunnel the water pressure is the main consideration. In discussing this question, it may be as well first to say a word as to land tunnels. If the tunnel should be in rock or self-supporting strata, no lining is needed for the actual support of the ground. But it has been found better to put in a thin lining of brickwork in railway tunnels, even in this case; for, in blasting the rock, some pieces are so far loosened that, though they do not come away at once they do fall subsequently, at an uncertain date after the tunnel has been opened for traffic, and thus they become a source of great danger to the trains. No invert is needed in this case, and sometimes no side walls; but in regard to the latter, the cost of dressing the rock on the sides, and of forming a good springing for the arch, makes the saving so small that it is usually better to build side walls as well as an arch. In soft or yielding ground, an invert is also wanted, with heavier arch and side walls. But it is a fact well known to practical engineers, that the greatest weight on the brickwork is always met with in shallow tunnels; that is, when they are only 60 feet or so below the surface. The ground then breaks up to the top, and the whole superincumbent load comes upon the arch. But in deep tunnels, the ground does not break up very far above the arch; and therefore it mainly supports itself.

The chief precaution to be adopted in order to ensure permanent stability in a tunnel arch and side walls is to have the space at the back, between the excavated ground and the brickwork, quite built up with bricks and mortar. There must always be a space left over the arch where the timbers are withdrawn, even if the ground has been got out with the greatest truth. But, in addition to this, miners have usually a tendency to take out too much ground at the haunches of an arch, for some hidden reason which appears to be common to mining judgment; and if this space is not completely filled up, the effect can readily be imagined. An arch, it must be remembered, is a balanced structure, and of great strength when properly loaded; but in the case now supposed, it will be found that, as the ground by-and-by naturally comes down heavily where it is least supported—that is, over the crown of the arch—if the space above the

haunches has not been quite filled up, the crown sinks under the load, and the haunches rise until they do get a bearing against the ground above, and the arch is badly crippled, more especially if the brickwork has been built in rings, for the inner rings then gape at the crown, and some of the bricks often fall out. When land tunnels fail, it is almost always because this back filling has been neglected; and this can only be seen to during the progress of the work, and not afterwards. In the Severn Tunnel, on the other hand, the chief load on the brickwork is from the water pressure, which differs entirely from the land pressure, as described above, in that the pressure is from all directions, and precisely according to the head of water at each point. Referring again to the sketch of this tunnel, the water pressures on the various parts of the work are figured in pounds on the square inch at every 2 feet in height. It will be observed that while the pressure on the crown of the arch is 52 lbs. on the square inch, that under the invert is $64\frac{1}{2}$ lbs.

These are the direct water pressures which have to be carried by the brickwork acting as an arch, which has to bear this converging pressure all round, and to convert the vertical load into a thrust or bed pressure on the brickwork all the way round the tunnel. These bed pressures are many times greater than the water pressures outside, so they are figured in hundred-weights per square inch; and they vary directly in proportion to the radius of curvature of the arch. The result, therefore, is that while the water pressure on the crown of the arch is 52 lbs., the bed pressure on the arch is 3.15 cwt. on the square inch; but the invert, being of a flatter radius, while the water pressure was $64\frac{1}{2}$ lbs., the bed pressure is 6.09 cwt., or just about double what it was on the arch. So, to make them of equal strength against water pressure, the invert should be twice as thick as the arch. In fact, however, the 27-inch invert would have been quite strong enough to have borne the thrust, if the load had been fairly distributed through the thickness of the work. But, as it was, it did give way in some places in the wet part of the tunnel before alluded to, where it passed through the bed of hard conglomerate rock; for nearly 20 chains in the neighbourhood of the big spring was so full of water, under great pressure, which made it spurt out in all directions, that the miners had considerable difficulty in keeping any lights burning by which they might see to do their excavation. So also, in the same part, the bricklayers had much trouble from the flow of water while putting in and making good their work all round. But the difficulty was most felt while they were putting in the invert, in the wetter places; for after the bottom had been got out, ready for the brickwork, the clear water could be seen welling up, not only in large springs from the wider joints, but also in smaller quantities from every tiny crack in the rock all over the excavated floor. If brickwork had been laid upon such a bottom, the water would, by its upward pressure (which there amounted to fully 60 lbs. on the square inch), either have raised up the brickwork in a body, or otherwise have forced its way through the joints of the brickwork; thus washing out the cement while it was still soft. The only way by which such an evil alternative could be avoided was to take off the water pressure. This the contractor had to do in the case of the side and upper walls, by placing 3-inch iron pipes against all the chief issues of the water as his brickwork came up to them, through which it could run freely while the walls above were built; and, in the case of the invert, by cutting a bottom drain through the rock under the middle, and consequently the lowest, part of the invert, and by laying in it 12-inch stoneware pipes, into which the water could run, during the building of the invert, and for such time afterwards as was thought necessary for the cement to have become well set.

But it must be recollected that, in accordance with the description given above, the pipes were only placed to take away the water from the larger springs, and that the many tiny ones were left to find their own way out, either along the back of the brickwork and through the nearest pipe, or through the mortar joints of the side walls. So also, under the invert, the larger springs were led away into the central drain along small channels made for the purpose. But the numerous tiny springs in the very wet parts, which could not all be thus provided for, had to force their own way out in the manner just mentioned in the case of the side walls. And it must at the same time be recollected that the smallest springs would come in under, and exert the same pressure against, the brickwork as the larger springs.

Thus was the brickwork, consisting of six $4\frac{1}{2}$ -inch rings in the arch and in the invert, but of bonded work in the side walls, built in these wet parts of the tunnel. After the brickwork had been completed all through this very wet ground, it was left for six months with the pipes running, and consequently with no water pressure upon it, in order to let the cement have time enough to set well. It may be mentioned here that all the cement, on its arrival at the works, was air-slaked for a month or more upon the dry floor of a shed built for the purpose. The effect of this was to make the cement set harder in the end, though it made it set more slowly in the meantime. At the end of six months, therefore, which was considered to have been a sufficient length of time for the cement to have become well set, the pipes were corked, and the drain under the invert was plugged. Thus the water pressure came gradually against the brickwork as the head of water rose

outside, until it became 60 lbs. on the square inch, as indicated by the gauges placed there for the purpose. The effect of this pressure on the brickwork was soon apparent. Streams of water spurted out, with more or less force, from many of the joints in the brickwork of the arch, and particularly from those in the side walls. Occasionally, and with a report like a pistol-shot, a flake from the face of the brickwork, two inches thick, and perhaps a foot or more square, would fly off, and let a trickling of the confined water escape. This flaking off of the brickwork here and there was a frequent occurrence in the side walls, and an occasional one in the arch also; and it continued for many days in succession.

But the effect of the water pressure on the invert was the most striking. In a number of places along this quarter of a mile of very wet ground, a patch of 20 or 30 square yards of the top ring of brickwork might be seen to rise slowly till it fell to pieces, a mere heap of loose bricks, from among which the water then ran away. One of the largest of these patches, 40 square yards or more in area, drew the greatest attention; and its progress was characteristic of the effects of the water pressure. After the first or top ring had been raised until it had fallen to pieces, and after the loose bricks had been cleared away, the ring below—that is the second ring—was observed to rise slowly and then fall to pieces, as the first had done; and after the loose bricks had been again cleared away, the third ring was seen to be rising in the same way. The contractor then, fearing that the whole thickness of the invert would be destroyed in this way, ring after ring, at once uncorked the pipes, and let the water run again; thus taking off the pressure.

The explanation of these effects of the water pressure upon the tunnel brickwork seems to be clear enough, when it is borne in mind that they must have been due to the water pressure alone. Taking the case of the side walls, in these the cement was well set; and the blowing off of the 2-inch flakes from the face of the bricks was probably due to the fact that all bricklayers, as a rule, invariably fill up the joints of brickwork just against the face more tightly than they do the internal joints, which are never seen, and that the water which came easily through the back part of the work was checked by these tighter face-joints. Thus the whole water pressure came upon the mere face of the work, and blew it off with such violence, through the hard bricks themselves, which were torn through straight and clean. It may be observed here that little brickwork has hitherto been built under such water pressure; but the same flaking off the face of the brickwork did occur under considerable water pressure in some work connected with the Thames Tunnel.

Then, as to the "blowing up" of the invert, as the men called it. In this connection, the following facts should be borne in mind: First, that there was, under the invert, an upward water pressure of 60 lbs. on every square inch of its surface. Secondly, that in the wettest parts, the water under this pressure forced its way up through the rock floor by innumerable cracks all over it. Thirdly, that the invert itself was built of six $4\frac{1}{2}$ -inch rings of brickwork, which were not in any way tied or bonded together. Again, with regard to these six independent rings, it should be further understood that it is, in all cases, an exceedingly difficult thing to build, even with the greatest care, a small piece of brickwork really water-tight; and it is practically impossible to do so in a large work where a number of men are employed. Thus it may be taken for granted that these six rings were all leaky in different degrees, and that there would usually be, in any small length of invert, one ring at all events among the six which was the tightest. Now, whichever it was, that one ring would certainly get the whole water pressure—for water is one of the least elastic of substances, and the quantity that forced its way through the tightest of the rings would pass easily and with little or no pressure through the more leaky rings. To judge how these facts would affect the invert, let it be supposed for a moment that the third ring from the top was the tightest. Then the whole pressure of the water would bear against that ring, tending to force it upwards. The three rings below would give it no support, and would take none of the pressure; but it could not be forced upwards without also driving upwards the two rings above it. Thus the strength of the invert to resist the pressure of the water, when the third ring was the tightest, would be limited to the combined strength of that ring and the two above it. If the second ring was the tightest, there would only be the top ring to help it; and its strength would be confined to that of the two top rings. Lastly, if the top ring was the tightest, it would, by itself, have to bear the whole water pressure. Again, supposing the top ring to have been the tightest, and to have been blown up, there would still be five rings of the invert left. In that case, the whole pressure would come upon the tightest ring of the remaining five; and if that were the top ring, it would in like manner be blown up, and so on to the last.

If these considerations are applied to the already described facts of the blowing up of the invert in the places where it did occur, it may be observed that in all the cases, the top ring alone was first blown up—thus showing that in all those places (which, together, formed probably not more than a tenth part of the whole twenty chains of invert affected) the top ring was tightest and had to bear the whole of the water pressure, which, by itself, it could not stand; that in two of these cases only,

the second ring was then the tightest and was seen to rise slowly, after the top ring by falling had ceased to take the pressure, until it also fell to pieces; that in one of these last cases, the third ring was then the tightest, and was rising to its fall when the pressure was taken off; and lastly, that in no single case did two rings rise together along the twenty chains of invert which were under this water pressure. It must further be added that, after the blown-up rings of the invert had fallen to pieces, every brick was sound—it was the cement that had been crushed. The ring that was blown up formed an independent $4\frac{1}{2}$ -inch arch; and, as it rose, the water pressure was so equable that this arch preserved its form, only growing flatter and flatter until it fell.

The natural conclusion from all these facts appears to be that one ring by itself could not bear the load, but that two rings together could; and this conclusion would appear to be probable enough from a simple calculation of the actual thrusts upon the brickwork of the invert under the known water pressure—for a water pressure of 60 lbs. on the square inch under the invert, would cause a crushing force on the square inch of brickwork equal to 15 cwt. on a 9-inch thick invert, and to $31\frac{1}{2}$ cwt. on a $4\frac{1}{2}$ -inch invert. Now, though good Portland cement ought when well set to bear a crushing load of 40 cwt. on the square inch, yet in this case it is more than doubtful if the cement had become really hard set. Thus it might well have borne 15 cwt. on the inch in a 9-inch arch, though it gave way under a thrust of 31 cwt. on a $4\frac{1}{2}$ -inch arch—and this would have simply explained the way in which the invert was blown up in all the different places. If the invert had been built in complete vertical bond, there could have been no blowing up; for the brickwork would have been in one solid block. As it was built, however, the great thickness of six rings of brickwork added little to its strength against the water pressure, but added very largely to its cost. Eighteen inches of well-bonded brickwork would have been amply strong for any part of the tunnel; but it could not have been built so as to prevent great leakage in the wetter parts, without the employment of special appliances outside it.

The Severn water did get into the tunnel in two places near the English shore. The new red strata, which are so hard under the central parts of the river, are there much softer; so that at low water the level of the river bed is 8 feet lower than on the English Stones proper, and a shallow low water pond is left by the tide, some three or four feet deep in the deepest places, and called the Salmon Pool. On the other hand, the tunnel gradient, rising at the rate of 1 in 100 from the Shoots, comes nearer to the bed of the river there than at any other point. When the heading was enlarged to the full-sized tunnel, the Severn water in its muddy state did find its way through into the tunnel below, and for a time flooded the seawall portion of the works. On examining the river bottom at low water, a large hole was found; and the contractor then cut two wide gutters to drain the Salmon Pool, and afterwards filled the hole on top with bags of clay. This enabled him to build the arch of the tunnel under that ground, and to make all secure. The same thing occurred only a few chains further on, and was got over in the same manner; but the clay in the bags gradually ran through the pipes with the water, and the holes had eventually to be filled with gravel and coarse sand, which stopped the leakage from the Severn. The spring water from below, however, continues to flow into the tunnel in many places under the Severn, and is of a strongly mineralized character, some of the springs colouring the walls of the tunnel a bright red, and others a jet black. One of these black waters has a strongly sulphurous smell. They are also, as a rule, somewhat saline to the taste.

In making the great cutting on the English side through the Severn marsh lands, some curious discoveries were made. These lands are all level and unbroken on the surface, and were evidently formed at some period by deposit from the Severn. The lowest stratum, lying on the new red, was coarse gravel; with large masses of old red conglomerate, and of mountain limestone, deposited here and there; then a finer gravel, and on this a clear river sand. All this was quite free from mud, having been deposited in water moving too fast to let the fine mud remain. Then came silt or muddy sand; and then a layer of peat, which is remarkable in being below half-tide level, and therefore many feet below the water-level of every tide. After this came a pale coloured clay; and then another bed of peat, 2 feet thick, upon which was a blue clay up to the top soil. Both these beds of peat are below the high-water level of ordinary tides; and yet it is said they were of fresh water origin, and the trunk of a large oak tree was found buried below the upper peat bed. The beds above described preserved their level, though sometimes undulating slightly all along the cutting. They must have been deposited a long time ago; for there were found four river courses, as the men called them (creeks or pills, as they would be called here), cutting through these beds, which must have indicated a former course of the Chessel Pill, or some such tidal watercourse, for they were filled with more recent Severn mud, and this must have taken place long ago, for there was no indication of their position left on the surface.

The works were all completed; and the tunnel was opened for goods traffic on the 1st of September, and for local passenger traffic on the 1st of December, 1886.

Discussion.

Mr. WILLEY said he had listened with sincere pleasure to the able and excellent paper which had been read by Mr. Richardson; and he thought he was expressing the mind of every gentleman present, as well as his own, when he said they had enjoyed an instructive and intellectual treat. As a gigantic piece of work, he ventured to say that it stood before them as a masterpiece of engineering skill; and he rejoiced that they had in their English school of science, gentlemen possessing the capacity and indomitable courage to undertake and carry through such a work so successfully, and so commercially successful, as this had been. Mr. Willey portrayed the old means of communication with Glamorganshire and Carmarthen-shire—a journey which at one time he had to undertake very frequently—and, in concluding his remarks, said the name of the gentleman who conceived the Severn Tunnel would be handed down to posterity with gratitude.

Mr. W. STAGG (Bristol) said he had noticed, in the drawings put before the meeting, that there were several geological faults; and he should like to know what the future effect of these would be on the tunnel. He thought this was a matter which would interest gas engineers, because gasholder tanks were often constructed in ground that had faults.

Mr. RICHARDSON replied that these faults geologically were very antique; and they were choked entirely by gravel and other material. They were never troubled by the Severn water now; only by that running from the springs below.

Mr. E. C. RILEY (Swindon) asked if Mr. Richardson could inform the members what quantity of water had now to be pumped from the tunnel.

Mr. DURKIN inquired whether, while the invert was being constructed, the superimposed column of water was reduced, so as to relieve the inward pressure; and had there been any means left to reduce that pressure now, or was it done by the pumping machinery. Sometimes in constructing gasholder tanks, it was necessary to relieve the floor by inserting safety-holes, so that if the water rose on the side of the tank, it would flow in and out until such times as it was requisite to bring it into use. The holes were stopped up, and then the water passed into the tank, and acted as a counterbalance to the column of water outside.

Mr. N. H. HUMPHRYS (Salisbury) said the paper consisted of such a plain and lucid account of one of their grand engineering enterprises that it really left no matter for discussion. There was nothing of a controversial nature in it; and all they could do was to ask questions for the purpose of getting information. As gas engineers, apart from the general interest attaching to the subject, they were deeply interested in the methods described as to the application of brickwork and earthwork; and when they had read the paper, they would know a great deal more about this important matter than they did before, especially as to the application of the rings of brickwork. Those of them who had to build gasholder tanks knew how important it was to get a good horizontal bond; the failure of many of the tanks built 20 or 30 years ago being due to the fact that they did not get a good bond right through the work.

Mr. W. A. VALON (Ramsgate), on the invitation of the President, said that he thought the members were deeply indebted to Mr. Richardson for bringing this exhaustive paper before them. There were many practical points to be observed as they went through it; but he rather agreed with Mr. Humphrys that they must take the paper home, and read it carefully, to grasp the valuable lessons that it contained. He had done a good deal of tunnelling himself, but not in such difficult ground, or on such an extensive scale, as the Severn Tunnel. The execution of this work showed the marvellous amount of energy, perseverance, intellect, and indomitable courage of everyone from the Engineer to the diver.

The PRESIDENT remarked that it was true the paper was not of a controversial character, but it was one which would serve as a standard of reference in all such work. It was necessary to live in the district to witness and to appreciate the real value that this tunnel had rendered to the railway communication of the West of England. As had been remarked, the paper revealed the faith, the courage, and the perseverance of the originator for at least a quarter of a century. He thought Mr. Richardson had successfully impeached the bond that was adopted in the invert. They ought to have had a diagram there showing the vertical bond;* but when they came to read the paper carefully, it would be found that the author had maintained that, if the bond he suggested had been adopted, the tunnel would have been capable of standing the great water strain that it was now incapable of standing. This was conclusive evidence that the bond adopted was not sufficient, or that the invert was not of sufficient strength, although it was 27 inches; and the very fact that in no case, as Mr. Richardson pointed out, did two rings of brickwork—viz., 9 inches—yield to the water pressure, was a proof that a vertical bond of 18 inches, as first suggested, was quite equal, and would have fully sustained, all the pressure that would have come upon it from the water. Although a vertical bond would have enabled the structure to stand the pressure, he would not say that it would have kept out the water any better. It would be very difficult indeed to construct a tunnel that would be water-tight under such circumstances. Everyone who had had

to build a tank or set bricks in cement knew that it was not an easy matter to make anything approaching water-tight work. The vertical bond, however, would have been a decided advantage, and would have been less costly.

Mr. RICHARDSON, in replying upon the discussion, said the quantity of water they had to deal with in the tunnel was now about 20 million gallons per day; and in the winter, during wet times, about 30 millions. As he had hinted, 18 inches of brickwork would have been amply sufficient to have made the work tight; but there would have had to be something outside the brickwork to have kept it quite tight. It was impossible to build brickwork properly by the ordinary labouring man. In the tunnel the bricks and the cement were water-tight; but it was the labour that was defective. With regard to the pressure on the tunnel now, there was practically none at all, because, wherever the water came in, it formed channels for itself. Besides, where there was pressure, there was spurting of water, but now there was none.

Mr. E. C. RILEY next read a paper, entitled "The Development of Gas Lighting in Railway Trains." This, however, owing to the pressure on our space, we must hold over till next week. In the course of his paper, Mr. Riley said that, since he came to Bristol that morning, he had been exceedingly interested in being informed that, on the very site of the building in which the meeting was being held, there formerly existed works for the production of oil gas. This gas was compressed in small bottles or holders, at a pressure of five to six atmospheres. These bottles were taken round to the consumers, placed on a table, and connected with the burners; and the next morning the Gas Company would send round for the empty receptacles, and take them back to be filled. Mr. Hiram Fiddes told him that his father was the inventor of this system; and he had very kindly brought to the meeting, for the inspection of the members, a sample of the bottle that was then used. The bottle was made in 1824.

The PRESIDENT said it had been suggested, in the absence of Mr. Frank W. Clark, who was suffering from a bad throat, that his paper on "The Enrichment of Gas in Bulk by Means of Carburetters" should be taken as read, and that the discussion on both Mr. Riley's and Mr. Clark's paper should be postponed until the September meeting. Several members were anxious to have a discussion on the supply of gas by prepayment meters; but it was impossible to do this and deal with the papers as well. Mr. Riley had kindly consented to the course suggested being adopted; and as Mr. Clark was not present to answer questions, he (the President) did not think they would be able to discuss his paper with profit.

The members concurred in the suggestion.

Mr. Clark's paper will be given in a subsequent issue of the JOURNAL.

THE SUPPLY OF GAS BY PREPAYMENT METERS, OR SHORT-PERIOD COLLECTIONS.

Mr. G. J. GOUGH (Calne) then opened the discussion on the above subject. He said: The notice on the *agenda* paper states that I am to open a discussion on the supply of gas by prepayment meters, or short-period collections, as a means of increasing consumption. That is not quite what I proposed to do, but to bring under discussion the question simply of facilitating the more general use of gas by providing and laying service-pipes and fittings in small houses. Perhaps the Committee wished to have the subject of increasing consumption discussed in its wider bearings; and therefore so formulated the notice. Nevertheless, I shall be pleased to offer a few remarks on prepayment and short-period collections; but what I am particularly anxious to have discussed is the initial question of getting gas installed in small houses. At Calne, we are in this position: Practically all the houses above £10 rental are supplied with gas; but of those under that rental, and within reach of our mains, not more than about one-third are supplied. It was quite independently of the fact that other companies had introduced the system of laying on services and fittings that I made the suggestion to my Directors that they should undertake it; for I was not then aware it had been tried. The course was suggested to me solely by our own circumstances; and my Directors at once decided to take up the question, and they hope shortly to put the plan into operation. Upon making inquiries, I found that Mr. Valon had adopted it at Ramsgate, in connection with his prepayment system. With the reasons why so large a proportion of these small houses are not supplied, perhaps we are not concerned to inquire here. Probably the chief reason is that the builders or owners have shirked the cost of laying on the services; but at any rate, under the existing circumstances, without the application of some such means as those suggested, the occupiers of these small houses are practically denied the use of gas. I have had no experience with prepayment meters; but I am strongly of opinion that they would not answer in small towns, either as a means of collection purely, or used with the view of increasing consumption. I think the consumers would object to them, unless perhaps a strong inducement to their use was held out in the shape of a substantial discount for the prepayment, which I imagine it would not be possible to offer, and that instead of their use operating to produce a larger consumption, or a more general

* This diagram Mr. Irving has since supplied (see p. 708).—ED. J.G.L.

employment of gas, they would act as a check. The landlord has to trust for his rent; the tradesmen for his goods supplied; and I think gas companies must be also prepared to trust for their gas to a reasonable extent. A reasonably short-period collection should certainly be adopted; and, the collection being then well attended to, there would not be much cause for complaint on the ground of bad debts. At Calne, we collect our accounts quarterly; and our bad debts, speaking particularly as to the small consumers, are almost *nil*. Whether we should find it more advantageous to adopt a shorter period collection in the case of small householders and cottagers—say a monthly collection—I incline to think we should. The amounts to be collected would be smaller, and perhaps more readily paid, and probably there would be more gas consumed, and less grumbling. I should like to hear expressions of opinion upon this point. The simple proposals I am suggesting to my Directors for adoption just at present, are the following: That they shall, with the consent of the landlord, and by the wish of the tenant, provide and lay on internal service-pipes, and also brackets or pendants (unless the tenants should determine to provide them themselves), and charge a permanent annual rent for their use; the consumers to keep them in repair, but the Company to make the renewals when required. I propose to lay the fittings on the ground floor only; and in my case, the average requirements would be about as follows: Fifteen yards of $\frac{1}{2}$ -inch composition pipe, $\frac{1}{2}$ -inch meter-tap, a pendant for the front room, a bracket for the kitchen, and provision for a boiling-stove. The cost of this would average under £1. I would charge a rental equivalent to 10 per cent. on this sum, which would be equal to 6d. per quarter, or 2d. per month, with a monthly collection. The landlord or tenant are to be at liberty to purchase the fittings at any time at their value. Under this plan, there would be no complication upon a change of tenancy. If the consumer should discontinue using gas, or if an incoming tenant should not require it, the connection would be cut off, and the internal service-pipe left for possible future use. In my case the Company would probably supply the fittings, and their servants do the work; but the work ought to be given to tradesmen if preferred. I cannot help thinking but that we shall find a large number of small householders willing to accept these terms; and if this should be found to be so, our object will be gained. I shall be glad to hear your criticisms and opinions; but I wish you to bear in mind that the remarks I have made only apply to small towns.

Mr. VALON said he thought the proposition put forward by Mr. Gough was quite sound. Of course he could fairly well recognize that in such a town as Calne, the gas manager would know everybody; and in such a case the risk of bad debts was reduced to a low point. There were some small places under his own supervision where he thought that would apply; but when they came to towns like Ramsgate, then it was not so safe. In the first instance, before the prepayment meters were adopted there, they tried to get on with the ordinary meter; and they fixed something like 120. But the difficulty was to get small householders to understand how much gas they might or might not burn; and, for that class of people they did consume considerable quantities of gas, and this led to disputes. They then introduced a meter by which a certain amount of gas could be used by these consumers and no more; and, except in a few instances, where they had miscalculated, they had had no disputes since. The whole of the original meters fixed without a stop had been taken away. The meter was really only an ordinary one with a stop on the index, so that, when an arrangement was made to burn 1s. or 1s. 6d. worth of gas, the stop was put forward to that point; and when the hand arrived there, it stopped. In the meantime, if the consumer burned that quantity of gas, he had to apply to the gas offices for a further supply. They found in Ramsgate that they had reached very nearly the end of their extending power as far as the consumption of gas was concerned (except they depended entirely upon gas-stoves and so on) unless they went into some scheme such as was now under discussion. They had at present from 600 to 700 consumers who lived in houses of a rateable value of from £10 to £30 a year; and these people would otherwise never have been consumers at all, for the reason that they could not afford the first expense of fitting up their houses. The Corporation charged them 4½d. per 100 cubic feet of gas, or 3s. 9d. per 1000 feet; being 7d. more than the ordinary consumers paid. Putting the 7d. on one side, they found this would be sufficient to wipe out the cost of the fittings in five years; so at the end of that time the outlay for the installation would be free. Supposing the difficulty arose, as he thought was foreshadowed by Mr. Gough, that someone took one of the houses that had been fitted up for the previous tenant and did not want gas, they had no alternative but to leave the fittings there; but they made an arrangement with the landlord by which the fittings remained the property of the Corporation. In a case where a new tenant came in who had been a consumer under the old system, he could, if he chose, go on paying as formerly. He was sure that, if the success at Ramsgate followed the adoption of the system in other towns, the gas managers would be pleased they had taken it up.

Mr. A. V. DANIEL (Portishead) asked whether anyone present had tried the automatic meter, in which, instead of the attendance of an official of the Gas Company being required to turn on the quantity of gas paid for, the consumer could get a supply by dropping in a coin. He knew that such meters had been in

use at Clevedon; but, he believed, they had not been very successful there.

Mr. W. CHEYNE (Briton Ferry) remarked that he had tried both the shilling-in-the-slot and the penny-in-the-slot meters; and he had found them a perfect success. The meters he had used were made by two different makers.

Mr. H. SAINSBURY (Trowbridge) said he had had some experience with small consumers in Trowbridge. They had a large number of working people there, and many were consumers, although the gas was sold at 3s. 4d. per 1000 cubic feet. Many of the bad debts they had were among the tradesmen, and not among the poorer class of people. With regard to laying the service-pipes to small houses when they were being erected, some cottages had lately been built at Trowbridge; and the landlords had put in the pipes and the Gas Company the service-pipes. In a range of eight or ten cottages, however, they found they did not get perhaps a couple of consumers.

Mr. N. H. HUMPHRYS said that in this question of extending the use of gas, there was a tendency to run too much in one rut, so to speak. In almost every town, there were different circumstances; and the best thing was for the gas manager to look round quietly, and see what would suit the fancies—he might almost say the eccentricities—of the consumers they had to deal with. Some 30 or 40 years ago, a customer sometimes had to go to the gas-works three or four times before he could get a service-pipe at all; and to lay 20 yards of pipe free was thought simply ridiculous. But this was changed now. The service-pipe was laid free; and some of them even went further, if they saw a chance of securing a regular customer, and did not object to a little additional expenditure. But it seemed to him that, while discussions of this sort as to the general principles to be adopted were very beneficial, they must go somewhat further themselves when they got home, and must look round their own district, and do the best they could for the different classes of people they had to deal with.

Mr. DURKIN said he quite agreed that each manager must be guided by the circumstances in his own particular locality. He had an instance where a new district in his neighbourhood was built upon. The builders introduced gas-pipes into the houses; and he was very liberal in laying the services without any expense to them. By-and-bye he found that no gas was being used, so he left off laying the services; for he thought it was a very improper thing to have a lot of pipes in the ground, and run the risk of getting them broken, and have leakages and so on. He very much upset one builder because he would not put a service-pipe into a house that was partly erected. He said he would wait until it was occupied; and he found he had done right, for the tenants had not yet applied for a supply of gas.

Mr. J. NICHOLLS (Crewkerne) observed that he had fitted up twenty cottages with a bracket in one bedroom, a pendant in the front room, and a bracket in the kitchen. The cost to the Company was about £1 for each cottage; but up to the present, they had only one consumer out of these houses.

Mr. T. W. R. WHITE said that he found the penny-in-the-slot meter worked very nicely. The great advantage was this—that with the prepayment meter, the consumer could get the gas as he wanted it; he paid for it as he went along; and was not troubled with an account at the end of the quarter. In one instance where they had a prepayment meter, to their surprise the first quarter, the consumer used 14s. worth of gas; and in the second quarter (in the meantime they had had a little cooking stove fixed), the Company collected £1 5s. 7d. Later on, in one quarter the box became so full of coppers that the consumer was obliged to send to the gas-works for someone to go and empty it. Unfortunately he could not get any more meters just now; and so was at a standstill.

The PRESIDENT said his experience coincided with that expressed by one of the speakers, that the poorer consumers were the best payers; and he believed this was so in Bristol—at all events it was his experience in the north. But in poor districts they did not generally use gas; they preferred oil. The gas companies supplied what they considered was a safer, better, and cheaper light. What, then, were the obstacles in the way of the extension of their business in this direction? Undoubtedly it was the quarterly account—the uncertainty of that account. If they could by any means have an arrangement whereby the consumers could pay for the gas as they used it, he was sure there was a wide field for extension. There were, however, two or three things required. First, the meter must be reliable; and, secondly, every facility should be given for furnishing the fittings something after the plan adopted by Mr. Valon. The extension of gas in the poorer districts in opposition to the use of oil was a subject which demanded, and ought to have, the close attention of every gas manager.

Mr. GOUGH said he should have liked to have heard the opinion of other gentlemen who had put some such scheme as he proposed into practice. The experiences of the gentlemen who had spoken had been widely divergent. While one speaker found in a row of houses fitted up with pipes that the tenants would not consume gas, another had consumers who were only too anxious to use more gas before they could get it. There was a great field open for the sale of gas among the working class. They had had difficulties in the way which had prevented a more general use of gas in the past; and it was the duty of gas managers to remove those, and to do all in their power to increase the consumption. In opening the discussion, he

omitted to mention a distinction between his plan and that in operation at Ramsgate as to payment for the fittings. He had suggested a fixed average rental—a percentage upon the outlay; while at Ramsgate, he believed it was fixed upon the consumption. He should like to know whether Mr. Valon saw any objection to his proposal. At Ramsgate, with an increasing consumption, they had an increasing payment for the fittings; and he rather feared that, instead of assisting in extending the consumption, this would tend to prevent it.

Mr. VALON said there was no great variation in the consumption in the class of houses they supplied under his plan. The average consumption last year, as far as he remembered, was 13,000 cubic feet per house—he believed it varied from 11,000 to 14,000 cubic feet. Of course, the larger houses consumed a little more gas; but their fittings were rather more expensive. He had no doubt, however, that it would work hardly in one or two cases. The average cost of fitting up the houses was something like £4. He had not found any objection to his system up to the present; but he quite agreed that a percentage on the outlay might be the most equitable way of charging for the fittings.

Mr. T. HARDICK (Salisbury) remarked that each one would have to take his own course in this matter. At the present time there were very few cottagers who could afford to burn gas. At Salisbury, they had gone on very quietly; but they never sold as much as 14,000 cubic feet of gas in a year to cottagers. If they reached 1500 or 2000 feet, it was as much as they could do. The houses of £30 and £40 rental never had a consumption of more than 10,000 cubic feet per annum. Mr. Humphrys had just issued in Salisbury a circular on the subject of gas for cooking and heating purposes, in which he stated that they had some 500 gas-stoves now in regular use. He also spoke about the advantages of gas as a fuel; and then proceeded to mention that at Salisbury they were among the first to offer their customers the advantage of gas-stoves on hire. For the last 30 years they had supplied them at a rental of 2s. per quarter upwards, according to size; and, as the result of experience gained during that period, they were able to send out stoves that would be sure to give satisfaction, if used with reasonable care. It not more than 40 feet of pipe was required, the stoves were fixed free of cost. Mr. Humphrys had exercised himself; and now they had also more than 100 high-power lamps in use in the city. For these they received a rental of 2s. 6d. or more, according to price and size. The stoves returned at least 11 per cent.; so that they were a far better investment than Consols.

VOTES OF THANKS.

The PRESIDENT proposed that the thanks of the meeting be accorded to the gentlemen who had kindly provided papers.

Mr. LOWE, in seconding the proposition, observed that they had a large contingent of South Wales friends with them that day; and he was still hoping to see the district of the Association extended, so as to include South Wales.

The motion was unanimously passed.

Mr. RILEY suitably acknowledged the vote; and the proceedings then terminated.

The members and friends afterwards dined together at the Royal Hotel; and a very pleasant evening was spent.

VISIT TO THE SEVERN TUNNEL.

On the following day, a party of about 50 visited the Severn Tunnel, under the guidance of Mr. Richardson and also of Mr. Hoskin (Resident Engineer). In view of the ample description of the work given in Mr. Richardson's paper, its inspection took place under favourable conditions. The chief features of interest, however, were the large pumping works, and the arrangements for ventilating the tunnel. An account of the visit will be given next week.

INFORMAL MEETING OF SCOTTISH GAS MANAGERS.

The Ninth Annual "Informal" Meeting of Scottish Gas Managers, convened by Mr. J. M'Gilchrist, of Dumbarton, with the view of keeping alive the memory of the West of Scotland Association (now incorporated in the North British Association) took place in the Victoria Hotel, Glasgow, last Thursday afternoon, under the presidency of Mr. T. D. HALL, of Montrose. There was a very encouraging assemblage of managers from both the eastern and the western divisions of the country, though, beyond the gentlemen whose names appear in the report as having taken part in the proceedings, there was no one of very special note.

Mr. HALL, on taking the chair, proceeded to deliver his opening address. Having thanked his colleagues for selecting him to fill the position he occupied, he said that the meeting, though informal by name, was year by year assuming proportions worthy of a more imposing title. His hearers must remember that they represented an industry which had no existence a hundred years ago, and which to-day employed capital to the amount of more than £100,000,000 sterling in Great Britain alone. They should also remember that this meeting represented the gas industry of Scotland, and that therefore it was a gathering of no small importance. He must, at the outset,

acknowledge, as he was sure they all did, their indebtedness to their esteemed and energetic Convener—Mr. M'Gilchrist—who spared no time or trouble to make the meeting a success, and whose genial countenance and winning ways guaranteed the attainment of this object. This was an important year in the history of gas lighting; being the centenary of the discovery of coal gas by William Murdoch, who, in his house at Cross Street, Redruth, in the year 1792, first produced and consumed coal gas. It was in the same house a few years previously—in 1784—that Murdoch, also the inventor of the steam locomotive, made and tried the first locomotive run in England. It was still in existence; and though only a working model, it was sufficiently large to demonstrate the practicability of steam locomotion, and was now a historic relic of great interest, inasmuch as it was the basis upon which the whole railway system of the world had been built. This model was in the possession of the well-known engineering firm of Tangyes, of Birmingham. It was not generally known that this enterprising firm, a few years ago, fixed on Murdoch's house at Redruth a mural tablet bearing the following inscription: "William Murdoch lived in this House 1782-1798. Made the first Locomotive here, and tested it in 1784. Invented Gas Lighting, and used it in this House in 1792. Erected by Tangye Brothers, Birmingham." Having had the honour of representing Redruth as its Gas Manager for some years, he (the Chairman) was able to exhibit a photograph of Murdoch's house, taken before the tablet was built in; also one taken this year, showing the position of the tablet. He had also a photograph of Murdoch's model locomotive, which was interesting. Also, through the kindness of Messrs. R. Laidlaw and Son, they had a bust of Murdoch to show that day. Mr. M'Gilchrist, the Secretary and Treasurer of the Murdoch Memorial Fund, would, he trusted, have something to say regarding the arrangements for placing the bust of Murdoch in the hall of the Wallace Monument at Stirling next July. Passing on to business matters, the Chairman remarked that, having gone through another winter's work, he thought he spoke the minds of most of those present when he said that it had been a comparatively prosperous season, and free from any great cause of annoyance. The absence of railway strikes—a source of trouble not likely to affect them again—and of colliery disputes of any magnitude, and the generally settled condition of the labour market, had all tended to carry them peacefully and profitably through the winter season. Workmen were beginning to find that gas managers were not now so much at their mercy as in days gone by. The introduction of machinery and labour-saving appliances had, he thought, a quieting effect on the mass of labour; and the general adoption of the eight-hour system, wherever practicable, had been a source of relief to both managers and employees. And, after all, he questioned if, in any other industry, there existed so much kindly feeling between masters and men as in that concerned with the supply of gas. Whether or not this was due to the genial natures of the managers or to the docility of the men, he left each to say for himself. The greatest element of trouble during the past winter had been the prevalence of fogs. Happening, as they usually did, at a time of the year when gas-works plant was already taxed to its utmost extent to meet the ordinary demand, fogs proved to be unfortunate for some companies. But they gave managers experience which, if taken advantage of, guided their future actions under similar circumstances. It would be interesting if anyone present could give the meeting the experience he had gained in foggy weather. He himself had not been troubled with the real "pea soup," "bottled-up smoke" fog to be seen in large towns. The fogs, or rather mists, of Scotland—at all events on the east coast—were not of a dark colour; and though at times they were very dense, they were not difficult to light up—at least with gas. The loss of the *Eider* during a fog, within three miles of the most powerful and perfect electric light in the world, clearly indicated that electricity was not the best illuminant for lighthouses. From what he had observed, he thought that the nearer they approached the nature of the light of the now defunct link-boy of London, the more impression they made on a fog. A lambent or smoky flame seemed to possess great diffusive power. The penetrating capacity of a torch or a naphtha lamp was very marked on a misty night. He observed a good example of this not long ago. On a thick misty night, two steamers were discharging close to each other—one using powerful electric lights; the other, Wells' oil-lamps. The former was lost in the mist, while the latter was effectively illuminated. He could not help thinking that the nature of the flame, apart from its intensity, had a good deal to do with its diffusive power, and consequently its effect on a fog. Some of those present who had had an opportunity of observing the action of gas-lighted buoys would doubtless touch upon this point. Turning to manufacturing operations, the Chairman remarked that the still prohibitive price of first-class cannel, coupled with grave rumours that the seams are being worked out, and the supplies exhausted, had caused the subject of enriching coal gas by means of liquid hydrocarbons to occupy the attention of many gas engineers; and evidence was not wanting to show that progress was being made. One fact alone established the truth of this assertion—viz., that the London Gas Companies buy thousands of pounds' worth of mineral oils and spirit every year. This, they all knew, had been forced on gas manufacturers by the high price of cannel, which was used as an enricher by English gas companies; by the poor quality

of their common coal; and by the strict and absurd testing clauses under which some gas companies had to work. He had had no practical experience with oil as an enricher. But he was glad to see Mr. Mackay, of Peterhead, present; and he hoped he would be able to give them some of his experience. Mr. Mackay's appliances appeared to be inexpensive, and his results good; being equal to those obtained from the best cannel coal, at one-third less cost. From experiments made at some of the London gas-works, it had been found that, to raise 16-candle gas one candle by means of oil instead of by cannel coal, a saving of $\frac{3}{4}$ d. per 1000 cubic feet could be effected. Though it might be a comparatively easy matter to raise 16-candle gas to 17-candle, yet to raise gas from 17 to 18 candles would be a different and also a difficult matter; and he was afraid that, as the quality of the gas to be enriched increased, so would the difficulty of incorporating the oil vapour with it to form a permanent or fixed gas. The question came to be, Was 20-candle gas capable of being further enriched with oil? If so, Would it carry the oil gas with it to the point of ignition? He was afraid not, unless they could chemically combine the two gases so as to form a permanent gas. Something must be done to get a substitute for cannel, and that at once. It was impossible to supply gas at anything approaching 5s. per 1000 cubic feet and pay for cannel coal as much as 35s. per ton at the pits. If they failed to enrich with a hydrocarbon, the only alternative left them was to reduce the illuminating power to such a standard as their English brethren would consider perfection—viz., 20 candles. This quality of gas could easily be obtained from any of their second-class cannels, provided condensation and purification were carefully attended to; and really he failed to see the hardship of being compelled to use 20-candle gas. Speaking from an experience of ten years as a manager of works supplying gas below 20-candle power, and during a like period supplying gas above this quality, he was inclined to say the former period was the more pleasant of the two. The Chairman went on to deal with consumers' complaints, and advocated the appointment of inspectors to inquire into and set right, or suggest means to make good, any defect in the supply of gas, to fix good burners free of charge, and generally to advise consumers—in short, to canvass for business, as is done in other industries. Speaking of the annoyance caused by the accumulation of water in consumers' meters, he said he was not going to discuss the question of wet *versus* dry meters. They all knew what these were; and if the Board of Trade took out of its pigeon-hole a little Bill anent dry meters, they might have some new experiences of a not altogether pleasant or profitable nature. The wet meter was, under certain conditions, a perfect measure; but it had one fault—that of charging the gas with aqueous vapour, which, in due time, was deposited in the form of water in the fittings. This caused the inevitable cry for dry meters, which, of course, was a cure for that evil. What was to be done to remedy it? Either they must use in the meter a liquid which the gas would not take up, or they must dry the gas after it had passed through the meters. Chloride of calcium had been suggested by the writer of a paper which was read before the Austrian Gas Association; and the meter manufacturers might look into the matter. The vexed question of a reliable standard of light was at present agitating gas people; and now that a Committee had been appointed to investigate the whole question, they might hope that it would be settled satisfactorily, once for all. It would be unbecoming were he to close his remarks without saying something about their friend and ally, the electric light. They had heard a good deal about it during the past year; but they had not seen much. There had been a good deal of the "big drum" business. Now, however, there were signs of the performance going to begin, not only in the city in which they were assembled, but also in Edinburgh and Dundee; and it was possible that the Chairman at the meeting next year might have something to report. All the same, the electric light was steadily progressing—slowly, but surely, assisting the gas industry as it went on. In his town, where three electric light installations had been introduced, the consumption of gas continued to increase. He found that its adoption tended to necessitate the employment of more powerful lights by other means. The electric light had a legitimate sphere of its own, quite distinct from that of gas; and yet each illuminant might find ample field for usefulness and profit. He hoped he had touched upon some points of interest with sufficient force to induce some of his hearers to take up and discuss them freely and frankly, as it was only by so doing that they could benefit each other.

Mr. A. WILSON (Dawsholm) opened the discussion. On the subject of enriching gas, he said his experience in London lay more in the making of water gas and enriching it with cannel gas. There they considered that, if they produced 16-candle gas, it served their purpose very well. He thought so too; and he believed they would all have to come to this standard. The gas lighting in London was quite as good as anywhere else; it simply meant that the fittings and burners were larger, and consumed the gas to advantage. Where rich cannel gas was used, they did not seem to be much better off. It was a case of a smaller flame; but really the illumination did not seem to be better. The Chairman appeared to be very well off in not having the annoyance of fogs. In London, and also in Glasgow, he found that the first day's fog was looked upon as a relief; but when it extended to two or three days, or more, gas managers

simply had to supply all they could produce. It was then a question of storage; and few gas undertakings had sufficient to cope with this difficulty. In the matter of electric lighting, they found in London that, wherever it was introduced, the quantity of gas consumed went on increasing. If one shopkeeper adopted it, the others, who still used gas, employed more light. He believed that the electric light would find its own place, and that there was no fear of their ever wanting a job in the gas industry because of it.

Mr. A. MACPHERSON (Kirkcaldy), the President of the North British Association of Gas Managers, said perhaps it was only proper that at that meeting they should first refer to the inventor of gas lighting—William Murdoch. There was not the least doubt that since the days of Murdoch they had made vast strides in gas manufacture. They had been told very frequently that they had not advanced; but whoever said this was an unfair critic. They had made great progress; and he had no doubt that this would continue. He thought the main thing they had to consider was how to derive more light from a given quantity of gas. If they could, by the introduction of superior burners, or by the application of science, get as much light out of 20-candle as they now obtained from 25-candle gas, they would be taking a step in the right direction. They hoped to see this accomplished. When they looked back at the best burners they had only a very few years ago, and considered that, with the regenerative burners now in use, they obtained 60 per cent. more light from gas, they were led to confidently anticipate that they would accomplish more in the future. There was no doubt, he thought, that they had to face the electric light. He did not wish to blink the fact that it was to be a serious competitor for gas and other illuminants; and they should look it squarely in the face, and do their best to meet it. He did not think they need look for an entire eclipsing of gas. Oil was a more serious competitor for them. There was no doubt that the oil-lamp gave a very good light; and some people preferred it, because they could get it whenever they wanted it. A great number of people, who had got a sort of sanitation on the brain, also preferred it as a more sanitary light—altogether ignoring the fact that the oil-lamp was three or four times worse than gas in that respect. He had no experience in the enriching of gas; and, like their Chairman, he was afraid that the permanency of such a gas would not be very great. However, they might be able to get a chemical mixture, instead of the mere suspension of the hydrocarbons; and if they did, there was no doubt that oil would be of great benefit to them. He did not agree with the Chairman on the question of meters. He said they should fit their houses properly; they should take their stand, and say to people that, if they did not fit up their houses properly, they would not be responsible. In 80 per cent. of the houses which were being erected, the gas-pipes were just thrown in; and nearly all the complaints came from houses where the fittings were bad. He was persuaded that condensation after the gas passed the meter was the cause of the trouble, and that the aqueous vapour which it took up from the meter was very, very small.

Mr. R. ROBERTSON (Bathgate) said he had been delighted with Mr. Hall's address. As he said, this was a most important year in the annals of the gas industry. They were looking forward to a very important meeting in July, when they would commemorate the centenary of such a wonderful man as the pioneer of the industry. He still held the opinion he had expressed before—that electric lighting was doing no harm to the gas industry. What they were hearing from all around bore out that the electric light was only the handmaid or the helpmeet of gas. On the question of the accumulation of water in pipes, he thought that the Chairman was entirely wrong, and that Mr. MacPherson had stated the real cause. He never had a complaint of water accumulating where a house was well fitted up; and he had found that in a house that was ill fitted up, the accumulation was the same with a dry as with a wet meter.

Mr. J. HALL (St. Andrews), in a humorous speech, said he thought, considering his relation to the Chairman, he might be excused from making any remarks on the address. Of course, as they knew, he had differed from the Chairman many times; and he that day differed from the President of the North British Association in what he had said with regard to meters. He thought there was no doubt that the water which was found in the pipes came from the meters; and also that the water lodged in the pipes because they were ill laid. There was another fact—that water would collect in a pipe if there was a current of cold air blowing on the pipe. He supposed he was about the oldest man in the meeting; and he had probably been a good deal out of touch with some of them. He could not say what their opinions were; but those who had had experience of dry meters would be able to state whether or not it was the fact that the dry meter cured the jumping of lights. It was his experience that it did. They had a difficulty in putting bad fittings right. Architects of even large houses found a trouble in carrying the gas-pipes without leaving a small corner where water might accumulate. If they had an old house, it was much worse; because people, before they would allow their house to be torn up, would rather order the meter to be taken away. He had made an effort to attend the present meeting. He was very anxious to see how the young men would conduct themselves, and if they would be able to take the old ones' places. It was a day of great things in St. Andrews. They were conferring degrees,

which made the old city bright with a display of millinery. That did not mean much; but there were certain letters added to names, which did mean something. Next year they would have ladies in their classes at St. Andrews; and what would they think of having a lady as an assistant gas manager? If they were to have lady doctors and lady teachers, did they not think they might have a lady inspector as well? This was an age of high-class schools, though he rather thought that the higher-class education was running a bit wild. They wanted something a little more practical. It was all very good to pass an examination, and get a degree, with a few letters at the end of one's name; but it was found that the benefit often terminated there. It was an age of bursaries; and was it not strange that there was no bursary in connection with the North British Association? If they had such a thing, it would be in their power to give some young man an education in chemistry, and so to establish an analyst who could assist small gas companies in getting an analysis of anything. It also occurred to him, seeing that coalowners were making such fortunes out of gas companies, that some of them out of their thousands might assist in the getting up of a fund. With regard to the illuminating power of gas, he believed they would be compelled to come to the 20-candle power. At one time, he did think that they should sell light and not gas; but the times had changed, and those coalowners who asked such a large sum for their coals should just be allowed to keep them for a little time. Gas companies could go more in for coal of a cheaper class, and try to secure superior burners for their consumers. He thought it would be better in every way if this were the case.

Mr. J. M'GILCHRIST (Dumbarton) was very pleased with the Chairman's address, and with the fine turn-out of gas managers and other friends. It was rather remarkable that two St. Andrews boys were the Presidents of the two Associations in this the centenary year of gas. St. Andrews was in Fifeshire; and the first Gas Association that ever was started was formed in the kingdom of Fife. The only unfortunate circumstance connected with the matter was that Murdoch did not happen to be born there. However, they must keep something for the West. Their young friend Mr. Mackay, of Peterhead, would tell them his experiences with oil. Peterhead was a wonderful place, because it was there that the first experiment was made in the calming of the troubled waters with oil. Notwithstanding all that had been said of water gas and oil gas, he had still a love for coal gas; and he thought that, if the coalmasters were wise, they would not drive gas managers to the manufacture of oil or water gas. If, however, they continued to charge such exorbitant prices for coal, he was afraid it was a matter of prime necessity that they would require to look in other directions for material wherewith to produce a high illuminating gas. If they could produce, per unit of light, gas of 25-candle power cheaper than they could gas of 16-candle power, every argument was in favour of their manufacturing a high illuminating gas. It was a question of cost entirely. Up to within the last two or three years, he held that they could manufacture gas per unit of light cheaper by using coal than by any substitute that had been put forward. He had all along held out for wet meters. Dry meters certainly had cured what Mr. Hall had referred to; but he thought Mr. MacPherson did right in pointing out that they should insist upon the pipes in houses being properly fitted up—no matter whether they were to use a wet or a dry meter. Gas managers, he thought, had been a little too lax on this point. It was a disgrace to see how gas-pipes were laid. He did not mean to close the discussion; but he thought it was due to their Chairman that they should give him a hearty vote of thanks for his excellent address; and this he moved.

Mr. R. S. CARLOW (Arbroath) was delighted with Mr. Hall's address. The question of adopting a lower illuminating power would require them to take into consideration the size of their main-pipes and fittings, and the provision of more gasholder room and purification plant. In fact, they would require to remodel their gas-works entirely. There would be such a great increase of output, that they would not have accommodation for it. It was a subject which needed great consideration; and every manager would have to think out his own individual case. They all knew that electricity had made very great strides in some places; but he must say that his experience had been the same as that of other gentlemen. They had had one large installation established in Arbroath; but their gas consumption was on the increase. He agreed with Mr. Hall, of St. Andrews, in what he said about meters. A good deal was due to the meters. He thought that a certain proportion of the water in the meter was absorbed by the gas, and carried into the pipes. He had known houses, where within about six or eight months after they were fitted up, the gas got very bad with jumping, and a dry meter had put a stop to it. This was especially the case if the meter was in a hot place, or where the meter was small.

Mr. MACKAY (Peterhead) said he did not take up the question of oil enrichment from any love for oil gas in preference to coal gas, but because he was forced into it. In December, he could not get any first-class cannel; and it was necessary that they should keep up their illuminating power, if for no other reason, for want of gasholder room. He tried oil; and the results he got were such as to warrant him in incurring some expense in carrying on the practice on a permanent scale. They first tried it with fine paraffin; but it was too expensive, and they procured

unrefined oil from the oil companies. It was found to be thoroughly effective. They injected it into the retort, by means of an ordinary force-pump, at a pressure of 80 lbs. For a time, they got on all right; but after a bit, they began to have trouble with the tar and liquor. The liquor got into the tar well; and they had trouble in getting rid of it. They did not know whether they were to distil for liquor or tar. This continued; and then they laid aside the paraffin for a time, and the trouble ceased. They found that up to a certain point, the paraffin brought up the illuminating power; but then after that they realized no benefit from it. They had only a jet photometer in Peterhead; and the coal they started with gave a durability of $4\frac{1}{2}$ minutes. By injecting oil to the extent of 6 to 10 gallons per ton of coal, they brought up the durability to about 20 minutes; but beyond that, they could not get. These results he still had to check. He might say they had doubled the pressure at which they injected the oil, making it from 100 to 200 lbs. per square inch; and they had found that a considerable quantity of the paraffin was turned into vapour before it entered the retort. Latterly, they had not injected the paraffin over the red-hot coke, but into the empty retort after the coke was drawn; and they got the same results by that process. They took a charge of coal and paraffin turn about. All that a retort could do, to do the thing justice, was about 6 gallons of oil per charge. There was a point with regard to the naphtha which he had not satisfied himself upon yet. After he began to use oil, it fell from 34 or 36 to about 15; and he could not say whether it was carried off by the paraffin or not. Possibly he might be able to say something about that in July. They were still using from 10 to 12 gallons per ton of coal; and they were having no trouble.

Mr. D. M. NELSON (Glasgow) thought that wet meters had stood the test. Dry meters gave less trouble; but they had the disadvantage of not being so durable.

Mr. D. MACFIE (Edinburgh) said a question had been put to him, as to whether it was a fact that trouble had been found in the governors of regenerative lamps. In the early days of these lamps, the governors had an up-current, and there was trouble because it formed a trap for water; but that had been done away with, and the trouble did not now exist. With the down-current system, any condensation was simply dried up by the heat of the lamp itself. He should, from a consumer's point of view, like to put in a word with regard to the quality of the gas. He had had some experience in London of 16-candle gas; and as a consumer he much preferred to have 22-candle gas. They could certainly get as much light from 16 as from 22 candle gas; but the condition of the atmosphere was very different. Even in an ordinary hotel living-room, this was apparent; and it could not be otherwise, when the quantity of gas consumed was taken into account. In Edinburgh, he might say, the Gas Commissioners made a mistake, on reducing the illuminating power of the gas, in that they did not take the public into their confidence, and tell them they had done so. He himself had no difficulty in getting light, because he knew the conditions, and he legislated accordingly; but his friends, not having the same knowledge, could not get enough light.

Mr. QUIGLEY (Penicuik) thought Mr. Mackay's statement as to oil gas was very important. He would like to know whether Mr. Mackay took a note of the temperature; and whether he was troubled with naphthalene.

Mr. MACKAY stated that he did not take a note of the temperature; but it was pretty even. They had had no trouble with naphthalene; but he might say that they tried some Russian petroleum, and they found that it would not work at all.

Mr. QUIGLEY: Were you troubled with carbon forming in the retorts where you injected the oil?

Mr. MACKAY said there was a thin skin of carbon all over the retort when they used the oil alone; but the next charge of coal took it off.

Mr. ROBERTSON (Dunoon), speaking of gas-lit buoys, stated that there was one on a dangerous rock about 500 yards off the shore at Dunoon. The gas was supplied to it from a reservoir in which it was stored at a pressure of about 120 lbs. per square inch; and the supply lasted about three months. A tank steam-boat came round renewing the stock of gas. He did not believe that any light was of use in fogs. On the subject of meters, he said that their business was to sell as much gas as possible; and if a meter was troublesome, it was the duty of the gas manager, rather than put the consumer to trouble over fittings, to let him have a dry meter.

Mr. J. HALL (St. Andrews) remarked that the discussion had become one upon fittings, and said that malleable galvanized-iron fittings were being placed on the outside of houses.

Mr. MACKAY stated that at Peterhead all the Government buildings were so fitted.

Mr. MACFIE observed that he knew many architects now specified for such pipes.

Mr. BALLANTYNE (Rothesay) thought his experience must have been unique; because in his case it was dry meters that gave trouble. In a wet meter, the condensation would have run into the meter and done no harm; but when it ran into a dry meter it stopped the working. In Rothesay, however, most of the meters were near the front doors, and were thus exposed to cold. He thought it had been forgotten that, if gas absorbed moisture from the water in the meter, it must do the same from the water in the gasholder.

Mr. D. VASS (Portobello) raised the question of how long a consumer could claim repayment in the event of his meter having been found to be registering fast. The statute stated that a meter was to be held to be correct, unless it were proved to be incorrect. If the word had been "until" instead of "unless," they would be safe. But it was open to a consumer to claim repayment; and there was no law as to how far back he could go.

Mr. RUTHERFORD (Langbank) having spoken of his experience in the registering of meters,

The CHAIRMAN closed the discussion. He said he had all along advocated wet meters; but at the same time they could not get rid of the fact that water did come from them. In an experience extending over 20 years, he had never known a case of water in the fittings where a dry meter was used. The water that was found in pipes was perfectly clean, and was quite different from that resulting from ordinary condensation. He thought everyone had admitted that dry meters were a cure for water in fittings.

Mr. MACPHERSON remarked that he did not.

The CHAIRMAN (continuing) said that in his town they had upright governors on the Wenham lamps; and they could not supply them with gas till they put on dry meters, and then the trouble was removed. The lady assistant was not altogether a new idea; and he quite realized that a lady who knew something about the management of gas in stoves would be able to do a great deal in the way of increasing the consumption of gas. The bursary proposal also was not new. It had been agreed that the balance of the Murdoch Memorial Fund, after the erection of the bust (which was only a preliminary matter), should be applied to the foundation of a bursary for the benefit of young gas managers or the sons of gas managers. He thanked the meeting for the hearty way in which they had received his remarks.

Replying to Mr. Vass, the CHAIRMAN said he did not think a consumer could ask repayment for more than the period in which he made complaint as to the working of the meter.

Mr. VASS said he was afraid this was not so, but that a Sheriff might go farther back if the consumer demanded.

Mr. M'GILCHRIST proposed Mr. A. Wilson, Superintendent of the Dawsholm and Maryhill Gas-Works of the Glasgow Corporation, as the Chairman of next year's gathering.

Mr. CARLOW seconded the motion; and it was carried—Mr. Wilson agreeing to accept office.

On the motion of the CHAIRMAN, Mr. J. M'Gilchrist was appointed Convener of the meeting; and he expressed his pleasure in again undertaking the duty.

A vote of thanks to the Chairman was then put formally by Mr. M'GILCHRIST, and agreed to.

The CHAIRMAN having briefly replied, the proceedings closed.

The company dined together, as usual, in the evening; Mr. Hall again presiding, and Mr. A. MacPherson occupying the vice-chair.

Gas and Electricity at Burton-on-Trent.—At the last monthly meeting of the Burton-upon-Trent Town Council, the Gas and Electric Light Committee presented a report in which they recommended the acceptance of the joint tender of Messrs. J. Fowler and Co., of Leeds, and Messrs. Hammond and Co., of London, for plant (exclusive of building) for the introduction of the electric light into the borough, subject to the sanction of the Board of Trade. Alderman Lowe, in moving the adoption of the report, stated that, when advertising for tenders, the Committee instructed the Gas Manager (Mr. F. L. Ramsden) to prepare specifications and conditions on a broad basis, so as to leave the system of installation entirely for the tenderers to suggest the one they thought most suitable for the requirements of the town. The result was that they received 16 tenders; 13 being on the high-tension alternating current transformer system, and the remainder on the continuous current system, with transformer sub-stations and storage batteries. After careful inquiry, they had decided to adopt the former system. The tenders were reduced to two, and those they now recommended were unanimously selected. In the course of their inquiries, the Committee were informed, without exception, that the cost of electricity as compared with gas as an illuminant was high. They therefore had no reason to fear that the gas-works were likely to suffer by its introduction into the town; as it was believed that, for many years to come, at any rate, electricity would be used as a lighting agent by those only who could afford to pay for the luxury. Alderman Evershed asked if the Chairman of the Committee could tell them anything as to the profits on the gas-works for the last year, for the purpose of comparison with previous years, when they would be able to ascertain the propriety or otherwise of reducing the price of gas. The first year of the reduction they lost £2,300 from the rates, and the second year £2,400—which was equal to 3d. in the pound; therefore any further lowering of the price must be regarded as entirely out of the question. Mr. Rugg totally disagreed with Alderman Evershed. He held that the consumers should have the benefit of the profits they helped to make, and that non-consumers should not be relieved, by means of the rates, at the expense of the consumers. Mr. Parker pointed out that, if there was any loss on the gas-works, owing to the introduction of the electric light, the general body of ratepayers would suffer, and not the consumers alone; therefore the ratepayers at large should reap any advantage to be obtained from the gas-works. Alderman Lowe said he was unable to give all the information asked for by Alderman Evershed; but he could state that the gas profits in 1890 were £6,400, and in 1891 they were £5,200; while this year they had been estimated at £3,500. He maintained that the price of gas was as low as it ought to be under present circumstances, with wages high and coal dear. The discussion then dropped; and the report was adopted.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS PROCEEDINGS ON GAS AND WATER BILLS.

Progress Made during the Session to Easter.

Down to the rising of the House for the Easter recess (April 12), the following progress had been made with Gas and Water Bills that originated in the Lower House, and some already passed by the House of Lords. Those not named, in which our readers are specially interested, are still going through their various stages in the latter House.

Withdrawn: Barry and Cadoxton Gas and Water Bill; Pontypool Gas and Water Bill; St. Pancras Vestry Bill; Sunderland and South Shields Water Bill.

Read the third time: Airdrie and Coatbridge Water Bill; Brynmawr and Abertillery Gas and Water Bill; East Grinstead Gas and Water Bill; Lanarkshire (Middle Ward District) Water Bill; Ormskirk Gas Bill; Southend Gas Bill.

Reported from Committees: Blackburn Corporation Bill; Bristol Gas Bill; London County Council (Subways) Bill; Mold Water Bill; Rhyl District Water Bill; Rhyl Improvement Commissioners Bill; Stamford and St. Martin's Stamford Baron Gas Bill.

Read a second time: Barrow-in-Furness Corporation Water Bill; Birmingham Corporation Water Bill; Blackpool Improvement Bill; Bournemouth Improvement Bill; Cleator Moor Local Board (Gas) Bill; Exmouth and District Water Bill; Ilkley Local Board Bill; Leeds Corporation Bill; London Water (No. 1) Bill; Middlesbrough Corporation Bill; Newcastle-upon-Tyne Improvement Bill; Oxford Gas Bill.

Read the first time: Bradford Corporation Water Bill; Kilmar-nock Corporation Water Bill; Liverpool United Gas Bill; London County Council (General Powers) Bill; Rhymney Valley Gas and Water Bill; Southborough Local Board (Gas) Bill; Tredegar Local Board Water Bill.

The Bills originating in the House of Lords are: Ashton-under-Lyne, Stalybridge, and Dukinfield District Water Bill; Glasgow Corporation Water Bill; Ipswich Corporation Bill; Llanbradach District and Aber Valley Water Bill; Newport Corporation Bill; North Shields Water Bill; Pontypool Water Bill; Swansea Corporation Water Bill; Swinton and Pendlebury Local Board Bill; Uttoxeter Water Bill; Western Valleys (Mon.) Water (Gas Purchase) Bill. All the foregoing Bills are still in progress, with the exception of the Llanbradach District and Aber Valley Water Bill, which was rejected, in Committee.

Three Bills to confirm Provisional Orders made by the Board of Trade under the Electric Lighting Acts, 1882 to 1890, were presented and read the first time on the 11th inst. No. 1 related to the Burgh of Govan; No. 2, to Aberystwith, Ashton-under-Lyne, Halifax, Harwich, Limerick, and Maidstone; No. 3, to Kilkenny, Newbury, Sutton (Surrey), West Ham, and Woking (Horsell and Chertsey).

The Blackpool Corporation and the St. Anne's Gas Company.—The amount agreed upon to be paid by the Blackpool Corporation for the lighting rights, gas-mains, &c., of the St. Anne's-on-the-Sea Gas Company in the borough of Blackpool, for acquiring which the Corporation are now applying for parliamentary authority, is £5,000.

Municipal Gas-Works for South Shields.—The South Shields Town Council last Wednesday resolved to appoint a Special Committee "to consider the question of establishing municipal gas-works under the statutory powers of the Corporation, and to report thereon, with power, if they think fit, to take opinion of counsel, and of an expert on gas-works, upon any question that may arise."

San Paulo Gas Company, Limited.—The report of the Directors of this Company for the six months ended Dec. 31 last states that during this period the block at the port of Santos increased, and the demurrage incurred, combined with the heavy discharging expenses, increased wages, &c., caused the cost of coal sent up for carbonization to be doubled, so that the net revenue was only £5516. The rate of exchange having fallen from 18d. per milreis in June to 13d. in December, the currency balances, &c., were taken at the latter figure; and this necessitated writing off the sum of £11,682. The Directors, therefore, deemed it equitable to place the deficit of £5081 to the debit of the contingency account, in order not to bring forward a balance adverse to the present half-year's working. Notwithstanding this disappointing result, the Company's business has, it is stated, largely developed; the consumption of gas showing an increase of 33½ per cent. The number of public lamps has been augmented by 182; and the meters fixed are 935 more than in the corresponding period of the previous year.

The Opposition to the London County Council Water Bill.—The time specified by the Standing Orders of the House of Commons within which to present petitions in opposition to the Bill promoted by the London County Council for preliminary powers to deal with the London Water Supply has now expired. The total number of petitions deposited is 16, among which is one bearing the seals of the eight London Water Companies. The remaining 15 include separate petitions lodged by the Southwark and Vauxhall, Lambeth, Grand Junction, Kent, and East London Companies. The public bodies who have petitioned in opposition are the County Councils of Middlesex and Hertfordshire, the Corporations of Croydon and West Ham, the Local Boards of East Ham and Bromley, the West Kent Main Sewerage Board, the Thames Conservators, and the Bromley Rural Sanitary Authority. A petition representing the smaller Water Companies in the outlying areas affected by the Bill has also been lodged in the name of the Provincial Water Companies' Association.

MISCELLANEOUS NEWS.

EXTENSIONS AT THE SALFORD CORPORATION GAS-WORKS.

On the invitation of the Gas Committee, the members of the Salford County Borough Council paid a visit last Saturday week, to the Regent Road Gas-Works for the purpose of inspecting the important alterations and extensions of the plant which have lately been carried out. The party were first taken through the older portion of the works, and saw the mechanical stokers at work. Explanations of the various processes through which the gas passes before it reaches the consumer were given by the Gas Engineer (Mr. S. Y. Shoubridge). Passing over the London and North-Western Railway, the party came to the new retort-house on the Liverpool Street side of the establishment. Before the rebuilding of this retort-house, which has just been completed, it contained 300 retorts, most of them small ones, equal to carbonizing 198 tons of coal, and making 2,000,000 cubic feet of gas per 24 hours. The coal was all unloaded by hand on the ground floor, at a cost varying from 4d. to 1s. 6d. per ton. The retorts and house were badly built originally, and were in a very dilapidated condition. The Committee therefore decided to pull them down and rebuild them on the most modern and improved plan. The work was let by contract to Messrs. Dennis and Butler, of Bury and Leeds, who commenced it in March, 1891, and completed it in January last. The house now contains 189 large retorts capable of carbonizing 283 tons of coal, and producing 2,900,000 cubic feet of gas per 24 hours. When the existing retorts are worn out, it is intended to put an extra retort in each bed, increasing the number from seven to eight. The house will then contain 224 retorts, and carbonize 336 tons of coal, producing 3,500,000 cubic feet of gas per day, or 75 per cent. more than was made in the old house. In rebuilding the retort-house, the original roof was not taken down; but it was supported on a timber framing, until the new walls were built, and was then raised on to them, about 12 feet higher than before. The retorts are all heated by regenerative furnaces. The coal is now raised in the trucks to an elevated railway over the coal-stores by powerful hydraulic hoists; and it is conveyed along the railway as required by hydraulic capstan engines. By these means the coal is supplied much more expeditiously, and with very much less cost in handling, than under the old system. The retort-house has been designed to permit of stoking machinery being used, if found desirable. The Committee intend to build another retort-house soon, as the present manufacturing power will not suffice very long. The new house will be erected on land adjoining the works, on the opposite side of Liverpool Street; and it will be connected with the present house by continuing the elevated railway from the existing coal-stores, through the coal-stores of the new house, and joining it to the sidings of the Lancashire and Yorkshire Railway. This communication will enable the Committee to obtain supplies of coal from collieries in Yorkshire and elsewhere, with which, hitherto, they have had no connection. In order to afford storage room for the increased quantity of coke made in the Liverpool Street retort-house, a large piece of ground at the north end of the house, has been excavated to the level of the coke-floor and paved. Coke docks in connection with the low-level railway have been made to facilitate the loading of coke into railway-trucks. A commodious mess-room with capacious cooking-ranges, and a lavatory fitted with shower baths and every convenience, has been erected adjoining the retort-house for the use of the workmen. In 1889 one of the gas-holders at the Liverpool Street works was enlarged by the addition of a third lift; the storage capacity being increased from 1,340,000 to 2,070,000 cubic feet; and another holder is to be dealt with in the same way this year. The work will be commenced shortly, and finished before next winter. Additional condensers and purifiers at Liverpool Street will be shortly erected; and improved arrangements for filling the purifiers at the Regent Road works so as to dispense with hand labour to a great extent, will be adopted this year.

When the visitors reached the new messhouse, the Mayor (Alderman Keevney), at the request of the Deputy-Chairman of the Gas Committee (Mr. Phillips), and in the presence of a number of the workmen, whose presence had been invited, formally declared it open. The Mayor said it was quite clear, from what the party had seen, that the gas-works would compare favourably with any in the country; and they were going on to still greater improvements. He was very pleased to know how comfortably the officials and men had worked during the past winter; and he sincerely hoped that these harmonious relations would continue. He then declared the building opened. Mr. Pendleton, one of the workmen, replied on their behalf, and thanked the Committee for providing the excellent accommodation which the building afforded. It would, he assured the Corporation, be a boon to the workman.

On the completion of the inspection, tea was partaken of in the offices. Subsequently several toasts were submitted and honoured. After the toast of "The Queen" had been drunk, the Chairman (Mr. Phillips) proposed "The Mayor," remarking that Alderman Keevney was one of the ablest mayors Salford had ever had. The Mayor, in reply, said he had read with some pain the reports which had appeared in the local papers while a certain Bill was before the Committee of the House of Lords respecting the quality of the Salford gas. These remarks were not only devoid of truth, but were an exaggeration which could only have been believed by persons who knew very little about Salford. He pointed out that independent tests were constantly made; and the result of those tests was to show that the quality of the gas was above, not below, the standard fixed by Act of Parliament. Certain out-districts which they had supplied were seeking power to make their own gas. In his opinion, small districts could not manufacture gas to pay. Salford was, however, on the right lines, and was in a position to make gas cheaper and better than it was possible for a small company to do. If a certain Bill was passed, he was sure that the people on whose behalf it was being promoted, would regret the day that it was sanctioned. He concluded by proposing the health of the Gas Committee, and expressed his regret that the Chairman of the Committee (Mr. Holland) was prevented by illness from being present.

Mr. Phillips, in responding, said that since the strike a good feeling had existed between the workmen and the Committee; and when last winter the workmen were called upon for a little extra service, they willingly responded. Proceeding to sketch the history of the gas undertaking, he said the first gas manufactured in Salford was made by Mr. George Augustus Lee, of the firm of Messrs. Phillips, Wood, and Lee, at the Salford cotton mills, in Chapel Street, about the year 1806. In 1820 gas-works were erected by Mr. Appleby, in Clowes Street, near the River Irwell. Mr. Appleby retained possession of the works until December, 1831, when they were purchased for £6000 by the Police Commissioners. The price of gas in Mr. Appleby's time, was 12s. per 1000 cubic feet; but the Commissioners reduced it during the first year to 10s. 6d. In 1836, the gas-works in Bloom Street were erected; and the make of gas increased to 300,000 cubic feet per day. In 1858, the Regent Road works were built. The make of gas at this time had increased to about 900,000 feet per day, and the number of consumers was 6146. In 1868 the Liverpool Street works were commenced. The make of gas at this time was about 1,700,000 cubic feet per day; and the number of consumers was 14,669. In the year ended March 25 last, the production of gas was 6,200,000 cubic feet per day; and the number of consumers, 27,434. To show what the Gas Committee had done since its re-construction, he pointed out that in 1888 the price of gas was 3s. 1d. per 1000 feet, while now it was 2s. 4d.—a result of which the Committee might justly be proud. But he did not think they had quite come to the end yet. These reductions had been rendered possible by the excellence of the management—and he gave all credit to Mr. Shoubridge and his subordinates—and by the care which was exercised in the purchase of the materials. A few other toasts followed.

HALIFAX CORPORATION GAS SUPPLY.

At the Meeting of the Halifax County Borough Council last Wednesday week, the minutes presented by the Gas Committee stated that they had resolved to instruct the Town Clerk to apply for powers to borrow, with the consent of the Local Government Board, the further sum of £20,000, for the purpose of purchasing, when necessary, certain lands, for gas-works purposes; and also, that an application be made to the Local Government Board for a Provisional Order to enable the Corporation annually to set aside the sum of £3000, being a portion of the surplus arising from the income, until a sum not exceeding £25,000 had been accumulated, for the purpose of being used as working capital, and that the sum of £25,000 be increased, when necessary, with the consent of the Local Government Board. They also reported that a tender of West's Gas Improvement Company, Limited, for the supply of coal conveyors, hoppers, and coal breakers, and charging and drawing machinery for the sum of £5655, had been accepted. The Mayor (Alderman Davis) suggested to the Chairman of the Gas Committee, that he should allow the resolution, referring to the taking of £3000 from the gas profits, to be reconsidered by the Committee. The matter was one which required very careful consideration. The Town Clerk had already, he believed, made application to the Local Government Board for permission to take this money; but he was informed that the application was too late for this year. Mr. Brook, in proposing the adoption of the minutes, said this was the first intimation he had received that the application was too late. The Committee had passed the matter unanimously; and he did not see any reason why it should be referred back. It was felt, he said, that a gigantic concern like the gas-works ought to have money in hand. The interest last year was £889, representing an overdraft at the bank of about £30,000. As to the new stoking apparatus, he had seen similar machinery at work at many gas-works; and there was a considerable saving. They were told it saved 1s. per ton of coal carbonized; but if they reckoned even 6d. a ton, the saving in their case would be equal to £1400 or £1500 a year. Mr. Brear seconded the motion. The Mayor proposed, as an amendment, that the resolution relating to the £3000 being taken from the gas profits be referred back to the Committee. He did this, he explained, because, to carry out the resolution, would entail a very large annual expenditure on the ratepayers, which might easily be avoided. At present the amount charged for interest on the overdraft at the bank was about £800 or £900, which was equivalent to two-thirds of a penny rate. But if they abstracted from the gas profits £3000 annually, they took what would either be devoted towards the rates or to the reduction of the price of gas. Alderman Booth seconded the amendment; saying that if the Gas Committee wanted this £25,000, it would be a great deal easier and cheaper to borrow it and pay interest upon it, along with the sinking fund. The amendment was adopted, and the rest of the minutes were then approved.

The Huddersfield Corporation and the Longwood Gas Company.

—At a public meeting of ratepayers at Longwood, last Thursday week, Mr. Brearley—a member of the Huddersfield Town Council—who presided, stated that negotiations were now pending between the Huddersfield Corporation and the Longwood Gas Company. In the works of the latter there was invested £39,000; and by Act of Parliament, they were allowed to make 7½ per cent. interest, which he considered was a great deal too much. Unless the Gas Company would pay 3½ per cent. for the money invested, it was not wise for the Corporation to purchase the undertaking. He had been told on the authority of the Chairman of the Corporation Gas Committee that they had weighed fairly both sides of the question; and while they were seeking to do what was right and just to the shareholders of the Company, they would also protect the interests of the ratepayers. Resolutions were afterwards carried, protesting against the arbitrary conduct of the Directors of the Company "in their attempts to interfere with the liberty of their workmen in connection with their Union;" declaring that the time had now arrived when the consumers were determined to have gas and meter-rent at the same price as in other parts of the borough; and appointing a deputation to wait upon the Directors in regard to the price of gas and the meter-rent.

THE LONDON COUNTY COUNCIL AND THE WATER QUESTION.

The Expenses of Evidence for the Royal Commission.

At the Meeting of the London County Council last Tuesday, the Special Water Committee reported that they had received a letter from the Secretary of the Royal Commission on Water Supply, asking the Council to submit to the Commission information bearing on the subject of the inquiry, and requesting that such information might be forwarded not later than the end of the present month. They had accordingly requested the Chairman, in consultation with the Chief Engineer (Mr. A. R. Binnie, M.Inst.C.E.), the Chemist (Mr. W. J. Dibdin, F.I.C., F.C.S.), the Medical Officer, and the Parliamentary Agent, to prepare a statement of the points which the Council were prepared to bring before the Commission. In connection with this matter, it was necessary that provision should be made for outlay on points connected with the inquiry. The Special Water Committee of the previous Council had at their disposal a sum of £5000, the expenditure of which was authorized by Parliament in the session of 1890. The whole of this amount had either been actually spent or hypothecated to expenditure in connection with the inquiries which had been going on during the past 18 months; and estimates for the various amounts had been from time to time submitted by the Finance Committee and approved by the Council. At present, therefore, they were practically without funds. The sum granted by Parliament was asked for in view of doubts which had been expressed as to the power of the Council to expend money on such matters as water inquiries; and it was thought safer to obtain parliamentary authority. The Committee thought, however, that, whatever might be the state of the law as affecting inquiries voluntarily instituted by the Council, the aspect of the question was entirely altered by the appointment of the Royal Commission; and they considered that, having been requested by the Commission to furnish information, the Council would be not only neglecting the interests of London, but treating the Commission in an improper manner, were it not willing to supply every information in its power, and to substantiate its views before the Commission by the best expert evidence. They were not prepared at present to say what precise amount would be required; but they were of opinion that, under the circumstances, the Council would be fully justified in incurring the necessary expenditure. They therefore recommended the Council to sanction the spending of a sum not exceeding £2000 in placing the case of the Council before the Royal Commission, and on matters incidental thereto. The recommendation was agreed to.

ANTWERP WATER-WORKS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Thursday, at the London Offices, No. 86, Cannon Street, E.C.—Mr. CHARLES CREW in the chair.

The notice convening the meeting having been read,

The CHAIRMAN, in moving the adoption of the report and accounts, said he was glad they showed a more satisfactory state of things than in the previous year. The income from all sources had increased by £2017; and this was very satisfactory. Referring to the exceptional expenditure attributable to the frost during the winter of 1890-91 (which amounted to £3854), he said the report indicated the way in which the Directors proposed to deal with that. In 1890, a sum of £199 was charged against the reserve fund; and a further £1000 was charged last year—leaving £2655 still to be dealt with, and this they recommended should be written off the profits in five instalments, commencing in 1892. During the past year only £416 had been spent on capital account; part of this being for furniture and fittings for a laboratory for their Manager (M. Kemna), and the rest for extensions of mains, &c. The expenditure at Antwerp had increased by £320; but the London expenses were practically the same. The net profits showed an increase of £697—the total net profit being £9248, as against £8550 in 1890. The receipts for water amounted to £20,052, which was an increase of £1015. In the first three months of the year, very little business was done on account of the frost; and therefore he thought the increase in the receipts was very satisfactory. The contracts exhibited an addition of 567 houses; while in the first quarter of the current year, they had had a further advance of 132. As to the electric lighting contract for Antwerp (which provided for the use of hydraulic power for the production of the light), the Directors were now able to report that three of the authorities had given their consent to the contract, and the only one hitch with regard to it was that the Provincial Authority still withheld their decision upon a technical point of law; but no real difficulty was apprehended. The Electric Light Company believed they had a good system; and they were very anxious to light Antwerp, and to show the world what they could do with it. Respecting the future of their own Company, they had a growing trade; and he believed their success was certain. In conclusion, he proposed that the report be adopted, that £400 be appropriated out of the profits towards the amalgamation fund, and that a dividend of $2\frac{3}{4}$ per cent. be paid—this being an increase of $\frac{1}{4}$ per cent.

Mr. D. EVANS seconded the motion, which was carried unanimously.

The retiring Directors and the Auditors having been re-elected,

M. KEMNA addressed the meeting at some length, dealing principally with the difficulty he had met with in enforcing the rules and regulations of the Company. He believed that, if the weather was favourable this year, and they had no exceptional expenditure, the results would prove even more gratifying than those of the past twelve months.

The proceedings closed with the usual complimentary votes.

Sales of Shares.—Messrs. Tootell and Sons sold at Maidstone a few days ago 130 ordinary shares in the *Maidstone Water-Works Company*, at an average price of £17 8s. 9d. The dividend paid upon similar shares last year was at the rate of $6\frac{1}{2}$ per cent.—At Hastings, on Monday of last week, a number of £20 shares in the *Hastings Gas Company* were sold by auction at prices ranging from £38 to £38 12s. 6d.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The informal meeting—or, as it is by some preferably called, the spring meeting—of gas managers in Glasgow last Thursday cannot be described as a brilliant gathering. But that is in the nature of things; for no one looks for much that is new, or indeed for anything more than conversation and pleasant intercourse out of the meeting. The opening address by Mr. T. D. Hall ranged over a wide field, and was full of common sense. There may be said to have been three outstanding features in the meeting. The first was the advent among Scotch gas managers, or rather the return to Scotland, of Mr. A. Wilson, of the Dawsholm works of the Glasgow Corporation. Mr. Wilson is quite a young man; but he has unmistakably a grip of his work which would do credit to anyone who has had twice his experience. He is an acquisition to the ranks of the managers; and, in electing him as next year's Chairman, the company were honouring themselves as much as him. The second feature was the most important of the three, and consisted of the statement by Mr. Mackay, of Peterhead, upon the enriching of coal gas by means of oil. This subject is a new one to almost all the gas managers in Scotland. Though most of them are familiar with the process of making gas from oil, the employment of a mixture of coal and oil has not yet come within the range of their observation. Mr. Mackay was only able to give a rough sketch of what he has been doing, because he has still to check his results; and he was also, naturally, anxious to reserve the weightier portions of his subject for the annual meeting of the North British Association in July. What he did say was, however, sufficient to indicate the lines on which he is working, and to incite to experiment on the part of those who have not yet taken up the subject, or to give encouragement to those who have already begun. One could not help thinking, as Mr. Mackay spoke, of the "blessing in disguise" which the want of first-class cannell last December was to him; for it drove him into a line of working which has already brought him fame. Of course, the situation might have come to many who would not, or could not, have taken advantage of it; and it was just there that Mr. Mackay's personality came in. It was quite apparent that he had approached the subject on scientific lines, and had worked his experiments intelligently. The third feature was the appearance of Mr. J. Hall, of St. Andrews—the venerable father of the Chairman—who, knowing that for him there can remain but few such gatherings, journeyed to Glasgow to give expression to his solicitude for the future of the gas industry. He unfortunately did not say whether or not he was satisfied that the young men would be able to take the place of those who were passing away. I think, however, he could have no doubt that they are in every respect as capable as those who were the pioneers of gas lighting. His remarks on the educational side of the subject were sufficiently weighty to warrant more extended notice at another time.

There was another feature of the meeting which I had almost forgotten. It was the exhibition of the bust of Murdoch which is to be taken as the model for the marble one that is to be placed in the Wallace Monument in July. This bust (a stucco one) has been in the possession of the late Mr. David Laidlaw, of Messrs. R. Laidlaw and Sons, for many years, and was brought up from the house at Skelmorlie, where he so long resided, for exhibition. Mr. Laidlaw is said to have purchased it from the maker; so that its authenticity seems to be placed beyond doubt. The Committee (of which Mr. J. M'Gilchrist is Secretary and Treasurer) who are taking charge of the arrangements for placing the bust in the Monument believe that there is another bust of Murdoch, similar to the one they have obtained, somewhere in England; but they are unaware of any others being in existence. They have not yet engaged a sculptor. There is, however, sufficient time, between this and the end of July, for the preparation of the bust. Would it not be a good thing to request the artist who prepares the bust to make a number of smaller bronzes or stuccos of Murdoch, suitable for standing on mantelpieces? These, I have no doubt, would command a ready sale among gas managers and others.

It will be information of an interesting nature to most of your readers to learn that Mr. W. Key, the Manager of the Tradeston Gas-Works of the Glasgow Corporation, is about, after 30 years' service in the gas industry, to sever his connection with it, and to commence practice in London as a ventilating engineer. Mr. Key is a man of an exceedingly inventive turn of mind. He devised, as your readers are aware, a most successful system of ventilation, which has been adopted in the Victoria Infirmary in Glasgow, and in some of the Dundee and other public schools in the country. It is, in fact, the success which has attended it, that has led to his relinquishing his present position, and devoting his energies exclusively to its development. Besides the ventilating system, he is the inventor of a gas governor which is largely in use, and of a pressure regulator for water. He has been for about ten years Superintendent at the Tradeston works; and before that he was Manager at Dumbarton. He is a Vice-President of the North British Association of Gas Managers; and it was at a meeting of the Committee of that Association in Glasgow last Thursday that he made the communication as to the proposed change. It is almost needless to say that the members of the Committee, while sorry to lose so able and agreeable a comrade as Mr. Key, were unanimous in wishing him success in his new position. He leaves the service of the Glasgow Corporation at the end of May; and his resignation places a valuable appointment in their hands. Rumour has it that the post is already practically filled up; and that the choice of the Gas Committee has fallen upon a young man of brilliant parts who is at present in the service of the Corporation.

A short, but exceedingly important, meeting of the Edinburgh and Leith Gas Commission was held on Monday last. The business before the Commissioners was the fixing of the contracts for the next financial year for all stores, except coal and lime. For these, Mr. Kinloch Anderson stated, they would not require to go into the market for some time yet. Having sat in Committee on the other stores, the Commission found everything cut and dry; and the recommendations of the Works Committee were, with one exception, agreed to *nem. con.* The exception had reference to one of the offerers, whose financial position did not seem to some of the Commissioners to be satisfactory; and the

Committee took the matter back for re-consideration. The business lasted only a couple of minutes. Doubtless it took a long time in Committee to settle the details of the different contracts; and that may have explained the desire of the Commissioners to hurry the business through when they sat in public. A little general information as to the prices would have been appropriate. But it was not given; and it was only by private inquiry that I elicited from an official that the prices agreed to are, over all, a little less than they were last year. From a national point of view, this may not be good news, as it means a shrinkage of trade; but from the point of view of the gas supplier, it is of the nature of a welcome communication, because it implies a slight relief from the heavy outlays of the last few years. It is a misfortune that prosperous trade always means a heavy increase of expenditure for consumers. This is, however, a state of matters which will continue so long as producers are unable to solve the difficulty they have in agreeing with their workmen as to the matter of wages. The present methods of settling trade disputes are ruinous to the country—involving as they do the double conflict, of the masters, in a rising market, endeavouring to resist the demands of the men for increased pay, and of the men, in a falling market, endeavouring to resist the attempts of the masters to reduce wages. When the enormous losses which are inflicted upon the country by trade disputes are taken into account, it is matter for surprise that, as a nation, we are so prosperous as we are. The present is a state of matters which can hardly be expected to last always. Surely, in time, means will be found for the reconciliation of capital and labour, under a scheme whereby wages will fix themselves without recourse to open war. Were such attained, the combinations among workmen would become a source of strength, instead of weakness. It has been so found in some instances already; and why it should not be made general, it is difficult to say. It would, of course, do away with the existing objects of trade organizations, which have, unfortunately, in recent years been directed by the leaders of the men into channels directly opposed to the interests of employers. One of the first requirements of a better state of things is the education of workmen—the teaching of them how hollow and unreliable are the aims set before them by their leaders—so that demagogues may not hold the sway over them which they at present have. When this takes place, the masters will be able to place confidence in their men's combinations. It seems as if the first move should come from the masters. Were they able to gain the confidence of their men, much would be attained in the way of getting rid of the gentlemen who find their living in setting masters and workmen by the ears. The subject is one which is well worth working up. A treatise showing the dire results of the stirring up of strife, and the beneficial results of peaceful dealing, supported by concrete examples, would be a valuable contribution at present to the discussion of the capital and labour question, and would be more useful, probably, than the forthcoming report of the Labour Commission.

The Works Committee of the Edinburgh and Leith Gas Commission have considered the subject of the proposed expenditure of £44,000 upon extensions and renewals of the gas-works; and have resolved that, in view of the decrease in the consumption of gas and the probability of the introduction of electric lighting, it should be deferred in the meantime. Regarding this decision, it may be pointed out that the shrinkage is only upon last year's consumption, which showed the altogether abnormal increase of 100 million cubic feet, and is therefore not to be looked upon as a permanent decrease; and that, as regards electric lighting, it is still a good deal more than a twelvemonth ahead. The Gas Commissioners are, however, not in any way pressed in the matter of output; and it may be wisdom to wait a little and see how events will turn out with themselves, leaving electricity out of account.

For some time a dead set has been made against the Portobello Gas Company, which is managed by Mr. David Vass, an exceedingly capable young man. Portobello is in the awkward position of being a suburb of Edinburgh; and the Gas Company being a small concern, it is a natural consequence that odious comparisons are made of its results, with its larger neighbour. Dr. Ivison Macadam, who is resident in Portobello, has for a time tested the illuminating power of the gas in his own dwelling; and the results he obtained were recently submitted to the Town Council. At Monday's meeting of the Council, a letter from Mr. Vass was read, in which he pointed out that Dr. Macadam's apparatus must be faulty, because his results materially differed from those obtained with the testing apparatus at the works. The Gas Company have generously allowed Dr. Macadam full liberty to use their photometer at any time he chooses; so that any cause of difference on that head should be effectually removed. But as it transpired at the Council, it is not the quality of the gas which is complained of; it is the price. It is out of the question that the Portobello Gas Company should be able to sell gas at as low a price as in Edinburgh; and as Portobello is within the scheduled district of the Edinburgh and Leith Gas Commission, it is most probable that the inhabitants will later on approach the Edinburgh and Leith Commission with a request for a supply of gas from them. There is no reason for the separate existence of the Portobello Company. They hold their position by sufferance, which is their weakness; and if they could come to terms with the local Corporation for a transfer to them, they would act wisely, as they may, before long, be gobbled up without consideration. Were the Corporation to acquire the works, there should be no difficulty in their handing them over to the Edinburgh and Leith Commission. It would be a pity if, on account of any transfer, loss should fall upon the shareholders of the Portobello Company; but that is just what would likely happen if the Company were to negotiate direct with the Edinburgh and Leith Commission.

The Glasgow Police Commissioners last Monday formally resolved to proceed with the electric lighting of the streets, which I mentioned last week, with, in addition, part of Buchanan Street, and St. Vincent Place and George Square. In all, 106 arc lamps are to be set up, at a cost of £20 per lamp per annum, or £2120 in all, besides which there is a capital charge of £2500 for lamp-posts and fittings, making the annual charge £2371. The lamps are to be placed so as to light side streets upon the thoroughfares dealt with, and are estimated to supersede gas lighting, which costs £1627, so that it is estimated the extra expense of electric lighting is, roughly, £700 a year. Regarding this, it has to be pointed out that the charge for gas is known, while that for electric lighting is only an estimate, and one which is so low

that it is likely to be exceeded. In recommending the adoption of the report of the Committee which had prepared the estimates, Mr. Gray stated that the light would be ten times that of gas—a statement which may be taken as doubling the actual result which will be attained. Further, it is not out of the way to remark that, though the light given out may be greater than that of the present gas-lamps, it is yet possible that, owing to the distance at which the lamps will be placed from each other, the streets will not be so well illuminated as they are at present. Another matter which was brought forward at the Council meeting—and one which is of supreme interest, though the Committee seemed to make little of it—was the smallness of the area to be treated. Bailie Morris pointed out that business people in the streets to be electrically lighted would have an advantage over those in other streets, and there was really no reply to this remark, except the statement that the business people in those streets paid very high rates. This is, as matter of fact, no argument; but it shows the weakness of electric lighting schemes in two ways—first that they can only be introduced with any chance of paying where a very large sum is drawn in the shape of rates; and, secondly, that, though the whole town has to pay for them, it would be ruinous to introduce them over the whole area to be lighted. The Glasgow scheme is an experiment which is calculated on the basis of the outlay being repaid in ten years. If it should be a success, the area electrically lighted will be extended; if it should be otherwise, the good sense of the Corporation may be relied upon in confining it to the area decided on.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, April 16.

Sulphate of Ammonia.—A fair amount of business has been done in the course of the week, principally at £10 5s. f.o.b. Hull, £10 3s. 9d. to £10 2s. 6d. f.o.b. Leith, and £10 2s. 6d. to £10 1s. 3d. f.o.b. Liverpool; and there is at the moment little offering. The market will probably be in a quiet state for a few days, in consequence of the Easter holidays; but it does not necessarily follow that prices on that account will be easier, as is freely predicted by the dealers. There are indications that a considerable quantity of sulphate will yet be required for delivery this month; hence a decline in values seems improbable. Nitrate, although in better demand, is quoted easier in price, and can be bought a little below 9s.

LONDON, April 16.

Tar Products.—Great depression prevails in this market. Very absurd prices are being mentioned as the value of benzols; but there certainly has not been any important business done in this article at the prices quoted below. Anthracene is also dull, and practically unsaleable. There is a little more life in carbolic acid products; and it is expected that the spring will see improved values in them. Stocks seem to have disappeared; and its application as an explosive seems to have risen. Prices nominally quoted are: Tar, 10s. to 12s. Pitch, 28s. to 29s. Benzol, 90 per cent., 1s. 7½d.; 50 per cent., 1s. 4d. Toluol, 1s. 2½d. Solvent naphtha, 1s. 2d. Crude benzol naphtha, 30 per cent., 9½d. Creosote, ½d. Naphthalene salts, 20s.; pressed, 45s. Carbolic acid, crude, 60's, 1s. 1d.; 70's, 1s. 4½d.; crystals, 5d. Cresol, 8d. Anthracene, 30 per cent., "A" quality, 10½d.; "B," 7½d.

Sulphate of Ammonia.—There is little to report in connection with this article. Home buyers are now covering their requirements, and to this extent country producers are busier; but there is an extraordinary falling off in the demand for shipment, especially to Germany. To-day's value ranges from £10 to £10 2s. 6d., less 3½ per cent. Gas liquor (10-oz.), 5s. to 6s.

Increased Storeage Accommodation for the Middleton Gas-Works.—At the last meeting of the Middleton Town Council, Mr. G. Booth, in moving the adoption of the minutes of the Gas Committee, stated that they had decided to erect a new holder, instead of re-sheeting the old one. He pointed out that the reason for this was that the internal portion of the present holder had been in use 26 years; and the Committee found that it would cost a considerable sum to repair the holder in a satisfactory way. The minutes were agreed to.

Extensions at the Stockport Gas-Works.—As already mentioned in these columns, several alterations and additions are about to be made at the Stockport Corporation Gas-Works, on the recommendation of the Gas Engineer (Mr. S. Meunier). It is proposed to erect at the Portwood station a washer of 2,000,000 cubic feet capacity; and at the Heaton Lane works, one of 800,000 feet capacity. A new exhaustor, of 70,000 feet per hour capacity, is to be put down at the Portwood works (with a horizontal engine), and two new 18-inch station governors. The Engineer has also submitted a scheme for subdividing the lighting district into four parts; so that the pressure of gas can be more completely regulated than at present. This will necessitate the laying of some trunk mains, the extension of the governor-house, and the erection of the two governors at the Portwood works.

West Gloucestershire Water Company.—The half-yearly meeting of this Company was held at Bristol on Saturday, March 26. The Directors reported that 273 additional services had been laid on; making the number of houses supplied 3190, and which, including some meter supplies, were estimated to produce a water-rental of £2662 per annum. They also had pleasure in stating that they had placed the whole of the £15,000 debenture capital, authorized by their Act of 1884 (excepting £1600), as perpetual 4 per cent. debenture stock. With the proceeds they proposed to purchase at once the freehold of the estate at Frampton Cotterel, upon which their springs and pumping-station and other property were situated, and which they previously held on lease. The Chairman (Mr. Enoch Horton), in moving the adoption of the report, said it showed definite and steady progress; and the Directors looked forward in the coming summer to a special increase in the revenue. Thanks to their recent extensions, they hoped to reap the benefit of their enterprise, and, in the course of a reasonable time, to pay a dividend. The motion was carried.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—For all descriptions of fuel, there is a decided slackening off in the demand; and shippers are becoming increasingly plentiful in the market, although it is very exceptional where pits are working anything approaching full time. In view of the present unsatisfactory state of trade, the usual Easter stoppages of the pits are in many cases being extended over a longer period than usual. The better qualities of round coal, suitable for house-fire purposes, still move off fairly well, and are maintained at about late rates. Best Wigan Arley is quoted at 12s. 6d.; Pemberton four-feet and second qualities of Arley, 10s. 6d. to 11s.; and common house-fire coals, 9s. to 9s. 6d. per ton. The lower descriptions of round coal are, however, becoming increasingly difficult to dispose of. The depressed state of the iron trade and other coal-using industries necessarily largely affects the demand; and with prices already easing down, colliery proprietors are looking forward with some anxiety to the position in which they may possibly be placed when the usual gas-coals and locomotive contracts come upon the market. At the pit mouth, the ordinary descriptions of steam and forge coals are readily obtainable at 8s. to 8s. 6d. per ton; whilst for shipment, substantially under these figures has been taken—in some cases as low as 7s. 6d. to 7s. 9d. per ton. This represents about 9s. 6d. to 9s. 9d. per ton delivered at the ports on the Mersey, although 10s. is still quoted for some of the better qualities. Engine classes of fuel are hanging upon the market, owing to the unsettled outlook in the cotton trade; and although good qualities of burgy are still quoted at 6s. to 6s. 6d., and the best qualities of slack 5s. to 5s. 6d., inferior sorts are offering at very low figures, and can be bought without difficulty at 3s. 6d. to 4s. per ton, at the pit mouth.

Northern Coal Trade.—There are rather more signs of a settlement of the strike in Durham; and these signs are beginning to influence the price of coals. Supplies have been ample of late; because the consumption had been so much reduced by the closing of works and by the great numbers of steamers that have been laid idle. Best Northumbrian coals have been quoted at from 10s. 6d. to 10s. 9d. per ton, f.o.b.; and as the holidays are influencing the production, that price may be put as about right for prompt shipments. Steam small coal is quiet at 4s. 6d. to 4s. 9d. Bunker and household coals are dull, the demand being very limited. Gas coal is steady, because the stocks of gas companies are decreasing; and for prompt supplies, rather high prices have to be paid. About 12s. per ton, f.o.b., is asked; but prices such as this are generally refused, as the end of the strike must bring down the rates very largely. Still, stocks of coal will have to be replenished by many gas companies. Coke is extremely scarce as far as blast-furnace qualities are concerned, and fancy prices are asked for it. Gas coke has been reduced in price by one or two gas companies, to enable a clearance to be made, the consumption at the factories being now limited.

Accident at the Bolton Gas-Works.—Last Tuesday morning an alarming accident occurred at the Lum Street Gas-Works of the Bolton Corporation. The arches supporting the roof of one of the retort-houses gave way, and a number of workmen were buried beneath the debris. Two men, named John Halliwell and Frank M'Nally, were seriously hurt, and had to be conveyed to the Infirmary.

Electric Lighting at Exeter.—The Exeter Electric Lighting Company having placed the whole of their wires underground, a large majority of the City Council are of opinion that the time has arrived when they should reconsider the question of the lighting of the main streets with electricity; and last Wednesday they instructed the Surveyor to prepare a full report upon the subject.

Guernsey Water-Works Company, Limited.—At the recent annual general meeting of this Company, the Engineers (Messrs. J. Quick and Sons) presented a report on the works. These were stated to be in good condition; but, in view of the increasing demand for water, the Engineers recommended the Directors to proceed with the second pumping-station forming part of the original contract. The estimate for this work, including the high-service reservoir, was £6400; and it is not anticipated that this will be exceeded. During the past year several applications for extensions of the mains were made in accordance with the terms of the Company's concession, by which they are required to make these on a written engagement to take water for three consecutive years; the proprietors and tenants guaranteeing an annual payment of a sum equivalent to 10 per cent. upon the capital outlay. Further applications for extensions on this basis, involving an estimated outlay of about £2500, are also being considered; and the demand for the Company's water is steadily increasing, both for trade and domestic supplies. For these reasons, all the capital expended in this direction is a source of profit.

Gas Exhibitions and Cookery Lectures.—During the week ending the 9th inst., Messrs. Fletcher, Russell, and Co., Ltd., of Warrington and London, held an exhibition of gas cooking and other appliances in the Palatine Hall, Lancaster. In connection with the exhibition, demonstrations in cookery were given twice daily by Mr. W. J. Young, M.P.S., of Chester, who showed himself to be a thorough master of the culinary art, and conclusively proved that, although ladies are usually selected to give instruction in this matter—in fact, Mrs. Young herself is a well-known lectress—it can be equally well imparted by a male expert. In all his demonstrations, Mr. Young was highly successful. In the neighbouring seaside town of Morecambe, Messrs. Richmond and Co., Limited, also of Warrington and London, have lately held an exhibition of their "Model" ranges and other appliances, a display of which likewise took place last week under the auspices of the Brentford Gas Company. At the latter, Miss Edden and Mrs. Bennett gave lectures on cooking by gas. An exhibition of gas appliances by Messrs. R. and A. Main, of Glasgow, was opened in Greenock, last Tuesday, by Bailie Erskine, the Convener of the Gas Committee. A good display was made, both of the appliances and of the cookery demonstrations, which were conducted by Miss Burden, of Glasgow. There are already 400 gas-stoves in Greenock; and the exhibition should add to their number.

Reduction in the Price of Electricity at Bradford.—The Bradford Town Council last Wednesday agreed, on the recommendation of the Gas and Electricity Supply Committee, to reduce the price charged for electricity from 6d. to 5d. per unit from the 1st inst.

The Burnley Corporation Coal Contract and the Price of Gas.—The Sub-Committee appointed by the Burnley Corporation to wait upon the Executors of Colonel Hargreaves with regard to the supply of coal for the gas-works, report that they would agree with the Executors for a supply of coal for the three years ending June 30, 1895, at 13s. 4d. per ton, with a sliding scale, providing for an increase or decrease of 1d. per ton for every 1 per cent. of alteration in wages. This recommendation was adopted at the last meeting of the Town Council. The price under the old contract was 10s. per ton, with a slight discount; and the enhanced rate will entail an additional burden both upon the gas consumers and the ratepayers. In fact, the price of gas has now been advanced from 2s. 4d. to 2s. 9d. per 1000 cubic feet, with a discount of 3d. if paid within 21 days. The charge to outside consumers is advanced 6d.; the figure now being 3s. 6d., with a discount of 10 per cent. if paid within 21 days.

The Price of Gas in Bolton and the District.—At the last meeting of the Bolton Town Council, a discussion took place upon the proposal of the Gas Committee to reduce the price of gas to the Horwich and Chapelton (out-townships) consumers by 3d. per 1000 cubic feet. An amendment was brought forward that there should be an all-round reduction of 2d. per 1000 feet; the argument being that, as this would only mean £6000 loss of revenue per annum, it was not much, especially in face of the fact that the increased gas-rental was close on £17,000. Alderman Miles, Chairman of the Gas Committee, replying upon the discussion which followed, held that the course adopted by the Committee was a wise one. It would only mean a loss of about £164 per annum; while an all-round reduction of 2d. would represent £6300. The Committee were not prepared at the present time to make such a sweeping reduction. The net price within two miles of the Bolton Town Hall was 2s. 8d.; the price outside that area, 3s. 2d., or 6d. more; and in Horwich and Chapelton, it was 3d. more than that, or 9d. beyond what was charged in the centre of the town. On a division, the Committee's recommendation was approved.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

For Stock Market Intelligence, see ante, p. 700.)

Issue.	Share	When ex-Dividend.	Dividend or Div. Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon invest. ment.
£			p. c.					£ s. d.
GAS COMPANIES.								
590,000	10	13 Apr.	10½	Alliance & Dublin 10 p. c.	10	15½-16½	..	6 7 3
100,000	10	"	7½	Do. 7 p. c.	10	11-12*	..	6 5 0
300,000	100	2 Jan.	5	Australian (Sydney) 5% Deb.	100	125-107	..	4 13 5
100,000	20	27 Nov.	8	Bahia, Limited	20	12-14	..	11 8 1
200,000	5	12 Nov.	7½	Bombay, Limited	5	6½-6½	..	5 11 6
40,000	5	"	7½	Do. New	4	4½-5½	..	5 14 1
380,000	Stock.	26 Feb.	12½	Brentford Consolidated . .	100	210-215	+2½	5 14 1
150,000	"	"	9½	Do. New	100	158-163	+1	5 13 5
220,000	20	11 Mar.	11½	Brighton & Hove Original .	20	39-41	..	5 12 2
888,500	Stock.	11 Mar.	5	Bristol	100	95-100	..	5 0 0
320,000	20	13 Apr.	11½	British	20	42-44*	..	5 2 3
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	10	19-20	..	5 15 0
51,510	10	"	8½	Do. 7 p. c.	10	14-15	..	5 13 4
328,750	10	"	—	Buenos Ayres (New) Limited	10	6½-7½	+½	—
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	93-96	..	6 5 0
150,000	20	26 Feb.	8	Cagliari, Limited	20	24-26	..	6 3 1
550,000	Stock.	13 Apr.	13	Commercial, Old Stock . .	100	232-236*	-4	5 10 2
165,000	"	"	10	Do. New do.	100	185-190*	..	5 5 3
150,000	"	30 Dec.	4½	Do. 4½ p. c. Deb. do.	100	118-123	..	3 13 2
800,000	Stock.	30 Dec.	13	Continental Union, Limited.	100	221-226	..	5 15 1
200,000	"	"	10	Do. 7 p. c. Pref.	100	185-195	..	5 2 7
75,000	Stock.	30 Mar.	10	Crystal Palace District . .	100	185-195	..	5 2 7
486,090	10	29 Jan.	10	European, Limited	10	19-20	..	5 0 0
354,060	10	"	10	Do. Partly paid	7½	14-15	..	5 0 0
5,470,820	Stock.	12 Feb.	12	Gaslight & Coke, A, Ordinary	100	210-215	-2	5 11 8
100,000	"	"	4	Do. B, 4 p. c. max.	100	94-97	..	4 2 5
665,000	"	"	10	Do. C, D, & E, 10 p. c. Pf.	100	245-250	..	4 0 0
30,000	"	"	5	Do. F, 5 p. c. Prt.	100	116-121	..	4 2 9
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	169-174	..	4 6 2
1,300,000	"	"	7	Do. H, 7 p. c. max.	100	153-156	..	4 9 9
463,000	"	"	10	Do. J, 10 p. c. Prt.	100	241-246	..	4 1 3
476,000	"	"	—	Do. K, 6 p. c. Prt.	100	145-150	..	4 0 0
1,061,150	"	11 Dec.	4	Do. 4 p. c. Deb. Stk.	100	113-116	..	3 9 0
294,850	"	"	4½	Do. 4½ p. c. do.	100	118-123	..	3 13 2
908,000	"	"	6	Do. 6 p. c. do.	100	163-168	..	3 11 5
3,800,000	Stock.	12 Nov.	12	Imperial Continental . . .	100	224-228	+1	5 5 3
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4-4½	..	6 13 4
560,000	100	1 Apr.	5	Met. of Melbourne, 5p. c. Deb.	100	106-108	..	4 12 7
541,920	20	27 Nov.	6½	Monte Video, Limited. . .	20	14½-15½	..	8 7 8
150,000	5	27 Nov.	10	Oriental, Limited	5	8½-8½	..	5 14 3
60,000	5	30 Mar.	7	Ottoman, Limited	5	4-5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited.	10	2½-3½	..	—
People's Gas of Chicago—								
420,000	100	3 Nov.	6	1st Mtg. Bds.	100	105-108	+4	5 11 1
500,000	100	1 Dec.	6	2nd Do.	100	105-108	+4	5 11 1
150,000	10	15 Oct.	10	San Paulo, Limited	10	8½-9½	-½	10 10 6
500,000	Stock.	26 Feb.	15½	South Metropolitan, A Stock	100	267-272	..	5 14 0
1,350,000	"	"	12	Do. B do.	100	220-225	..	5 6 8
200,000	"	"	13	Do. C do.	100	235-240	..	5 8 4
725,000	"	30 Dec.	5	Do. 5 p. c. Deb. Stk.	100	140-145	..	3 9 0
600,000	Stock.	11 Mar.	11½	Tottenham & Edm'ton, Orig.	100	—	..	—
WATER COMPANIES.								
729,331	Stock.	30 Dec.	10	Chelsea, Ordinary	100	243-248	..	4 0 8
1,720,252	Stock.	13 Apr.	8	East London, Ordinary . .	100	192-197*	+1	4 1 2
544,440	"	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	136-140	..	3 4 3
700,000	50	11 Dec.	8	Grand Junction	50	95-100	..	4 1 8
708,000	Stock.	12 Feb.	10½	Kent	100	247-252	+4½	4 3 4
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max. . .	100	213-218	+3	4 7 2
406,200	100	"	7½	Do. 7½ p. c. max.	100	182-187	+2	4 0 2
260,000	Stock.	30 Mar.	4	Do. 4 p. c. Deb. Stk. . . .	100	120-123	..	3 5 0
500,000	100	12 Feb.	12½	New River, New Shares . .	100	320-330	..	3 13 6
1,000,000	Stock.	29 Jan.	4	Do. 4 p. c. Deb. Stk. . . .	100	126-129	+1	3 2 0
902,300	Stock.	30 Dec.	6½	S'thwk & V'xhall, 10p. c. max.	100	140-145	+5	4 9 8
126,500	100	"	6½	Do. D 7½ p. c. do.	100	130-135	+2½	4 16 3
1,155,066	Stock.	11 Dec.	10	West Middlesex.	100	240-245	+3	4 1 7

*Ex div.

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THE

JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, APRIL 26, 1892.

The Centenary of Gas Lighting.

THE present season, just before the appointed times for the meetings of the representative gas institutions of England and Scotland, is a fitting opportunity for drawing the attention of readers of the JOURNAL to the interesting fact that this year is the centenary of the application of coal gas to the purpose of illumination, which was first done by William Murdoch, at his house in Cross Street, Redruth, in the year 1792. This circumstance was mentioned by Mr. T. D. Hall, of Montrose, in the course of his address at the recent informal meeting of Scottish gas managers in Glasgow. Mr. Hall (who, as he told his audience, was for some years Manager of the Redruth Gas-Works) at the same time exhibited to the meeting some

photographs of Murdoch's house—one showing the memorial tablet affixed to the wall by Messrs. Tangye Bros., of Birmingham, which proclaims to the world the remarkable legend that from this humble abode two such world-changing inventions as steam locomotion and coal-gas lighting issued upon their momentous course. The Scottish gas managers, who claim Murdoch as a fellow-countryman, have acquitted themselves well in the matter of securing his formal admission into the ranks of their national worthies. Through the kindness of Messrs. R. Laidlaw and Son, a bust of Murdoch was exhibited at the Glasgow meeting; and, as already announced, arrangements will be made for placing the Murdoch memorial bust in the hall of the Wallace Monument at Stirling next July. We shall have to deal with this work of the Murdoch Memorial Committee (of which Mr. J. M'Gilchrist, of Dumbarton, is Secretary and Treasurer) at a future time, and shall therefore leave the subject for the present with an expression of congratulation upon the success which has so far rewarded their honourable labours.

The idea of celebrating centenaries and anniversaries of all sorts of events is being a little overdone in these times; and we are by no means inclined to ask our readers to attach any exaggerated importance to the one-hundredth year of gas lighting. All the same, the principle of publicly recognizing notable men and events at stated times is deeply rooted in human nature; and it would be as great a mistake to overlook such a period as the Murdoch Centenary as to overdo the celebration. From all that remains on record of his personality, we may safely conclude that Murdoch was a far more deserving man than many who, through favouring circumstances and a trick of self-advertisement, occupy a more conspicuous niche in the temple of Fame. It is, however, the glory of the British people that behind, and sometimes above and beyond, the notabilities whose names Fortune has blazoned with lustre eternally bright, so that they shine through the dusk of ages as beacons for their kind, there is an innumerable throng of worthies to whom the world owes more than it knows. Much that remains of Murdoch the man and the mechanic is told, with other appropriate matter, by his grandson, Alexander Murdoch, in a little book entitled "Light without a Wick: A Century of Gas Lighting," which, embellished with a photogravure of the memorial bust, is now being sold for the benefit of the Memorial Fund. The least that any gas manager or gas-works official, past, present, or prospective, can do is to procure a copy of this little work, for Murdoch's sake. One glance at the open, shrewd countenance, lighted up by a half-smile and a twinkling of the eye, will be enough to convince anyone that the ingenious Founder of one of the greatest of living industries was a good fellow, who would have taken pleasure in the thought that, although his partners in business did not think his application of gas for lighting worth patenting, his name and deeds would be remembered with due honour a hundred years later.

How little does the wisest of us know of the things that shall come to pass! The application of coal gas to the purpose of lighting was never patented, any more than Murdoch's other invention of the steam locomotive; and what have these discoveries done for the world! For steam locomotion we will not speak; but for gas we will maintain that this first suggestion in the world's history of a means of general public and private lighting, has done more to further the immense progress of the last century in mental and moral, as well as in mere physical enlightenment, than anything else that can be named in the same breath with it. We are not now speaking of Murdoch's own work, but of what came after Murdoch, who does not appear to have contemplated public lighting. It is easy to see now that a cheap, brilliant method of illumination applicable to large open spaces and capacious halls, and not needing to be trimmed, or calling for attention for any length of time when once set going, must have created a complete revolution in the social arrangements obtaining at the end of the last, and the commencement of the present century. Evening amusements and educational meetings hardly existed; the homes of the people were dingy and unlovely; and the police of the towns must have been inefficient, if the character of the force itself had been ever so good, in the absence of public lighting. Of course, the provision of good lighting did not create evening amusements and instruction, nor did it reform the forces charged with the duty of keeping the

peace; but it rendered possible and easy those wide-reaching reforms in these and other features of town life which have so distinguished our age from all that went before it. Gas has been more than sun and moon to modern times; and if, in traversing the streets at night, one should happen to entertain a passing emotion of wonder as to whether it is possible to believe, in despite of modern pessimism, that the world has gone forward somewhat as the result of the labours of all the good men and true who, like Murdoch, have lived and died since the dawn of the Era of Coal, Iron, and Steam—well, the feeling and the doubt should vanish at the sight of what the poet has styled “The century’s chief adorning—The flame of gas, in its frame of glass, Of the gas-lamp at the corner!”

The Assessment of the Birmingham Corporation Gas-Mains.

THE literature of rating cases is being swollen by the record of the appeal of the Birmingham Corporation against the assessment of their gas property in the parish of Harborne, as fixed by the Assessment Committee of the King’s Norton Union, to which the parish in question belongs. We give the report of the first part of these proceedings in another column. The matter stands adjourned to May 17; and this being so, we are precluded from discussing the merits of the case. As will be seen by our report, some of the same actors who played conspicuous parts in the recent Chartered assessment appeals—to wit, Mr. Henry E. Jones, the Chief Engineer of the Commercial Gas Company, and Mr. Danckwerts—have accepted this “starring” engagement in Staffordshire; and the way in which they opened their business was strongly reminiscent of the Clerkenwell performance. This is very obvious upon the face of the case. The Assessment Committee having raised the valuation of the mains in the parish of Harborne to £480 gross and £400 net from the rating agreed upon five years ago, which was taken at £270 net, the Corporation have set themselves to show that, instead of being raised, their assessment ought to have been rather reduced to about £200 net. This is precisely what the advisers of the Chartered Company did; and, so far as can be gathered from the evidence, the same advice is to be acted upon throughout the Birmingham case. There are, of course, some peculiarities of the latter which differentiate it from the former. Remarkably enough, the Birmingham Corporation happen to be charging the same price for gas now as when the last assessment was agreed upon; and it is not contested that their revenue has considerably increased. The appellants plead, however, that while their revenue has grown, their expenses have swollen disproportionately; so that their enlarged business is not worth so much, as a going concern, as it was formerly. It is quite refreshing to hear Counsel for the Birmingham Gas Department expatiate upon the plea that really the Corporation ought not to be treated as if they were a mere trading body, who kept the gas-works for profit. It is true, of course, that a profit is made, and that the outlying parishes supplied with gas by the public-spirited Corporation can see, in the various street and building improvements that have changed the face of Central Birmingham during the past twenty years, the fruit of the good prices they have had to pay for their light; but we are assured, on the authority of Mr. Danckwerts, that it would be quite a mistake to imagine that the Corporation regard their gas undertaking as a mere money-making concern. This part of the case is very funny reading; and one can but wonder whether the Corporation advocates and witnesses would pipe in the same key if it were a case of any parish desiring to buy its portion of the undertaking. These rating appeals are, however, peculiar things, as more than one legal luminary has confessed; and the invention of the “hypothetical tenant” is responsible for a good many other hypotheses operating to remove both evidence and pleadings from the region of sober facts to the realms of fancy.

An Informal Gas Managers’ Meeting.

THE report which appeared in the last issue of the JOURNAL of the proceedings of the Scottish Gas Managers at their now annual “informal” meeting in Glasgow is of a character which reflects the highest credit upon all concerned. We should not be surprised to hear that the mouths of many gas managers in other parts of the kingdom had watered over this record of a most helpful, sociable, and enjoyable

chat about “shop” in all its bearings. It is an old complaint of ours that District Associations of Gas Managers are apt to be far too formal. They are mostly over-staffed with officials who have little or nothing to do; and all their formality of constitution does not prevent the occasional collapse of a meeting. Taking into consideration the brief time of the whole year devoted to these gatherings, the share of it occupied by purely formal “business,” to the perfunctory passing of resolutions, votes of thanks, &c., is to our thinking deplorable. What do gas managers enjoy most, when they meet their “brother chips” from whom they are severed for weeks and months on end, but the limitless talking of “shop”? This, followed by a modest dinner or meat tea, is a treat of a high order to the isolated gas manager; but it is what he does not get at many district meetings. Now, it is obvious that there is only one M’Gilchrist, upon whom the honour and the labour of getting up these “informal” meetings in memory of the West of Scotland Association falls so lightly; but surely England is not destitute of genial gentlemen who would be able to do as Mr. M’Gilchrist does, even at some little distance after him. The way he manages these friendly gatherings, without any organization, fuss, or expense, is a testimonial of considerable value to his talent in administration; and the popularity of the meetings clearly shows that they meet a distinct want. It would hardly be too much to say that in its “informal” immortality the West of Scotland Association is not less useful in death than it was in life. At all events, we trust that the Scottish gas managers will continue for many years to meet as they did on the 14th, and talk in the same interesting way upon the matters with which they and their professional colleagues everywhere are concerned in their every-day work. There is many a man who can give a useful hint in a few words which he could hardly expand into a paper; and these meetings are just the right place for such remarks. The “paper,” indeed, great as is its utility, has certainly had the effect of banishing other less pretentious means of imparting information from the regular professional gatherings. This is to be regretted; and there is a corresponding amount of gratitude due to those who show, as the Scottish managers do once a year, that a supply of papers is not essential to the success of a gas engineering convention. We could wish that there were more of the same character.

A Common Form of Robbery.

NOR a day too soon, the editors of newspapers, periodicals, and the numerous and important class of scientific, technical, and trade journals which provide their readers with original matter, bought for the purpose, are raising a protest against the shameless way in which their best and most attractive articles are regularly stolen and reproduced by the conductors of other publications, of the scissors-and-paste kind, often with very insufficient acknowledgment, or none at all. Our esteemed contemporary the *Builder* began it; and, quite independently, a lively controversy upon the same subject broke out in the columns of the *Times*, over a theft of matter by one “religious” paper from another. Few technical publications suffer more in this way than the JOURNAL; and we are therefore glad to take this opportunity of assisting in the exposure of a practice of which the ever-increasing number of catch-penny periodicals is at once an effect and a cause. It can hardly have escaped the notice of any intelligent observer of railway bookstalls and news-vendors’ shop-windows, that the space available for the display of newspapers and journals becomes more crowded every week with publications of infinite variety of title. A little closer examination reveals the, at first blush, amazing fact that highly specialized journals—organs of opinion and chronicles of facts and events appealing to different classes and divisions of the community—which were once rare and high priced, are now apparently both plentiful and cheap. Not merely every science, art, profession, trade, and calling has its one or two cheap weekly papers, but the followers of every fad or fancy that ripples the surface of social existence are catered for by journalistic bidders for custom. This would be harmless enough if it were only honest; but, unfortunately, with hardly a single exception, these “cheap” specialized publications are also “nasty.” They are mostly made up of news cuttings from all sources, and their readable matter is all purloined

from respectable journals which pay their contributors. It is easy enough to produce a cheap paper dealing (say) with a branch of engineering, by the simple process of pasting together pell-mell all the newspaper clippings referring to the subject that can be raked together, headed with a few articles lifted bodily from better journals, and weighted with reported proceedings of technical societies, which are common property. American editors have long enjoyed a bad pre-eminence for this kind of piracy, which is perhaps to be explained by the callousness of the national conscience with regard to copyright in general literature. Some of our English newspaper people are, however, just as bad as any Yankee; and their offence is not diluted by the intervention of an ocean between robbers and robbed. For our part, we care little who takes our matter after it has once served its object in these pages; but it would be of some practical convenience, to say nothing of any consideration of common honesty, if those who borrow our choice bits would take the trouble to state where they obtained them. For lack of such a mark of origin, it not unfrequently happens that something which first appeared in the columns of the JOURNAL, and was promptly stolen and passed off as quite original in some other publication, is bandied about all over the globe; and, after many months (having meanwhile been translated into and out of several languages), arrives once more at the point whence it started. Several experiments have been made with a variety of animate and inanimate objects, with a view to ascertaining in how short a time the journey round the world may be made. We have seen the trip done by one of our paragraphs in from fifteen to eighteen months; and we are bound in fairness to admit that some of these have turned up quite fresh-looking at the end of the journey. Indeed, some bits of technical matter appear to be endowed with the troublesome immortality of the Wandering Jew, for they are always making their appearance in unexpected places. These, however, are usually the battered ones, whose misfortunes serve them for a disguise so complete that it requires a paternal eye to recognize them.

Mr. J. S. Naylor, Assistant Manager at the Cleckheaton Gas-Works, has been appointed Manager of the gas-works of the Selby Local Board of Health, in succession to Mr. W. H. Bell, resigned. He will enter upon his duties on the 4th prox.

The Gas Supply of Paris and Brussels.—Almost coincidentally with the publication, in the last number of the JOURNAL, of the results of the working of the London Gas Companies in the past year, particulars came to hand of the gas supply of Paris and Brussels for the same period. Those referring to the former city were furnished by the report and accounts of the Paris Gas Company, which came before the shareholders at their meeting on the 29th ult.; the statistics as to Brussels being contained in the report presented by the Gas Committee of the Municipal Council to that body on the 11th inst. Taking Paris first, in the twelve months ending in December last, something like 11,000 million cubic feet of gas were sent from the Company's stations, as compared with 10,872 millions in 1890. The sale of this gas produced a revenue of £3,184,280—an increase of nearly £21,500 on the receipts in the preceding year. The accounts show a disposable sum of £1,016,000, half of which goes into the coffers of the Municipality, in addition to the tax of 2c. per cubic metre of gas, amounting to £215,892, and £8000 paid as rent for the use of the subsoil of the public streets. The shareholders received a dividend of 74frs. 50c., which, however, was a drop to the extent of 50c. on that for 1890, notwithstanding the augmented consumption. This is, of course, explained by the high price of coal and labour. The question of reducing the price of gas is still the subject of conferences between the Company and the Municipality; and though both parties profess to be desirous of coming to some understanding on the matter, a definite settlement seems to be still a long way off. The latest proposition is to lighten the Company's financial burdens by deferring the redemption of the bond capital until the end of the concession (Dec. 31, 1905), and leave to the City, who will then take over the concern, the responsibility of discharging the obligations still outstanding. Negotiations on this basis are proceeding. Turning to Brussels, we find that the consumption of gas in the past twelve months rose to nearly 752 million cubic feet, or about 50 millions in advance of that of the preceding year. Owing, however, to the reduction in the price from 3s. 4½d. to 3s. 1½d. per 1000 cubic feet, and, as elsewhere, to the high price of coal and the depreciated value of coke, the result of the working was considerably lower than that of previous years. The Committee were only able to report a profit of about £32,000, against £55,830 in 1890—a falling off to the extent of £23,830. This is matter for regret, especially as the profits on the last-named year were less by £2264 than those for 1889.

WATER AND SANITARY AFFAIRS.

IN proof that municipalities do not in all cases manage the water supply so much better than a private company, Mr. F. G. Banbury a few days ago addressed a letter to *The Times*, showing that the water supplied daily for domestic use in Liverpool and Manchester, per head of the population, averaged less than half the quantity furnished to their customers for this purpose by the East London Company. Other municipalities were shown to be also giving a much more stinted allowance than that which is enjoyed in the Metropolis. The East London Company were stated to be providing a domestic supply at the rate of 28 gallons per head per day. But a gentleman residing at Queen Anne's Gate writes to *The Times*, challenging the figures relating to the Metropolis, and asking "has it ever been proved that the present sources "and filter-beds are sufficient to provide every day in the "year an amount equal to 28 gallons per head of the pre-"sent population?" We may observe that Mr. Banbury spoke for the East London district, and not for the whole area supplied by the eight Metropolitan Water Companies. For the entire area, the daily domestic supply last year would average a trifle less than 25 gallons per head. The difference is not essential, for the sceptical correspondent of *The Times* boldly declares his entire disbelief in the alleged magnitude of the Metropolitan supply. This is certainly a new phase of the controversy. Figures have been cited again and again to show that the Water Companies are shrinking the volume of the Thames, and are so depleting the Lea that it is a great wonder the river exists at all. If this new contention be correct, then the abstraction from the rivers is not equal to what has been alleged, and there is no cause for the outcry which has been raised. At the same time, it must be allowed that, if this is the case, there has been a lot of bungling on the part of those who have been gauging the stream and calculating the quantity abstracted. Perhaps these authorities will say a word in their own defence. General A. de Courcy Scott can also speak about the filter-beds. Another consideration is that, as the Metropolitan Water Companies have 185 pumping-engines at work—equal in all to more than 23,000-horse power, it must be presumed that an enormous volume of water is pumped up from the rivers and wells every day, or else that the engines must be intended for ornament rather than use. But we are glad to observe that this gentleman who has doubts as to the extent of the supply, has some reasonable notion with respect to the terms on which the Companies should be bought up. He proposes that for the space of 21 years after the undertakings have been transferred to the London County Council, the shareholders should receive from that body the same dividend as they had last year. After the close of the 21 years, the dividend is to be gradually reduced, until it becomes 2½ per cent. It is suggested that a transfer on these terms should be at once settled by Act of Parliament; thereby bringing matters to a speedy termination. But what says the County Council? As affecting the value of the water undertakings, Colonel Makins has a letter in *The Times* of yesterday, in the course of which he shows the fallacy of Sir T. Farrer's contention, that the future liability of the Companies for the extension of their supply is to be taken as a factor in decreasing the present value of their property. In reply to this view of the case, Colonel Makins points out that the obligations of the Companies can extend only so far as the means granted by Parliament will allow. Further liabilities, or further chances of profit, can only attach to further grants of capital which may prove to be necessary, either for dealing with the present sources of supply, or others more remote.

Dr. Frankland's report on the Metropolitan Water Supply for the past year possesses features somewhat opposite in their character; rendering it necessary to give a careful perusal to the entire document in order to arrive at a correct conclusion. The operations of those Companies which supply river water are stated to have been seriously interfered with by dense smoke-bearing fogs in the early part of the year, and by heavy floods in the Thames and the Lea during summer and autumn. The storage, subsidence, and filtration plant of the Companies who purvey river water is described as having been quite inadequate to deal with the exceptional pollution; "and water of "such bad quality, as regards organic matter in solution,

"has rarely been delivered by these Companies during the last twenty years." This also signifies that the supply has been of superior quality during that period; thereby raising the standard of purity. But with regard to the actual organic admixture in last year's supply, the important fact is announced that there appears to have been "no abnormal amount of sewage contamination in the river waters;" the great additional proportion of organic matter being due to vegetable sources. We also apprehend that the so-called "sewage contamination," minute in quantity, is merely of the "previous" character. A comparatively small proportion of organic material is found among the solid constituents of the water supply, and the real amount is "often quite insignificant." But a portion is made the ground of objection because of its "origin." It is said to come from sewage; and although it is sewage no longer, the argument is held that it may be accompanied by the germs of disease. Yet we are told by Dr. Frankland that such germs "have never been observed in any water supplied to London," though it is suggested that they may have been there, only they escaped notice. Against such a possibility we may put one or two facts. In the first place, the filtered water supplied by the West Middlesex Company shows that 99·83 per cent. of the germs in the original water have been removed. The water which showed the least amount of purification last year was that of the Lambeth Company, where the reduction was 98·76 per cent. Thus the exclusion was, on the whole, nearly absolute; and concerning microbes in general we are told that "the vast majority found in potable waters are, as far as is known, entirely harmless." With regard to the state of the supply last year, the adverse circumstances already mentioned made it compare badly with the quality of the water in previous years. But both last year and the year before there was one thing in favour of the supply—the continuous increase of total combined nitrogen noticed in previous years having been checked. Last year the reduction was even to a lower point than in 1890. Dr. Frankland thinks it most likely that this was due to the increased rainfall, though he admits that it may have been brought about "by the more efficient exclusion of untreated sewage." In two instances during last year the water supplied was found to be "slightly turbid;" but, with these exceptions, all the samples taken were "clear and transparent"—a state of things which is described as a great improvement compared with the record some twenty years ago. Although Dr. Frankland still entertains sundry shadowy fears, it must be acknowledged that the facts tell very much in favour of the present supply.

The Experiments in Enriching Gas with Oil at Peterhead.—Our attention has been called by Mr. J. Mackay, of Peterhead, to the figures relating to the above experiments, given in our report last week of the remarks made by him at the meeting of gas managers in Glasgow on the 14th inst. He states that the durability of the coal gas with which he started was 41½ minutes, which he increased to 50 minutes by enriching with oil—not 4 minutes increased to 20 minutes, as given in our report; and that the percentage of benzol in the naphtha was reduced from 24 to 30 down to about 15, and not from 34 to 36 down to 15. Our reporter explains that his figures were in accordance with those on his notes, but that as Mr. Mackay, while giving them, stood with his back towards him, he might not have heard him distinctly. But he considered he had taken down the figures accurately; and so he did not ask Mr. Mackay to verify them.

The Metropolitan Water Supply Commission.—Yesterday the proceedings of the Royal Commission on the Metropolitan Water Supply were resumed at their offices, Trafalgar Buildings, Charing Cross. There were present Lord Balfour of Burleigh (Chairman), Sir G. B. Bruce, Sir Archibald Geikie, Professor Dewar, Mr. G. H. Hill, Mr. J. Mansergh, and the Secretary (Mr. F. Gaskell). The Commissioners had under further consideration several matters connected with procedure, and with the preparation of the maps and plans requisite for the inquiry. They hope that the preliminary statements for which the Water Companies and the principal public bodies concerned in the inquiry have been asked will be in their hands before the close of the present month. If this should be the case, the Commissioners intend to proceed without delay to hear evidence, and will probably call first on the representatives of the Water Companies. The Commissioners have resolved to admit to the sittings at which evidence will be taken members and officials of any public body interested, as well as any officer connected with a Water Company; and provision will also be made for the accommodation of a reasonable number of representatives of the Press. The Commission adjourned until Tuesday, the 3rd prox.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 767.)

THE Stock Markets have not yet returned to life again. They were dead enough before the holidays; and it was hoped that they might revive after the vacation was over. But as yet they have shown no signs of resuscitation; and the past week has been depressing to those who looked for a more stirring time. Prices have not uniformly fallen; but they are generally lower—there being no demand for anything. The Money Market shows no change from its easy condition. The Gas Market has been just as quiet as the rest; and though a fair number of changes are to be found in the quotations, they are none of them of any importance, and the chief issues are unaffected. Among Gaslights, the "A" was a little dealt in every day, opening unchanged; but from 213 marked on Tuesday, the figures were disposed to fall away, and on Saturday the closing bargain was done at 210½—the lowest of the week. The debenture and preference issues, however, were well supported—the demand for investment stocks being maintained; and they changed hands at satisfactory prices generally, while the "J" 10 per cents. rose 2. South Metropolitans have been but little touched; but the few transactions effected in them show continued firmness. In Commercials, the old stock thrown upon the market has had the result of still further depressing the price; the quotations falling another 1½. When this self-sacrificing operation is complete, the price may be expected to go back again. The new and debenture stocks remain firm. The Suburban and Provincial Companies have not developed any remarkable feature; and the only move is an advance of 1 in Brighton and Hove. Upon information received from the Secretary of the Company, we quote Tottenham and Edmonton "A" at a 5 per cent. price; but the Stock Exchange official quotation is not yet restored. Continentals are steady generally; but European £7 10s. paid was put down ½, without any business marked. Of the Indians, Bombay has gone up ¼ upon a satisfactory report and accounts, notwithstanding the state of the Exchange; but this factor has depressed Oriental to an equal extent. Among South American undertakings, Pará and San Paulo have fallen ½ each. The Water Companies are steadily recovering from the unwarrantable knockdown to which they were subjected; and most of them have advanced from 1 to 5 per cent. in the week.

The daily operations were: Gas opened unchanged on Tuesday, and so remained; business being quiet. In Water, Chelsea rose 2; and East London, 1. Wednesday's prices in Gas were mostly steady; but Commercial old receded 1½; and Pará, ½. The rise in Water was 3 in Kent and both Lambeth issues; 2 in Chelsea and Southwark; and 1 in Grand Junction. Thursday was, if anything, even quieter in the Gas Market. Gaslight "J" rose 2; but San Paulo fell ½. Southwark Water rose 1; but Lambeth 7½ per cents. were put down 2. The only feature in Gas on Friday was a rise of 1 in Brighton and Hove, and ¼ in Bombay; and a fall of ½ in European part paid, and ¼ in Oriental. Chelsea, Lambeth, and Southwark Water rose 1 each. Saturday was as quiet as usual; and the only change in quotation was a further rise of 1 in Southwark.

ELECTRIC LIGHTING MEMORANDA.

Another Awkward Breakdown—The Fortunes of the House-to-House Company—A "Corner" Defeated—When Critics Agree!

THE statement that another "accidental" extinction of the electric light in the Winter Palace of the Czar, this time attended with a small fire among the rafters of the roof, is one of those pieces of evidence of the incompatibility of theory and practice in electric lighting matters which we are peculiarly interested in placing upon record. A good deal of fun is often poked at the absurdity of the old-fashioned way of characterizing certain manufacturing processes, or systems of construction, as being "theoretically right, but practically wrong." One is occasionally asked by confident gentlemen fresh from a modern technical college, how anything can be properly so described. Well, the experience of the electricians is pretty full of illustrations of what is meant by this proverbial expression. From many a stall at the Crystal Palace Exhibition may be had pamphlets in which this or that system of electrical distribution is recommended as absolutely free from all risk of breakdown, of causing fire, or injury to life, or indeed from every imperfection. Yet, somehow, even in places where it might reasonably be supposed that every precaution would be taken to ensure the continuity of the service, these accidents constantly occur. In face of these mishaps, it is hardly to be wondered at that the general public continue to take the perfervid assertions of the electric light enthusiasts, professional and otherwise, with a good deal of "salt."

The House-to-House Electric Light Supply Company, Limited, have just held their annual general meeting; and, like all other companies of the kind, have had to rest content once more with a *succès d'estime*. The Chairman called the condition of the Company "comparatively satisfactory;" and when this is the best that can be said for an admittedly speculative venture, it is pretty safe to suppose that the standard of comparison, if

it could be known, would not be found a very high one. The Chairman had to confess that the rate of progress in the Company's actual lighting business had not been maintained last year as compared with 1890; and upon the same subject Mr. Robert Hammond, the Managing Director, assured the proprietors that the business would have increased much more "if the Company's plant had permitted the Engineers to take on more orders." Thus it appears to be the same old story of more capital being wanted long before that already sunk has proved remunerative; and the Directors of the House-to-House Company will need to keep a watchful eye upon the spending departments, if the expenditure is not to be allowed to swamp the concern. Mr. Hammond has hitherto had much more experience of spending capital upon, than of earning dividends by, electric lighting. While they do a little lighting, the House-to-House Company still keep their hand in with a little company-mongering; and there appear to be some Yorkshire ventures which owe allegiance and tribute to Mr. Hammond and his partners. This indeed appears to be the source of the only profit the parent Company can rely upon for paying their preference dividends. But the life of this concessionary kind of business, if merry while it lasts, is very short. How the Company are going to live out of the Kensington lighting alone is more than we can see at present.

A very pretty piece of Yankee "smartness" has come to light in regard to the supply of arc lamps for the Chicago Exhibition. The Exhibition authorities and the electricians have been very friendly since the commencement of this enterprise; and the former have even obliged the latter by turning a cold shoulder upon the gas lighting industry of the country, which is, to say the least of it, considerable enough to claim recognition by the Executive of a national industrial bazaar. Then it came to letting the contract for the arc lighting of the Exhibition, which, as at least 6000 lamps will be required, is a big thing. The authorities had talked the matter over with the representatives of the principal American electric lighting companies—the Edison and Thomson-Houston—and had been led to believe that the charge per lamp would not be more than from \$15 to \$20 for the season. However, before the tenders were to be opened, the various companies interested in the contract had amalgamated, and, as a consequence, only one tender was sent in, which came from the Thomson-Houston Company, chosen to represent the "ring," and this demanded \$38½ per lamp. Such a barefaced attempt to "strike" the Exhibition was too much for the Executive, who appear to be acting honestly in the matter; and the tender was therefore peremptorily rejected. An intimation was also given that if the electricians persisted in their ill-advised policy, the lighting of the Exhibition might be handed over to European contractors. This and other representations of the same nature had a good effect; for it is now reported that the Thomson-Houston Company have "come down," and have agreed to furnish 2500 lamps at \$20 each; the rest being divided among other contractors. This settlement is reported to give "general satisfaction." Very likely; the good people of the United States are satisfied with a very small display of commercial honesty on the part of their gigantic "trusts" and "syndicates." From an outside standpoint, however, the incident affords lamentable proof that the practice of the newest of all trades, in connection with a show that is supposed to testify to the unequalled advance of the United States in civilization, is vitiated in this year of grace by the same old chicanery that even the pilgrims of the *Mayflower* would hardly have looked upon as worthy of a respectable trader—except, of course, in dealings with the natives.

It is with sincere gratification that we find ourselves so commonly in accord, in our criticisms of matters electrical, with the best representatives of the electrical press. It is only natural that, as compared with their attitude respecting electric lighting topics, we should appear to assume that of the *Avocatus Diaboli*; but upon many points of criticism our unanimity is really astonishing. The *Electrical Review* and the *Electrician*—which latter organ, by the way, has greatly improved of late—entertain the same contempt of the quacks and mountebanks of the electrical profession as we do; and they always maintain, with the JOURNAL, that if the electrical industry cannot get on without such impositions as "French measurement," and misrepresentations of the cost of electric lighting, it will never do any good. Similarly, in much that we have stated respecting the shortcomings of the Crystal Palace Exhibition, our contemporaries thoroughly bear us out. For example, the *Electrician* recently remarked of this show that, while it contains "little that is new," inspection of the contents of the various stalls "brings home very forcibly the very stable and developed state which has been reached by makers of electrical machinery and apparatus." Just our opinion; and we also coincide in the slighting expressions used by our contemporary respecting the lack of artistic merit in a large portion of the lighting fittings. The most puzzling question for us is, What are our art critics about, that they do not think it worth while to turn their attention in this direction? How can one wonder that tradesmen botch and bungle these things, if they get no guidance from those whose taste has been formed in accordance with true canons? The hopeless poverty and crudity of many of the electric light fittings in the Exhibition, and the extremely fantastical character of others, are alike a grief to the beholder.

AN ILL-ADVISED PROSECUTION.

A LAWSUIT which presents several points of interest for gas managers and others more or less directly connected with the gas industry was determined by the Lord Chief Justice and a special jury at the last Manchester Assizes. This was the case of *The Queen v. Levinstein & Co., Limited*, in which the real prosecutors were the Corporation of Manchester; the defendants being a firm of chemical manufacturers carrying on business at Crumpsall. Although the proceedings were taken in the criminal form, the action was really of the nature of civil litigation commenced by the Local Authority for the protection of ratepayers. We are not concerned with the question of how matters of this kind can be most conveniently handled. That is for the lawyers. The gist of the affair is simple enough—it was the Manchester Corporation attacking a firm of chemical manufacturers for creating a nuisance to the neighbourhood in which their works are situated. It appears that Messrs. Levinstein, who are engaged in the production of coal-tar derivatives, recently made the preparation of naphthylamine a branch of their manufacturing operations at Crumpsall; and it was alleged for the prosecution that this new manufacture, the starting-point of which is naphthalene, had the effect of poisoning the air of the neighbourhood with evil-smelling emanations. The stench complained of was supposed to come from a particular stage of the naphthylamine distillation process, and was described as possessing most peculiar qualities. It was capable of travelling to enormous distances, and was worse when diluted with air than when first produced. It was also accused of causing nausea, diarrhoea, &c., in the human subject. In every respect, therefore, the complaint against Messrs. Levinstein was a very serious one. In instituting the prosecution, the Corporation of Manchester were inspired by their newly-born desire for purifying the atmosphere of the city and its suburbs—a most praiseworthy idea, doubtless, although taken up so late in the day that the Nuisance Committee, hardly knowing where to begin, seem fated to make nothing but false starts. At any rate, they failed in this instance; the Court refusing to convict Messrs. Levinstein upon the evidence brought forward. The Court took what appears to be the common-sense view—that residents in the neighbourhood of Manchester, or any similar locality, must take the place as it is, and must not be too "squeamish" in regard to a new odour or two, or any other incident of the development of the *genius loci*, provided that nothing has been done, either wilfully or through carelessness, to give unnecessary offence. Of course, there is a limit to tolerance in these matters. If a manufacturing process can be shown to be injurious to the health of people living in the neighbourhood, it will be no answer to plead that the process is carried on as well and as carefully as possible. The law will still say that the manufacture is an intolerable one, and must be stopped. All this is perfectly clear. Unfortunately for the Corporation, many of the witnesses whom they put forward to complain of Messrs. Levinstein's doings were unsuited, by their personal appearance, for the part of martyrs to chemical fumes which they essayed to play; and so the prosecution fell through.

Gas manufacturers are interested, as has already been remarked, in this litigation; and their interest is of two kinds. As owners of factories which come into the category of works from which noxious vapours are, can, or may be emitted, they are naturally concerned to watch proceedings for creating nuisance taken by local authorities and others against their fellows of the same industrial order. Gas manufacture is a business which may be credited with certain salubrious effects, notably in the matter of diminishing the smoke of towns by rendering possible the substitution of smokeless cooking and heating stoves for smoky grates and kitcheners. At the same time, a gas-works is not an establishment that would be regarded by owners of property as an improvement to a residential neighbourhood. Yet the arrangements and processes of gas-works have been very greatly improved of late years, sometimes deliberately, and of set purpose, for the abatement of nuisance, and quite as largely by what may be called consequential ameliorations—that is to say, incidentally upon the improvement of manufacturing and purifying methods. A good example of the latter is the modern working of gas-purifiers, with or without sulphur purification. Not many years ago, when Dr. Ballard investigated the subject for the Home Office, the emptying of the contents of the so-called "sulphide boxes," deemed to be an essential feature of sulphur purification, was productive of such an intolerable nuisance, that it was questionable whether a gas-works could be removed far enough from human habitations to permit of the process being carried on without offence, or whether the benefit of gas with a little less sulphur in it was not bought too dearly at the price of a whole neighbourhood deprived of charm for residential purposes. As then understood, in short, the question of the sulphur purification of gas was, for sanitarians, that of occasionally doing evil to the atmosphere surrounding the works, in order that some debateable good might be done to the air of the rooms of gas consumers. All this, or at any rate the worst of it, has now been changed; and no gas purifier need ever be opened to the air until its contents are perfectly inert, and incapable of giving offence. Now be it observed that this result

was not achieved by directly striving after an innocuous system of purification. The point to be dwelt upon in this connection is that no hardship, but rather benefit, would result from the application to a gas undertaking suspected of practising an old-fashioned, offensive system of purification, of the standard upheld among others in the Levinstein case—that manufacturing operations suspected of creating nuisances must be conducted according to the best known methods. If this can be proved, and the manufacture is not obviously prejudicial to health, the law will not hold it a nuisance. This legal obligation to carry on manufactures in accordance with the most approved systems, and with the employment of the most efficient machinery and appliances, is not so well defined or so generally observed as could be desired. We see by this Levinstein action that it applies in respect of the creation of nuisances; and it generally holds good with regard to the relations of manufacturers and traders with the public. Inside a factory, however, in the matter of the relations of employers to employed and the conditions of employment, the doctrine does not apply.

To return to the Levinstein case. The aspect of this affair which is of interest to gas manufacturers has reference to the peculiar nature of Messrs. Levinstein's operations. They make coal-tar colours, and they work up naphthalene; thus doing in England what has long been done in Germany, to the reproach of the English chemical industry. It was stated in evidence that the Crumpsall works are the only establishment in England where the preparation of naphthylamine is carried on. Until recently, this compound, which Messrs. Levinstein required in the ordinary way of their trade, had to be purchased in Germany; and it was only after the firm had decided upon making it for themselves that they were visited by a criminal prosecution. This is one way of "encouraging" the establishment of new industries in our midst. One of Messrs. Levinstein's assailants admitted in the witness-box that he had helped to ventilate the subject at public meetings, where he had asked whether the people were willing to tolerate "a German 'Syndicate coming to Crumpsall and poisoning a thousand 'inhabitants.'" The industry of the United Kingdom would not be what it is if all and sundry of every nation and kindred and tongue, having work to do, had not been welcomed to settle among us, and teach and employ our people, just as Messrs. Levinstein are doing, and as Brunner, Mond, Siemans, and a worthy company of traders and technicians have done before them, from the days of King Alfred downwards.

The manufacture of naphthylamine may or may not be a cause of contributing one more unpleasant odour to the by no means virgin atmosphere of Manchester; and it may or may not be an important branch of the chemical industry in itself, or the necessary support of others still more important. We regard it as something to be thankful for, so far as it goes, as a sign that the higher branches of the coal-tar industry are being gradually planted in this country, where the industry itself originated, and where the bulk of the raw material is produced. It has always been a mystery to us why the more recondite products of coal-tar must be purchased of German manufacturers. There may not be a great deal of money in the coal-tar colour and drug trade; but what there is may as well be made and spent in this country as on the Continent. It was asserted at one time that there was a difficulty in procuring trained young working chemists in England, owing to the absence of technical schools. If this complaint was ever justified, there ought not to be any point in it now.

It is worthy of notice, as bearing upon the importance of the coal-tar colour trade, that one of the witnesses called for the defence of Messrs. Levinstein was Mr. A. E. Fletcher, the Chief Inspector under the Alkali, &c., Works Regulation Act, who declared that "the industry involved in the manufacture of naphthylamine is a very important one nationally. Owing to the skill and energy of the German chemists, the manufacture of dyes representing about £3,000,000 is taken away from us; and we are very much indebted to Mr. Levinstein and his German friends for their efforts to establish the trade here, and retrieve our position." This is a worthy saying; but it is only what might be expected of Mr. Fletcher, who is in all respects devoted to the best interests of those industries over which he exercises an official surveillance that in unsympathetic hands might be made very irksome. Thanks to Mr. Fletcher and the other expert and resident witnesses called for Messrs. Levinstein, the jury had no difficulty in coming to a conclusion upon the questions submitted to them. They declined to put an end to an important and interesting industry; and the case ended with one more exposure of the occasional littleness and one-sidedness of Municipalism.

The Proposed Gas Pavilion at the Chicago Exhibition.—We learn from the *American Gaslight Journal* that, in immediate response to the appeal made by the Gas Industry Council of the Chicago Exhibition, to whom reference was made in the *JOURNAL* for the 5th inst., for support for their project of erecting a building wherein the gas industry may be adequately represented, about 12½ per cent. of the entire amount required (\$200,000) has been promised; and of this the Consumers' Gas Company of Toronto, Canada, have pledged themselves for \$2000. This is a splendid start; and the example will doubtless be speedily followed.

NOTES.

The First Colour of Heated Iron.

Mr. A. Noble writes to *Nature* respecting some remarks recently made by Lord Rayleigh as to the colour exhibited by heated iron when raised to such a temperature as only to be just visible in a dark room. Lord Rayleigh stated that Weber, who originally drew attention to the subject, described the first visible light as a greenish grey. Lord Rayleigh himself repeated the experiment by making a piece of thin iron part of the wall of a very dark room, and heating the iron gradually by an atmospheric gas-burner on the other side. He could not satisfy himself as to the greenish tint; but was convinced that no redness was apparent. Mr. Noble has had the idea of trying the same experiment by introducing a round bar of heated iron into a thin sleeve, by which means the latter would become heated slowly, so that the first appearance of visibility and the subsequent changes of colour could be observed. Two such sleeves were prepared—one of turned and polished iron; the other left with a thick coating of oxide. Two sets of experiments, in both of which six observers took part, were made. In each case the observers were in the dark room for some minutes beforehand. In the first set of experiments they gave their opinion, as a body, that the first appearance of colour was a greyish white; as the sleeve became hotter, the colour was yellow—gradually changing into orange. There was little or no difference between the observers as to the moment of visibility; and there was no difference in colour between the bright and oxidized sleeves. When the observers had no communication with each other, had no idea what colour they were expected to see, and gave their impressions independently, these agreed fairly well with the first statement.

A Thermo-Dynamical Photometer.

At a recent meeting of the Physical Society, Mr. H. M. Elder, M.A., read a paper on "A Thermo-Dynamical View of the Action of Light on Silver Chloride," which contained a suggestion of the basis of a chemical photometer. He stated that, in the decomposition of silver chloride by light, chlorine is given off, and a coloured solid body of unknown composition is formed; the reaction being indicated by an accepted formula. If the experiment is carried out in a sealed vacuum, the chlorine is darkened up to a certain point, but regains whiteness when left in the dark. These facts have led the author to think that the pressure of the liberated chlorine is a function of the illumination or intensity of the light falling upon the chloride, in the same way as the pressure of a saturated vapour is a function of the temperature. Since illumination is a quantity in many respects analogous to temperature, Mr. Elder considers it not unreasonable to apply thermo-dynamic arguments to the phenomenon in question, and to regard chlorine, in presence of silver chloride and the resulting compound, as the working substance in a kind of "light-engine." He therefore supposes a Carnot's cycle to be performed on the substances in question at constant temperature; the variables being pressure, volume, and illumination. Since the cycle is strictly analogous to Carnot's, except that illumination is written for temperature, Mr. Elder infers that the efficiency is a function of the two illuminations. It also follows that just as Carnot's cycle is used to determine an absolute scale of temperature, so this cycle may be applied to determine an absolute scale of illumination. It only remains to settle an empiric scale analogous to the air thermometer, and to compare it with the photo-dynamic scale, provided a method of making the comparisons can be devised.

A New Tar Roofing.

The somewhat misleading name of wood-cement roofing is given in Germany to a method of using coal tar for water-proofing the covering of temporary buildings which is largely employed by the German Government for military huts. The foundation is composed of ordinary boarding laid close, with a slight fall—say from 1 in 12 to 1 in 24. Upon this platform is first spread very fine dry sand to a thickness of about ¼ inch, overlaid with sheets of a particular make of cardboard, which is covered with the so-called wood-cement, laid on hot with a brush. The exact composition of this cement is kept as a trade secret; but the principal ingredient is stated to be coal tar, with which is incorporated sulphur, rosin, lamp black, coal dust, "and other substances." Five or six layers of pasteboard and cement are laid down alternately, and the last is covered while the cement is still plastic, with a coating of the fine, dry sand, which becomes incrustated in it. The originality of the arrangement is the combination of the cardboard and the tar composition to form a thin, light, and continuous impermeable covering, not liable to crack, and hardening with time. To protect this roofing from variations of temperature, it is sometimes further covered with 2 inches of fine gravel, and then with a little vegetable mould in which grass seed is sown, especially in situations exposed to strong winds. Care is taken to allow air to circulate underneath the wood platform, to prevent decay. The pasteboard is very strong, and is made from oakum. Everything depends upon the quickness with which the successive layers of "cement" are applied and covered up. The coal-tar composition is only melted, not boiled, in order to avoid the formation of bubbles. The employment of this system of constructing flat or terrace roofs is reported to be gaining ground. It is evidently cheap, and is stated to give great satisfaction.

COMMUNICATED ARTICLE.

THE PRESENT POSITION OF THE GAS-WORKS RATING QUESTION.

By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S.

Having shown in the article which has already appeared (see p. 575), the actual position of the parties concerned in the rating of gas-works, especially in regard to that of the user of gas, I proceed to offer some observations on the methods as established by precedent, that afford a means of arriving at a fair rateable value. Opinions may differ widely as to the extent to which a user of gas should be taxed, without injustice, for the benefit of his native parish or borough. In England, there are local authorities who have secured the gas undertaking ostensibly for the public benefit, but actually as a source of profit; and the revenues extracted from the gas consumers are said to go in relief of the rates. Whether this is really so, is a matter open for question; as instances are on record where they have been devoted to so-called improvements for which no pressing need existed, and for which the ratepayers would have objected to pay, if they had been at liberty to do so. On the Continent and in the United States, the gas consumer is still more unfortunate; and we hear of the sale of the rights to supply gas in districts by their respective local authorities, of rentals charged for the use of the roads (the fact of the mains being laid in them being considered to constitute a sort of occupation in addition to the liability to repair and make good any disturbance of the surface), and of shares of the profits being handed over to the local authorities. All these concessions, rents, or other payments are covered by a charge on the price of gas, similar to that required for the item of rates. Whatever form the transactions may take, they eventually come down to an item on the "Dr." side of the revenue account. But in England, at any rate, the general consensus of opinion runs in the direction of not taxing the user of gas to an extent greater than that allowable under the laws of parochial or borough rating; and all rates made upon the undertaking of a gas company are based upon the rateable value, as arrived at according to those laws. So that disputes between gas companies and assessment committees do not turn upon the main question of the right to levy rates, but on the manner in which the law, as admitted by both parties, is to be administered.

The fact that the law lays down as a first principle the rule that the rateable value should be equal to the rent which a tenant would be willing to give for the property from year to year, admits of several generalizations that are independent of the means pursued in arriving at that value. An assessment once decided upon is intended to hold for several years, or so long as no changes occur that are likely to affect the valuation to any important extent. It is never made for less than five, and often holds good for ten or twenty years. In order to get a fair average for the rent that would be paid "from year to year," it is obvious that all extraordinary circumstances must be left out of consideration, and a fair average year's working must be taken as the basis. The assessment committee must not pick out an exceptionally good year, when coal is cheap or the consumption of gas abnormally large, nor may the gas company rely upon a bad year. If a valuation is to hold good for one year only, then a fair value based upon that year's working must be taken. Fortunately, the difficulty involved in defining the constitution of a fair average year, or the definition of what is or is not an extraordinary expenditure, need not arise in the case of English statutory companies, because they are limited with regard to profits. In most cases, they are able to declare maximum dividends; and therefore it is easy to forecast for some years ahead, what the actual profits divided amongst the shareholders will amount to. With companies subject to the sliding scale, this arrangement could be easily extended to include the rateable value; and a proportionate adjustment for increase of capital can be made with equal ease. The fact of a tenant taking over the concern could not alter existing parliamentary regulations; and he would take it subject to the privileges and obligations conferred by such regulations. Assuming that the maximum rates of dividend allowed by the Special Act represent a sum of £5000, the gross profit that a tenant could expect to realize would be limited to that amount. If he appropriated an excess of £500 or £1000 beyond that sum, he could be forced to restore the same to the consumers, exactly as a company would be made to do. He would be under the same obligations as to furnishing copies of accounts and so on. To show on paper, then, that the concern is capable of yielding a profit of £5500 or £6000 per annum, is simply a misstatement of the case; for the £5000 is the only part that is of any benefit to the tenant, and if the concern made £7000 he would be no better off. It is not possible to conceive of any legal means of applying excess profits, over and above those represented by the statutory rates of dividend, to the direct benefit of the shareholders or of a tenant.

Sometimes it happens that a gas undertaking, being loaded with a large capital or subject to some other disadvantage, does not consider a division of the full rate of dividends advisable in the interests of the concern. In this event, it is easy to define the rate of dividend that will be paid, and to substitute the same for the maximum rate, which is only recommended for adoption when it is actually paid. If the company cannot

be worked to pay maximum dividends, a tenant could not reasonably expect to earn them. In any case, it is easy to decide the amount of profit that will actually be divided; and by this means to get at a fair estimate of the gross profit.

Such a method would certainly be more likely to afford a fair basis for valuation than estimates based on a so-called average year. The custom is to take, for the purposes of the valuation, the most recent set of audited annual accounts that may be available; and it rarely happens that both parties are willing to accept them without corrections for extraordinary circumstances. These corrections are to a large extent the result of opinions of experts, supported by arguments rather than by incontrovertible facts. The amount actually paid to the shareholders, is easily proved by the bank-book. Assuming the valuation to stand for not less than five years, any variations due to unusual circumstances would be neutralized; and to say the least, the payments would be more just and fair than any based upon a valuation fixed by an independent and often impractical tribunal, after hearing expert evidence and the arguments of counsel for and against.

It has become almost a custom to ignore the amount actually divided, and to base the valuation on the net receipts as shown by the accounts. As a general rule, these have been more than the payments, as they included sums carried to reserve funds, &c. So long as this state of things obtained, the valuers against the companies have been careful to maintain this condition unaltered; but in the recent appeal of The Gaslight and Coke Company, the Court had to deal with the fact that only about two-thirds of the profits divided were actually furnished by the earnings, the remainder coming from the reserve fund. According to previous valuations, all balances of profit have already been rated; and yet one valuer contested that, under these abnormal circumstances, the actual amount of profit divided should form the basis for the valuation. It usually happens that not only are the full dividends paid, but the reserve fund is maintained; and therefore the cases in which the substitution of a valuation based upon the actual divided profits for one founded upon net receipts, would bring in part of the profits to be rated twice over, are few and far between.

Given a certain amount of profit earned, that amount cannot be paid to the shareholders more than once, whether they receive it at the next half-yearly division of profits, or not until after some period of years, during which time it has represented either a part of the reserve fund or of the undivided balance. As it can only be paid once, it can only be rateable once; and it seems fairer that the rate should be paid when it is actually divided rather than when it is earned.

Assuming that the average dividend actually paid—which for our purpose may be regarded as the maximum rate allowed by Parliament—is taken as the gross profit, that sum will be divided between the landlord and the tenant. The former receives a rent for his property, and the latter a trade profit and interest on his embarked capital. The rent is the same amount as the rateable value; and it follows that this must be *considerably less than the whole gross profit*. The tenant will not be willing to undertake the responsibilities attached to the working of a gas-works under lease merely as a means of securing an average rate of interest on his capital, nor will he be satisfied with a small remuneration in addition. Apart from the help derived from the skilled assistants whose stipends are represented in the accounts, he would give regular personal attention to the progress of affairs generally. A yearly tenant cannot be in any sense likened to a shareholder or a sleeping partner; and the providing of the floating capital only, as required for carrying on the business, is a very different thing from an investment in the shares of the concern. The position of a lessee is vastly different from that of a shareholder; and the tenant would feel that there was risk of depreciation and loss, and would expect not a small, but a substantial share of the profits for himself. In short, he must be a man of position and means, who would not care to take the lease of the gas-works unless he could secure as handsome a return as might be obtained by embarking in any other branch of manufacturing or commercial enterprise. In many businesses, the floating capital can be "turned over" many times in the course of a year; but in taking over the parliamentary obligations, he would also take the privileges, and having an eye to these he would be satisfied with a reasonably moderate business profit. These may be taken as some of the characteristics of the imaginary personage who has figured largely in rating questions generally during the last half century under the title of the hypothetical tenant. An hypothesis must have some foundation in fact, and so this mythical individual is built up on the patterns of existing personages and practice.

(To be continued.)

Death of Dr. Tripe.—We regret to record the death, in his 72nd year, of Dr. John W. Tripe, Medical Officer of Health for the Hackney district. He had filled the above office ever since the formation of the district 36 years ago; and he was also its Public Analyst. He was a great authority on sanitary science, and took a prominent part at the recent Congress on Hygiene and Demography in London and at the Sanitary Congress at Worcester. He was the author of several works on sanitary questions.

TECHNICAL RECORD.

SOUTH-WEST OF ENGLAND DISTRICT ASSOCIATION OF GAS MANAGERS.

The Visit to the Severn Tunnel.

At the close of the report of the proceedings at the meeting of the above Association in Bristol on the 12th inst., which appeared in the last number of the JOURNAL, we briefly recorded the fact that on the following day the members and visitors, to the number of about fifty, inspected the Severn Tunnel, accompanied by Mr. C. Richardson, whose interesting paper descriptive of this important work had formed the principal item in their programme of business. We are now able to give a more extended account of the visit. It should be mentioned, at the outset, that all the arrangements necessary for the convenience of the party had been previously made by the President of the Association (Mr. D. Irving); and through the kindness of Mr. H. Lambert, the Manager of the Great Western Railway, two saloon carriages, and a special engine at the junction, were placed at their disposal. Joining an ordinary train at 9.45 a.m., the party were conveyed through the tunnel to the Junction Station, about two miles on the Welsh side, which was reached in about an hour. The time occupied in passing through the tunnel was $7\frac{1}{2}$ minutes.

In order to make the principal features of the visit clear, it should be explained that the chief difficulty encountered in the construction of the tunnel arose from springs of water. There was but little trouble in the way of leakage through from the Severn; and the tunnel is practically sound in this respect. But to keep it clear from spring water, three pumping-stations are necessary. Two of these—known as “Five mile four” and “Sudbrook” respectively—are on the Welsh side; and the third, which is called “Sea Wall,” is on the English side. The chimney-shafts of the two last-named stations form a guide as to the course of the tunnel, which lies in a direct line between them. Sudbrook is situated on the water's edge, as nearly as possible over the central part of the tunnel, and is by far the largest of the three—having to raise water from a level 40 feet below that at the other stations. “Five mile four” and “Sea Wall” act as intercepting stations at each end respectively; collecting and removing surface water and drainage before it can flow to the lowest part of the tunnel. The length of the tunnel proper is $4\frac{1}{4}$ miles; and besides this there are the approaches at each end, which of necessity extend a considerable distance in either direction, as the difference in altitude between the lowest part of the tunnel and the prevailing level of the lines of railway connected by it is 240 feet. These approaches are protected by the massive earthworks described in Mr. Richardson's paper, in order to avoid risk of getting the whole flooded at high tides. Passengers by the old ferry system at Portskewet will well remember the great difference between high and low tides at that point, which is 50 feet under ordinary circumstances, and occasionally much greater.

In the course of the journey, Mr. Richardson pointed out two or three bridges, built of brickwork on the vertical bond system he had described on the previous day, and illustrated in his paper. They presented a thoroughly satisfactory appearance; being free from cracks or other signs of weakness, although the arch segment was only 18 inches thick—about half that usually observable. The lightness and elegance of outline, as compared with ordinary brick arches, was very prominent; and, apart from the saving of bricks, the reduced thickness at the crown of the arch is a great advantage in many localities.

On arriving at the Junction Station, the party received a kindly reception from Mr. R. Hosken, the Resident Engineer, who was awaiting them. The programme for the day comprised a visit to “Five mile four” and to Sudbrook; after which a return to the junction would enable the carriages to be joined to an ordinary train, and conveyed back to Bristol. At “Five mile four” the party were shown the pumping plant, which included six Lancashire boilers, and two beam engines, each having cylinders 65 inches in diameter, and 10 feet stroke. One engine worked a plunger-pump 35 inches in diameter and 9 feet stroke, capable of delivering 356 gallons of water at each stroke, after deducting 5 per cent. for slip. (This deduction is made in each case mentioned later on.) The other worked a bucket pump 34 inches in diameter and also 9 feet stroke, capable of delivering 336 gallons at each lift. As these can be worked at eleven strokes per minutes, they are capable of dealing with 7600 gallons of water in that time. The shaft at this station is 160 feet deep. These engines, as well as those at the other stations, were constructed by Messrs. Harvey, of Hayle, Cornwall. The peculiar form of gearing adopted, by which avoidance of shock is secured, was inspected with great interest. It causes a quick up-stroke, a pause, a slower down-stroke, and a second pause. This is adopted on all the engines.

Re-entering the carriages, the party proceeded to Sudbrook. Here the chief feature of attraction to the more adventurous members of the party was the prospect of a descent of one of the shafts, and thence into the tunnel itself. Groups of half-dozens were arranged, and waterproof coats, leggings, and sou'-westers served out. The appearance of the first detachment (which included the President, the Vice-President, the

Honorary Secretary, and Mr. W. A. Valon), in full “war-paint” for the descent, created much amusement, derisive calls for a photographer, &c. There are three shafts at Sudbrook—29 feet, 18 feet, and 12 feet in diameter respectively; and the largest was selected. It is 180 feet deep, and contains six pumps, which are worked by beam engines; the shaft being situated in the centre of the engine-house, with three engines on either side. The cylinders are 70 inches in diameter and 10 feet stroke; and there are three bucket and three plunger pumps, in size similar to those at “Five mile four.” To two of the plunger pumps there is attached a 12-inch pump, which forces 42 gallons of water per stroke into a tank at the top of the building, whence the water supply for the district is taken. The quantity of water raised from this shaft varies according to the rainfall, and ranges from a maximum of $17\frac{1}{2}$ to a minimum of $9\frac{1}{2}$ gallons per 24 hours. It comes from an enormous land spring, the tapping of which drained all the neighbouring wells; and the water is now supplied as from an ordinary water-works. In anticipation of its being eventually utilized for the supply of some of the neighbouring towns, it is kept quite clear from tunnel drainage or any contamination. A special brick culvert has been constructed parallel to the tunnel, to bring it to the pumps. On reaching the bottom, the plungers and other parts of the pumps were examined; also a specimen of the pump-valve used. This is a most ingenious contrivance, arranged to open at full bore with a small movement, and furnished with wings placed at an angle so as to give the valve a slight rotary motion at each rising; thus causing it to bed in a different place at each falling, and keep itself true. The visitors were then taken along the culvert above mentioned, to see the source of the big spring; and they subsequently passed through a narrow passage into the tunnel itself—the point where they entered being at the lowest level, and nearly equidistant from either end. A gang of platelayers happened to be at work close by; and the paraffin lamps used by them gave quite an animated appearance to the scene. The ventilating arrangements are so effective that the men are able to work as comfortably as in the open. Some of the party had the satisfaction of being in the tunnel while a train passed. The first intimation of the approach of a train is a strong draught or wind, as immediately the tunnel is entered the train drives the air before it like a piston. The word was given to “Stand clear for the up-train;” and soon the train rushed by at a tremendous speed, having gained impetus by running down the approach into the tunnel, and reserving it for the ascent. It came without warning out of the darkness, and vanished again with equal rapidity. Even immediately after it had passed, the air was not so foul as that in many parts of the Metropolitan Railway; and on proceeding to the large ventilating-shaft close by, the rapid up-draught of the smoke could be seen by the light of the lamps, and in a few minutes all traces of it had disappeared. On returning to the surface, the boilers and engines were inspected. There are 40 large boilers; and, in addition to the six engines just mentioned, there are three at the 18-foot shaft, two having 50-inch cylinders, and the other a 75-inch cylinder, and each a 10-foot stroke. At the 12-foot shaft an engine with a 70-inch cylinder and 10-foot stroke was driving the largest pump on the works, which has a 37-inch plunger, and delivers 442 gallons of water per stroke. The inspection of these pumping-engines called up many interesting reminiscences of William Murdoch, and the active part he took in the development of this kind of machinery. It is necessary to see the flow of water from the outlet of this pump in order to realize the quantity raised. It was stated that the contents of the rising main alone represented 60 tons of water. These engines deal with the “tunnel drainage.” On the top of the ventilating-shaft above mentioned is a large Guibal fan, 40 feet in diameter and 12 feet wide. It is driven by a compound horizontal engine, and is capable of withdrawing from the tunnel 250,000 cubic feet of air per minute. A large cloud of smoke was escaping from its outlet. The quantity of water raised at the three stations has reached upwards of 30 million gallons per 24 hours, and at the time of the visit about a million gallons per hour were being pumped.

The party assembled near the entrance, and were photographed by Mr. Butler (of the firm of Messrs. W. Butler and Sons, of Bristol), who has attained some celebrity as an amateur photographer, and kindly offered to present each member of the party with a copy as a souvenir of the visit. The President then called for a hearty recognition of the courtesy and kindness extended to the Association by Mr. Hosken, his assistant (Mr. Richards), and the staff on the works, who had done everything in their power for the convenience of the visitors, most of whom had been able to descend the shaft and visit the tunnel in comfort and safety. This was energetically responded to; and Mr. Hosken briefly replied. Then, in response to repeated calls, Mr. Richardson came forward to address a few words to the company; and he was received with loud cheers. Subsequently the party returned to Bristol, which was reached about three o'clock, after having one of the most interesting and enjoyable outings that has ever fallen to the lot of the Association.

The Honorary Secretary (Mr. Norton H. Humphrys) has asked us to state that, as the result of an impromptu collection among the party, for the benefit of the medical and provident fund at the Severn Tunnel works, he has been able to forward to Mr. Hosken a cheque for £2 2s.

THE DEVELOPMENT OF GAS LIGHTING IN RAILWAY TRAINS.

A Paper read by Mr. E. C. Riley (Great Western Railway Works, Swindon) at the Meeting of the South-West of England Association, April 12.

As I have only consented to fill a gap at the last moment, I will not apologize for the brevity of the paper I propose reading—especially as it can only occupy the humble position of a side dish, to the great central attraction of our intellectual bill of fare to-day, in the valuable and interesting paper on the "Severn Tunnel" by Mr. Chas. Richardson [see *ante*, p. 705]. I also find that the meetings of other District Associations held at this time of year dispense very largely with lengthened or exhaustive papers.

I have thought it may be interesting to the members to know something of the quiet and yet important revolution that is steadily proceeding in the lighting of our railway trains. My predecessor in the Gas Department of the Great Western Railway (Mr. Botley) read a paper in June, 1883, before the members of The Gas Institute, at the Firth College, Sheffield, on the "Lighting of Railway Carriages;" but the development since that date (when, at any rate as regards its application to main-line trains, gaslighting was comparatively in its infancy), has been both rapid and important. I may say that at that date the "Battle of the Gases" was being fought out; and railway engineers and managers had not come to any definite conclusions as to the kind of gas and lamp most suitable to the various conditions and requirements of actual railway working.

The principal competitors for the place so long and so unsatisfactorily occupied by the oil roof-lamp, were: (1) Coal gas uncompressed; (2) coal gas compressed; (3) coal gas compressed and carburetted; (4) cannel gas compressed; (5) oil gas compressed.

The first system referred to is the ordinary coal gas, as made and supplied in the towns in which the railway is situated, obtained from the town main at the ordinary pressure, and stored either on the roof, under the carriages, or in the guard's van, as might be preferred. The only survival of this system still in use on any large scale that I am aware of, exists on the North London Railway, where the comparatively short journeys and the permanently made-up character of the trains lend themselves advantageously to this arrangement. On this line, the gas is stored in expanding holders in a part of the van specially provided, and containing a supply sufficient for about three hours' consumption. As time is an important element in the working arrangement of London suburban trains, special provision is made for the rapid replenishing of the holders at the terminal station by flexible gas hose pipes, about 6 inches in diameter, fitted with spring ball-valves and sockets, admitting instantaneous connection with the holders, which by this means can be filled in one minute. No more time, therefore, is required for gassing, nor so much, as is needed for changing engines and emptying and refilling the train with passengers. The supply of gas for each carriage is conveyed from the vans at each end of the train by pipes along the roofs of the carriages, with flexible connecting tubes between each carriage; and no regulator or governor has been used, as the pressure obtained in the holder from the mains gives an approximate burning pressure by the time it reaches the burners. The burners hitherto used have been the ordinary union type, usually about No. 4, but recently replaced by a simple regenerative burner of a useful and durable type for railway purposes. This system is efficient and useful where the trains are always made up and work regularly at short intervals into stations where a plentiful supply of good coal gas can be obtained at a pressure of not less than about three inches, and of course at a reasonable price; also where the companies do not limit the effect by providing a smaller number of lights than there are compartments to be lighted, or using smaller burners than are really necessary for effectual lighting—the practical standard of efficiency being ability to read an ordinary newspaper or book in any part of a compartment when the train is running at its highest speed.

The second system of those I have referred to as competing for the railway train lighting of the future is that of compressed coal gas. In this system, we have to confront the fact of the loss due to compression necessitated by the conditions of storage essential to compliance with the requirement that each carriage shall provide, separately and independently of the rest of the train, its own supply of light—of course, in the smallest possible space, and involving the carrying of the smallest possible amount of additional weight. To comply with these conditions, iron or steel reservoirs are provided under each carriage, of a total capacity of about 20 feet at atmospheric pressure, and filled to a pressure of 6 to 9 atmospheres, according to the class of work the carriage may be employed on. The reservoirs on the carriages are filled from large stationary reservoirs, into which the gas has been compressed by special pumps from the holder to about 10 atmospheres; or from travelling reservoirs which have first obtained their supply from the stationary reservoirs, the higher initial pressure in the original receptacle providing the necessary force for filling these secondary travelling supply or the final storage vessel of each carriage. Contrary to the views of some previous writers on this subject, a considerable loss, both of bulk and illuminating power, occurs in the

process of compression, in the deposition of hydrocarbon and water. From a series of tests made, in which I had the assistance of Mr. F. G. Dexter (now of Winchester), I found a loss of 49 per cent. in illuminating power in compressing to $13\frac{1}{2}$ atmospheres. We were able to confirm from our own experiments the power of the gas to take up again a portion of the hydrocarbon deposited under pressure as the pressure is reduced; but this power is not sufficient to be of any practical value in ordinary working. I have had considerable experience during the last five years of this system; and very useful and fairly efficient results have been obtained. For about three years, a train lighted in this way was running continuously for the purpose of effectually ascertaining its merits or disadvantages as compared with compressed oil gas, which was in use in other parts of the system. In experimenting with this train, I tried fourteen different burners, including plain ungoverned, governor, duplex, table-top, fish-tail, and several modifications of burners of regenerative type. A long chapter could be written on these trials; but as for general working, there were two important objections to the use of compressed coal gas at all (whatever might be the character of the burners or the working out of any minor details). They are of no present interest, and may be relegated to the comparative oblivion of the note-books and memories of those who worked them out. The two fatal objections to compressed coal gas for railway train lighting are, first, the low illuminating power of the gas; and, second, as a result, the large amount of storage required to provide sufficient light for a long journey without the necessity for replenishing the supply occurring before reaching a station where the necessary provision was available. The most efficient and reliable result obtained was by burning 4 feet of gas through a plain No. 8 fish-tail governor burner. One of the best examples of this class of lighting may be found in the travelling post-offices working between Gloucester, Swansea, and Milford Haven.

The third system is one that perhaps gas engineers at present may feel the most interest in, but which has proved so far least amenable to the variations or special conditions of railway working. I now refer to carburetted coal gas (compressed). As every gas manager or student is aware, a great variety of carburetters have been invented, and I think I may say *re-invented*, after a sufficient interval has passed for the previous one to be forgotten or lost sight of; and it is only natural that some attempt should have been made to apply the principle to railway-carriage lighting. The records of experiments in this direction do not appear to be very numerous. Mr. Bower experimented on the Great Northern Railway with both liquid and solid hydrocarbon, and took out a patent; but the matter eventually dropped. Mr. Pope, of Slough, also produced a carburetter for coal gas, and tried various experiments; but he relinquished his efforts in that direction in favour of oil gas. Mr. Botley tried alcoh-carbon; but was unable to get a result that would be practically uniform and reliable under all the varying conditions of railway working. I myself made experiments and constructed a carburetter, which was subjected to a variety of tests in the laboratory; but the results were not such as to give a reasonable prospect of fulfilling the conditions necessary on a train. Any carburetted gas used for train lighting should either be raised to the standard of illuminating power of oil gas, before being put into the carriage reservoir, so that no additional storage beyond present provision would be required, or else it would involve an arrangement for carburetting as used, which so far has proved impracticable in surmounting the difficulties of temperature, air supply, and all the vicissitudes of railway working. It is also undesirable to carry on a passenger vehicle any quantity of a substance of such a very inflammable character as is the liquid necessary for carburetting.

The fourth system is that of cannel gas. I cannot find that much has been done with this gas in railway-carriage lighting. Mr. Sugg's trials appear to have been the most noticeable. In cannel gas, as in oil gas, it is simply a question of cost and convenience. Within reasonable limits, the gas that gives the greatest amount of light with the least storage room, and consequently dead carrying weight to the train, and involves least interference with the train apparatus and working, is likely to be the favourite; and if cannel gas can be supplied at the same cost as oil gas of the same illuminating power and with the same general convenience, there is no reason why it should not be equally valuable. But the scarcity and high price of cannel, and the possible uncertainty of its constant supply and uniform character, tend to promote the use of the plentiful petroleum or shale oil gas.

I now come to the fifth and last of the principal competitors for railway train gas lighting—I mean oil gas. Every student of gas manufacture is aware that oil gas as an illuminant has a long history; but as our subject only refers to its application to the lighting of trains, I need only mention that the system was adopted first with success in Germany in 1871, and reported on by the Committee of the Society of Arts on "Railway Train Lighting" as being the best existing for that purpose. The gold medal of the Society was, on the reception of the report, awarded to Julius Pintsch, of Berlin, for the practical and successful application of oil gas for the purpose of train lighting; and from this time its development has been continuous, although at first "with cautious steps and slow." The Metropolitan Company adopted Pintsch's system in 1876, since which date it

has been in constant use with unfailing satisfaction and without a hitch—at an average cost of 0·66d. per train mile, as against 1·31d. per train mile for uncompressed coal gas. Following the Metropolitan, the Great Eastern Railway, with its extensive suburban train service, adopted oil gas; and then gradually this system was taken up by the London and North-Western, London and South-Western, and other large railway companies, until now most of the leading companies of England and Scotland have commenced applying it to part of their stock.

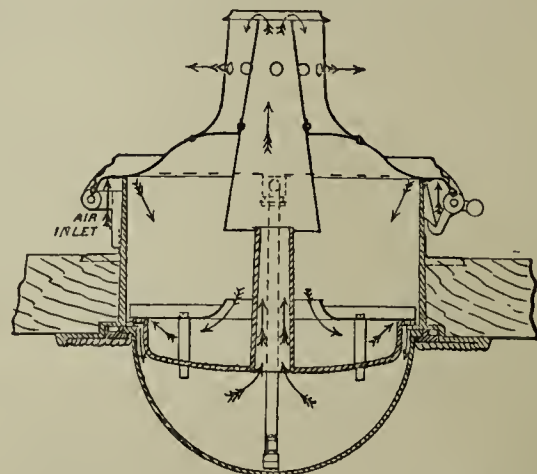
The two firms that have taken the lead in the working out of the application of oil gas to train lighting on any large scale are Pintsch's Patent Lighting Company and Messrs. Pope and Sons, of Slough. Both these firms have taken out patents for the lighting of railway carriages and the apparatus connected therewith, in each case including a governor or regulator for the reduction of the high pressure of 8 or 9 atmospheres, at which the gas has to be compressed in the storage holders under the carriages, to the low pressure of 6·10ths or 8·10ths required at the point of ignition. Owing to the prominence of these firms, the terms "Pintsch Gas" and "Pope Gas" have been so frequently used that, outside a comparatively small circle of experts or readers who are familiar with the principles and processes of oil gas manufacture, the impression largely obtains that gases of decidedly distinctive characteristics are meant. As a matter of fact, the gas produced by the Pintsch, Pope, Keith, or other numerous modifications of oil-gas plant used by various railway companies or other firms, is practically the same in general character and leading features; the differences, where they exist, being due usually to variations in the quality of oil used and the temperature of distillation.

Messrs. Pintsch and Pope both use two retorts for carbonizing—the first to crack or split up the liquid hydrocarbons, and the second to fix the vapour into permanent gas. In the former case the oil is run into the top retort *first*, then passed into the bottom for fixing, and conveyed *downwards* to a hydraulic main placed on the floor, from which it is taken to a vertical plate condenser, and then through a simple washer and a purifier (containing lime and sawdust) to the meter and holder; while in the latter system, the oil is run into the bottom retort first, then passed to the top retort, from which the gas *ascends* to a hydraulic main above the bed, and then on through a vertical pipe condenser to a dry scrubber or scrubbers, from which it passes to the meter and holder. It will be seen from the brief outline just given of the general arrangement of the plant, that the question of purification is much simpler than that of coal gas, owing to the almost entire absence of sulphur.

Passing from the question of manufacture to that of distribution, we come at once to an entirely different set of conditions to those of coal-gas supply for town lighting. Oil gas for trains, in order to be in a condition available for use, must be stored at a high pressure. Consequently, the ordinary type of gasholder is used only as a temporary receptacle into which the gas passes as manufactured. From this holder, it is drawn by specially-constructed compressing-pumps (which it does not come within the scope of this paper to describe), and forced into large cylindrical steel or iron tanks or reservoirs, from which it may be either taken in travelling tanks to any point where it is required for use, or conveyed in high-pressure pipes to valves or hydrants placed in the sidings, sheds, or stations, where it will be most convenient to gas the trains. This latter process is effected by connecting a flexible pipe to the valve on either the travelling tank or high-pressure main, and connecting to the storage cylinder or holder under each carriage. We will now assume the holder on the carriage is filled to 8 atmospheres. The high-pressure gas is then passed through a governor, reducing it to a suitable burning pressure; and from the outlet of the governor it ascends the main supply-pipe to the carriage roof. On this pipe is placed the main cock actuated by a slide rod, the handle of which is in a convenient position for working from the platform or side of the train.

We now come to the lamp itself. This from the beginning has invariably been placed in the roof in the position hitherto occupied by the oil-lamp; and several points of difficulty presented themselves in overcoming the varying conditions of railway working. The first point was the ventilation. It was necessary that the supply of air for combustion should be introduced in such a manner that the flame should be fed with practically the same regularity, when the train was standing still in a snug, covered, terminal station, as when rushing along a high embankment at a mile a minute, exposed to the sweep of the wind from a bleak moor or the open sea. This effect was secured in the first place by the arrangement of the holes and baffle-plates in the lamp-lid; so that, however strong the current of air outside, its course to the flame was so contrived that practically no trace of the rough wind outside reached the secure stillness of the inner globe. The next point was the removal of the products of combustion into the outer air; so as to avoid any vitiation of the atmosphere of a small compartment, when, from the condition of the weather, it was undesirable or disagreeable to open the windows. This result was also obtained by the special construction of the lamp lid or cover on the top of the carriage; which usually was also the only mode of access to the interior of the lamp for lighting, cleaning, &c. I have here a section of an ordinary type roof-lamp, which illustrates the usual arrangement for ventilation and discharge of the products of combustion. It will of course, be understood there are many modifica-

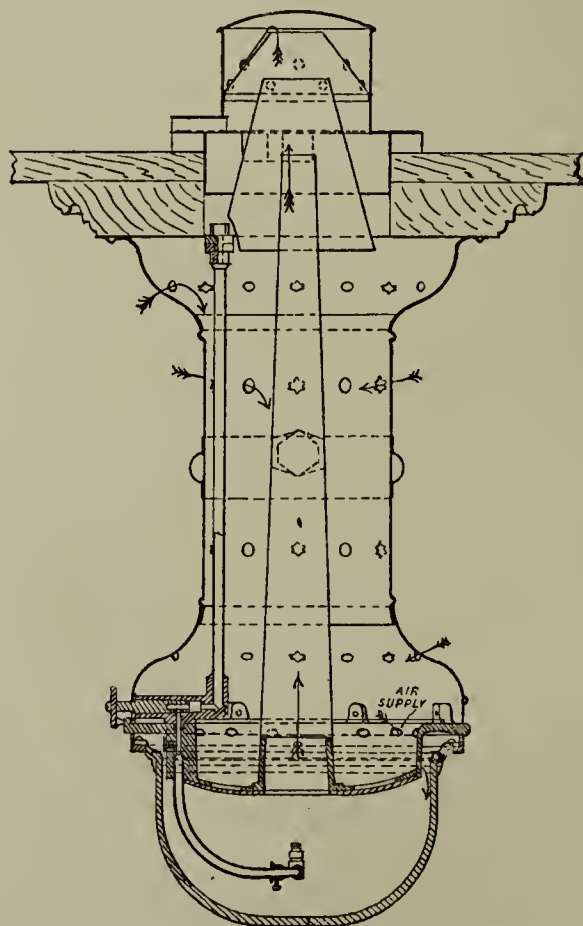
tions in the construction of the lamp, in minor details; but nothing affecting the general principle in the ordinary lamp ventilated from the outside.



RAILWAY CARRIAGE ROOF GAS-LAMP.

We now come to the next important feature—the burner. This is a plain small steatite tip with apertures of the union type fitted into a brass case; the holes being proportionately small to suit a rich gas of not less than 40-candle power when compressed. In the earlier days of train lighting with oil gas, a small flame based upon the light of a good oil-lamp, when at its best, was considered a satisfactory light; as the gas had the merit of being reliable and giving a uniform light for the whole of the time it was in use, and in the early advocacy of the use of oil gas, the consumption per lamp was given at 0·5 cubic foot per hour, and calculations of cost were made accordingly. Here, I think it only right to acknowledge (as every gas engineer and manager should readily admit), that we are indebted to our rival the electric light for raising the general standard of lighting, and setting up requirements that demand, and are ensuring, that the gas lighting of trains shall be something superior to the small burner of from 3 to 6 candle power first used; and several railways that have experimented to some considerable extent with the electric light, but have now adopted gas lighting, are in consequence using larger and better lamps and burners; the consumption per burner being nearer 1 cubic foot than the $\frac{1}{2}$ foot previously used. It was also found that, owing to the usually dark nature of the upholstery of the first-class carriage, the same lamp which gave a good reading light in the plainer and more slightly upholstered second and third class was insufficient in the first. This led to two lamps being placed in each compartment, one on each side; and then to the adoption of duplex and even triple burners, burning $1\frac{1}{2}$ and $2\frac{1}{4}$ cubic feet respectively.

The next step forward in lamp construction has been to combine the two features of lighting and ventilation in one lamp—in what I may describe as the most recent and perfect development of railway lamp. This has been effectually done by taking the air required for combustion from the inside of the carriage, and discharging the whole of the products through a fixed cover on the outside of the carriage, access to the lamp itself being obtained from inside. A lamp of this type has been adopted in the new carriages of the Great Western Railway Company, as it is specially constructed to suit the lofty omnibus ventilating roofs which travellers on that line are already familiar with; and by the kind permission of Mr. Dean, the Locomotive and Carriage Superintendent, under whose direction the new carriages are



RAILWAY CARRIAGE VENTILATING GAS-LAMP.

being built and fitted with gas, I have been able to provide a section, showing the principle of construction and a sample of the lamp lit with oil gas. This lamp, fitted with duplex burners, gives a light of 13½ candles, with a consumption of 1½ cubic feet of gas, as against 3 candles, which is the maximum of a good oil-lamp, with a consumption of 500 grains of rape oil per hour. It affords sufficient light to read a newspaper in any part of the compartment with perfect comfort, even when the train is travelling at its highest speed. The new corridor train built recently at Swindon, a description of which appeared a few weeks ago in the *Graphic* and other London and provincial papers, and which is now running between Paddington and Birkenhead, is fitted with this lamp.

The largest works for the manufacture of oil gas for train lighting are those recently erected for the Great Northern Railway at Holloway; and though only working to a small proportion of their capacity, they are a striking illustration of development in the gas lighting of trains which this paper endeavours to show.*

Nearly all the Railway Companies running into and about London and suburbs are lit with gas; and it is extending with great rapidity. The great trunk lines are fitting up their stock with gas apparatus and lamps; and soon a comfortable carriage well lit with gas will be the privilege of most railway travellers, while the old oil-lamp with its erratic behaviour, so often denounced as a disappointment, a delusion, and a snare, will take its place with the stage coach and rushlight of ancient history.

By the courtesy of Messrs. Pintsch, Pope, and Laidlaw, I have obtained the following figures showing the development of oil-gas manufacture and lighting by these firms:—

Name of Firm.	Gas-Works Erected.	Railway Carriages Fitted.	Oil-Gas Lamps Supplied.	Tram-cars Fitted.
Pintsch . . .	150 ..	40,000 ..	150,000*	..
Pope . . .	15 ..	10,354 ..	40,000 ..	90
Laidlaw . . .	— ..	— ..	8,000 ..	—

* Estimated.

These figures are exclusive of what may have been done by Railway Companies or other firms.

I have taken, for this meeting, a series of tests of the illuminating power of coal gas compressed to various pressures; the results of which are shown in the following tables:—

Statement of Tests of Compressed Coal Gas for Railway Train Lighting.

Date of Test.	When Gas was Compressed.	PRESSURES.		Temperature of Gas.	ILLUM. POWER.		Percentage Loss on Compression.
		To which originally Compressed.	In Cylinder at Time of Test.		Gas Uncompressed.	Gas Compressed.	
1892.	1892.	lbs.	lbs.	Deg. F.	Candles.	Candles.	
Mar. 16 .	Mar. 14 .	150	132	69	14' 17	9' 50	32' 9
" " .	" " .	150	130	69	14' 17	9' 00	36' 4
" " .	" " .	150	128	69	14' 17	8' 26	41' 7
Mar. 18 .	Mar. 14 .	150	100	72	14' 17	11' 49	18' 9
" " .	" " .	150	75	72	14' 17	10' 67	24' 7
" " .	" " .	150	50	73	14' 17	10' 42	26' 4
Mar. 21 .	Mar. 14 .	150	25	60	14' 17	10' 96	22' 6
" " .	" " .	150	15	61	14' 17	10' 44	26' 3
" " .	" " .	150	5	61	14' 17	11' 75	17' 0
April 5 .	April 5 .	20	20	66	15' 83	15' 77	0' 37
" 7 .	" 7 .	50	50	67	15' 50	15' 04	2' 9
" 8 .	" 8 .	100	100	62	15' 50	12' 79	17' 4
" " .	" " .	150	150	65	15' 50	10' 86	29' 9

Remarks.—In the tests made during March, the gas was compressed, through the catch-box, into a 10 cubic feet cylinder, to 150 lbs. per square inch, and the pressure was afterwards relieved. In the April tests, the gas was compressed direct into the 10 cubic feet cylinder without passing through the catch-box.

Tests of Oil-Gas Burners for Railway Train Lighting.

Description of Lamp.	Gas consumed per Hour.	ILLUMINATING POWER.			
		Total per Lamp.	Per Cub. Foot.	Per Burner per Foot.	Per Burner.
	C. Ft.	Candles.	Candles.	Candles.	Candles.
Triple burner .	1½	8' 67	5' 78	1' 93	2' 89
" " .	2	11' 18	5' 59	1' 86	3' 73
" " .	2½	19' 52	7' 80	2' 60	6' 51
Duplex burner .	1	8' 20	8' 20	4' 10	4' 10
" " .	1½	13' 25	8' 84	4' 42	6' 62
" " .	2	17' 08	8' 54	4' 27	8' 54
Single burner .	½	3' 70	7' 40	7' 40	3' 70
" " .	¾	5' 52	7' 36	7' 36	5' 52
" " .	1	7' 56	7' 56	7' 56	7' 56

I have not been able to do quite as much as I wished in this direction, but as much as the time I had available would allow; and as the question of illuminating power in relation to storage capacity is of such importance in train and tramway lighting, also for buoys and beacon lights, I have shown these results for the information of the members.

* This plant was fully described in an article appearing in the JOURNAL for April 21, 1891 (p. 740).

THE ENRICHMENT OF GAS IN BULK BY MEANS OF CARBURETTERS.

A Paper presented by Mr. F. W. Clark at the Meeting of the South-West of England Association, April 12.

The question of how best to enrich ordinary coal gas has been discussed at many of the meetings of the different societies of gas engineers. A paper was read on this subject in November, 1890, by Mr. Frank Livesey, before the Southern District Association of Gas Engineers and Managers, which treated of the same process as is described in this paper, and to which reference will be made.* The process is the introduction of the vapour of carburene—a light petroleum spirit of a specific gravity of .680—by drawing a small portion of the gas to be enriched from the main, and after mixing the vapour therewith, forcing this rich gas so produced back into the main, thereby enriching the bulk.

The evaporator is in the form of a vertical tubular boiler, the tubes running between two plates, which latter are fixed at about 8 inches distance from the top and bottom of the casing. Steam is introduced between these plates and the outside of the tubes. The enriching material is pumped from the store-tank (which is placed underground) by a small steam-pump into the evaporator, at a point below the bottom plate, and is forced up inside the tubes; the effect being that the spirit is evaporated—thus forming a pressure of vapour, which is conducted, by a tube fixed above the top plate of the evaporator, to a regulating-valve placed on an injector, which is connected to the gas-main containing the gas to be enriched, by small pipes at two points a short distance apart. The vapour under pressure is allowed to pass through the regulating-valve into the injector, forming a partial vacuum at the top of it, to which one of the small gas-pipes is connected. The effect is that the coal gas is drawn into the injector, where it mixes with the hot vapour, and forms a very rich gas, which is then driven through the second connection back into the gas-main, to mix with the bulk of gas at a point nearer to the gasholder or the consumer. The quantity of vapour is easily regulated by the valve in the injector. If the pressure of vapour in the evaporator is increased on account of a smaller consumption, the effect will be that less spirit will be thrown by the pump. As the pressure acts on the delivery of the spirit, the level thereof is lowered; and the amount of evaporating surface is thereby reduced. In the case of an increased consumption of vapour, the action would be just the opposite. The apparatus is, therefore, practically automatic.

The carburetters have been doing practical work for the past two years, in many cases effecting all the enrichment without the use of cannel or other rich coal. The South Metropolitan Gas Company have these enrichers at all their stations. The Gaslight and Coke Company have had them at work at some of their principal works for two years past; and several more are now being fixed at their other stations. The gas enriched by this process is quite as permanent as that produced by the use of cannel coal. In one instance, in London, the official testing-station is upwards of eight miles from the point where the gas is enriched (sometimes to the extent of more than a million cubic feet per hour) 2 or 3 candles, and no loss in illuminating power takes place.

Mr. Frank Livesey, in the paper already referred to, said the cost of enriching coal gas one sperm candle, by the use of cannel coal, was 2'68d. per 1000 cubic feet; and by the use of spirit, it was 1½d. per candle per 1000 cubic feet. The cost of the spirit was taken at 13½d. per gallon. The present price of carburene—a much more suitable material—is about three-fourths of this price; thus reducing Mr. Livesey's cost to about 1½d. per candle per 1000 cubic feet.

The following are some extracts from Mr. Frank Livesey's paper:—

The important point to ascertain first of all was, Will gas, after being enriched, retain its quality? To test this, 430,000 cubic feet of gas were enriched to the extent of 2 candles, put into a gasholder, and left there for five days. Practically, no depreciation could be discovered. Another trial was then made, by testing the gas in a district main about a mile from the works. Two jet photometers having been rated to correspond exactly, one was placed at the works, and one at the point of trial. Here, again, the results were quite satisfactory; the gas, however, was enriched 1 candle only. It would have been more satisfactory had the distance been four miles instead of one. . . . This, however, is not the only advantage, as the gasoline method is much more reliable and certain in its results; and by its means the quality can be adjusted with certainty to half a candle or less.

Cost of Making Gas in the Ordinary Manner per Ton of Coal.

Black coal, costing 13s. per ton = 10,000 cubic feet of 15'25 sperm candle gas.

Cannel coal, costing 42s. per ton = 12,000 cubic feet of 30 sperm candles.

To raise the quality 1 sperm candle, it would be necessary to use 7 per cent. of cannel coal.

Sperm Candles.	Cubic Feet.
93 per cent. × 15'25 = 14' 18	93 per cent. × 10,000 = 9,300
7 " × 30'00 = 2' 10	7 " × 12,000 = 840
16' 28	10,140
Equal to 10,140 cubic feet of 16'28 sperm candle gas.	

* See JOURNAL, Vol. LVI., p. 1041; also (for additional particulars as to the apparatus) Vol. LV., p. 66, and Vol. LVI., p. 242.

93 per cent. of black coal, at 13s. per ton	s. d.
7 " of cannel coal, at £2 2s. per ton.	12 1
	2 11
	15 0
Less 93 per cent. of 12 cwt. of coke, at 8d.	7 6
	7 6

(Other residuals not taken; same in both cases.)

Equal to 7s. 4½d. per 10,000 cubic feet of gas of 16·25 sperm candles, or 8·87d. per 1000.

100 per cent. of black coal, at 13s. per ton	s. d.
Less 100 per cent. of 12 cwt. of coke, at 8d.	13 0
	8 0
	5 0

Equal to 5s. per 10,000 cubic feet of gas of 15·25 sperm candles, or 6d. per 1000 feet.

Cost of enriching by cannel coal per candle, 2·87d. per 1000 feet.

Cost of Making Gas Enriched by Carburine, per Ton of Coals.

Black coal, 13s. per ton = 10,000 cubic feet of 15·25 sperm candles.

Carburine, 9d. per gallon, 1½ gallons = 100 cubic feet of 100 sperm candle gas.

To raise quality 1 sperm candle, it will be necessary to use 1½ gallons of carburine.

Sperm Candles.		Cubic Feet.
100 p. ct. of 15·25 . . . = 15·25	100 p. ct. × 10,000 . . . =	10,000
1½ gallons of carburine = 1·00	1 p. ct. increase in bulk =	100
	16·25	10,100

Equal to 10,100 cubic feet of 16·25 sperm candle gas.

100 per cent. of black coal, at 13s. per ton	s. d.
1½ gallons of carburine, at 9d. per gallon	13 0
	0 11½

	13 11½
Less 100 per cent. of 12 cwt. of coke, at 8d.	8 0

5 11½

(Other residuals not taken; same in both cases.)

Equal to 5s. 10½d. per 10,000 cubic feet of 16·25 sperm candle gas, or 7·05d. per 1000.

100 per cent. of black coal, at 13s. per ton	s. d.
Less 100 per cent. of 12 cwt. of coke, at 8d.	13 0
	8 0

5 0

Equal to 5s. per 10,000 cubic feet of 15·25 sperm candle gas, or 6d. per 1000 feet.

Cost of enriching by carburine per candle, equal to 1·05d. per 1000 feet.

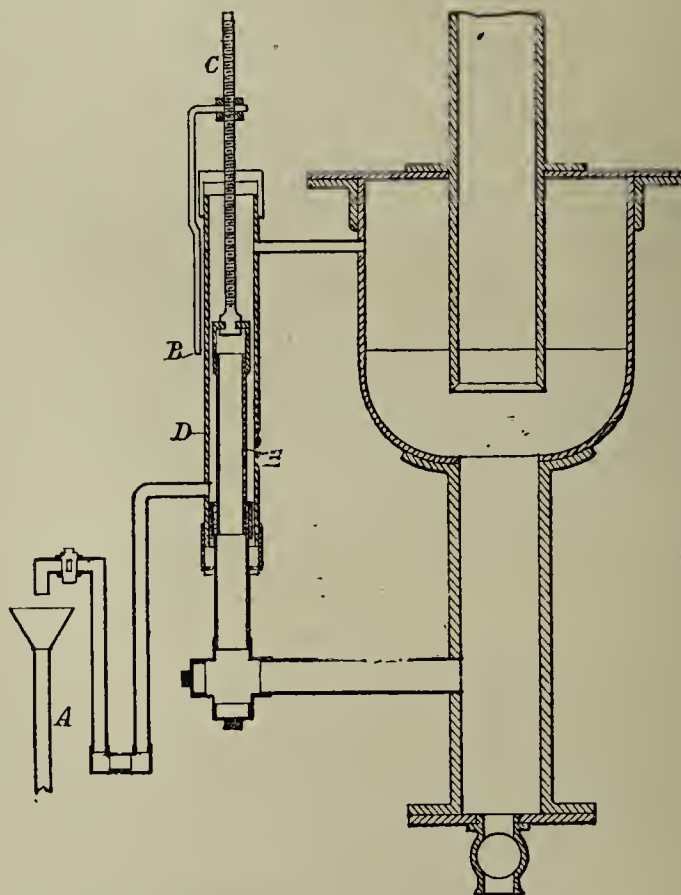
Besides showing a saving of upwards of 1½d. per candle per 1000 cubic feet of gas made, there are other great advantages in using the Gas Lighting Improvement Company's patent process of carburetting. They are: (1) More gas per ton of coal can be made, on account of being able to work the retorts at higher and more regular heats; also a level gauge can be kept on the retorts. (2) More gas per retort; therefore less cost for labour, wear and tear, capital outlay, &c. (3) The quality of the coke is not deteriorated, as is the case when using cannel coal. (4) Possibility of immediately increasing the illuminating power of the gas to any desired degree, either on the inlet to the gas-holder, or on the outlet mains to the consumers, either on the works or in the district. (5) The illuminating power of the gas can thus be regulated exactly to the quality required; thereby saving the cost of the extra quality usually put into the gas, so as to make sure of it going out to the consumer not under the proper illuminating power. (6) Saving in the cost of purification, enabling engineers to oxidize the purifying material as much as necessary. (7) The process also prevents to a very large extent the deposition of naphthalene in the mains and service pipes; carburine being a solvent for naphthalene. (8) Having the power of enriching at hand, in many cases a much cheaper coal can be used, or (what is also an important matter) a better coke-making coal.

Coal in Suffolk.—Dr. J. E. Taylor, of Ipswich, and other well-known geologists, are firmly of opinion that coal is to be found in Suffolk; and the trial boring which is being made at Culford, near Bury St. Edmunds, is watched with the greatest interest. Earl Cadogan is keenly alive to the importance of continuing the boring; and he has promised so much of his help to the geologists who have taken up the subject, that, if coal seams really exist at a reasonable depth, there is no doubt they will be reached.

The Use of Gas for Lighthouse Illumination.—At a meeting of the Science Section of the Royal Dublin Society last Wednesday, Mr. John R. Wigham exhibited a new lighthouse lens, which he called the "Giant," because it is of very much greater dimensions, and more than 50 per cent. greater focal distance, than any lens ever made. He read a short paper on the subject, in which he explained that the lens was constructed for him to meet the requirements of the flames of his large gas-burners, and that it had excited great interest as being likely to effect a revolution in lighthouse illumination. Each beam transmitted by the triform apparatus, of which this lens forms a part, measures 10 feet horizontally and 22½ feet vertically. It is considered that its light will, from its enormous volume as well as great intensity, be much more efficacious than an electric light of the highest power, assisted by the most suitable dioptric apparatus; and it is expected that, in fog dense enough to obscure the electric light, this new luminary will be able to make itself visible.

ELLERY'S SEAL REGULATOR FOR HYDRAULIC MAINS.

In the JOURNAL for the 22nd ult. (p. 540), Mr. C. Stafford Ellery, Engineer and Manager of the Bath Gas Company, referred to an arrangement for regulating the seal in, and drawing the tar from, hydraulic mains, which he had devised and adopted in his works. He claimed that it was similar to that patented by Mr. G. R. Hislop, of Paisley, which was described and illustrated in the JOURNAL for the 8th ult.; and we have since received from him, in support of his statement, a sketch of the appliance, from which the accompanying diagram has been prepared.



A, Pipe leading to tar-main. B, Pointer showing height of water-line C, ¼-inch Whitworth thread, screwed the whole length of the rod. D, 3-inch wrought-iron tube. E, 1½-inch wrought-iron turned tube. F, 2-inch wrought-iron tube.

Mr. Ellery thinks the general similarity of his arrangement to that of Mr. Hislop will be apparent, but it will be chiefly so in the following details: (1) The bored piston and regulator which regulates the seal, or, by lowering, empties the hydraulic main. (2) The manner of connecting the arrangement to the hydraulic main with top and bottom connections. (3) The method of actuating the regulator by means of a rod, screwed, and passing through the cover of the vessel. (4) The pointer and scale showing the exact water-line. It may be added that the appliance is made of ordinary gas tube and fittings; it is not patented; and it may be fitted up by any intelligent workman at small cost. The only casting required is the syphon bolted to the under side of the hydraulic main.

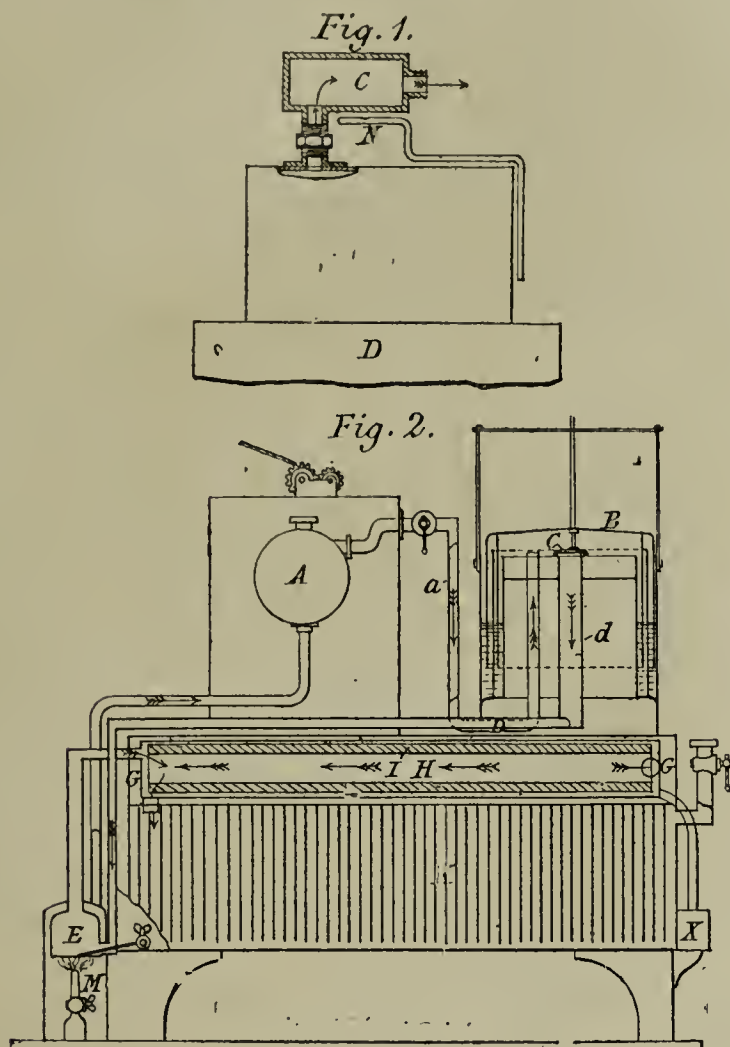
Death of Ex-Bailie Wilson.—The death is announced as having taken place recently at Pollokshields, of ex-Bailie William Wilson, who was for 25 years a member of the Glasgow Town Council, and also for a long time Convener of the Corporation Water Committee. Mr. Wilson was one of the leaders in the movement for the present extension works. He retired from the Council in November last, on account of failing health.

The Standards of Weight and Measure.—In view of the interesting event which took place at the Houses of Parliament on the 2nd inst.—when Mr. H. J. Chaney, the Superintendent of the Standards Department of the Board of Trade, tested the yard measure and pound weight in use in his department by the standards placed twenty years ago in a mural chamber on the staircase leading from the central hall to the committee-rooms—the "Descriptive List of Standards of Weight and Measure deposited with the Board of Trade, and of the Instrumental Equipment of the Standards Office," which has been issued as a parliamentary paper, claims more than ordinary attention. The Imperial standards of weight and measure now in use are: (1) Primary standards; (2) secondary, or Board of Trade standards; and (3) auxiliary standards. The account of the historical standards is full of general interest; but our readers will probably be more concerned with the description of the gas-measuring instruments, and the apparatus employed in connection therewith. The paper may therefore be commended to their notice. At the close of the ceremony above mentioned, which took place in the presence of the President of the Board of Trade (Sir Michael Hicks-Beach), several of his officials, the Speaker, and a numerous assembly, Mr. Chaney declared that the standards were to all intents and purposes unaltered. The test standards were then replaced in the chamber, which was duly sealed; and it will remain so till the time comes round for again calling its contents into requisition.

REGISTER OF PATENTS.

Manufacture of Gas.—Bourgoin, N., and Decorce, H., of Paris, No. 578; Jan. 12, 1891.

The apparatus proposed to be employed in the making of "lighting, heating, and motive-power gas," according to this invention, is shown in the engravings; fig. 1 being an apparatus without a condenser, and fig. 2 one with a condenser.



Referring to fig. 1 (which is somewhat diagrammatic in form), A indicates the position occupied by a pump which drives air into the retort C, which retort is heated by the gas-burner N. From the retort, the air passes into a pressure-regulator—not represented in the diagram, as it is identical with the pressure-regulator B shown in fig. 2, and hereafter described. In this regulator, the air expands, and as it mixes with a large volume of air contained therein, its temperature is reduced before passing into a carburettor D, arranged as will be described with reference to fig. 2. This arrangement, it is claimed, avoids all accidents; "in fact, if the air, for any reason, were to remain for a long time in the retort, it might be raised to a high temperature, and if in that state it were caused to penetrate directly into the carburettor, an accident would be likely to occur." But, say the patentees, by causing it to pass under a regulator, it can only reach the carburettor after it has mixed with the large volume of air already accumulated therein, which would immediately lower its temperature.

In the arrangement shown in fig. 2, the apparatus consists of a rotary pump A, operated by a weight or by other means; a pressure-regulator B; a retort E; a condenser G; and a reservoir K, separated from the condenser by an air-tight partition. The condenser G, which occupies the upper part, is formed of a series of tubes H, arranged in any suitable manner, and furnished internally with wire-gauze linings I, covered with cotton or other absorbent material. In the reservoir K are arranged sheets of metallic gauze, also surrounded with absorbent material, and so disposed as to afford the greatest evaporating surface.

The air to be carburetted is driven by the pump A into the pressure-regulator B. This is composed of a double-walled bell, which dips into two corresponding cylinders placed vertically, and open at the top. The air coming in from the pump, enters the bell by the pipe *a*, and lifts the cover or valve C by means of a rod, and allows air to pass in regulated quantities through the pipe *d* to the retort E. This retort is heated by the gas-jet M; and the air, which may be raised to a high degree of heat, enters the tubes H. The excess of vapour is now condensed; some of the liquid passing to the reservoir K, and from thence to the retort E. The saturated air from the condenser also enters the reservoir K, and after circulating around the vaporizing plates, passes either to the burners or to a holder.

In order to facilitate the saturation of the air, the heavier parts of the carburetted liquid are caused to fall drop by drop into the retort, when they are instantly volatilized, and mix with the air in the condenser. The air thus saturated, before going to the burners, circulates round the vaporizing sheets, and thus becomes completely saturated, mingling with the more volatile vapours given off from the sheets.

The advantage of this process of carburation (according to the inventors) consists (1) in rendering to the carburetted system all the heat absorbed by evaporation; and (2) to assure the continued and regular working of the apparatus, by avoiding the accumulation of the heavy parts of the carburetted liquid in the reservoir K. These heavy parts are, in effect, volatilized in the retort as fast as they deposit; and are thus caused to enter into the general circulation. Thus the richness of the gas remains the same; the saturation of the air always taking place at the same temperature.

A special reservoir is sometimes provided, into which the heavy products may pass, and which products, not being suitable to be drawn into the gaseous current, collect at the bottom of the condenser. This special reservoir is placed below the reservoir K, as at X (fig. 2),

and it is connected with the condenser G by a pipe. On the other hand, in order that the flame shall maintain always the same heating and luminous intensity, the apparatus is suitably arranged for the purpose of constantly restoring the heat lost by the fact of the evaporation of the carburetted liquid. This end is obtained either by previously warming the air in a retort, or the air may be drawn by the pump through an envelope surrounding the gas-burner, and by thus tapping all the air that passes to the burner, none of the heat is lost.

Banding on Leathers for Dry Gas-Meters.—Shears, R., of Pentonville. No. 4846; March 18, 1891.

The patentee proposes to employ either a half round or soft round wire, rolled the proper substance and width, leaving the two ends round, which are intended to be drawn tight by twisting. The inventor claims the right to turn an eye on each end; and link on a short piece of wire, and tighten in the same manner. The leathers in a dry gas-meter are fastened on two tin rims. They are drawn on the rims by a string with a slip knot in the usual way; and the band, with the ends turned up about $\frac{1}{2}$ inch, is then passed round the leather and twisted till tight.

Gas-Engines.—Barclay, A., of Kilmarnock, N.B. No. 6578; April 16, 1891.

The nature and novelty of these improvements, consist in making the cylinder of a gas-engine closed at both ends and double acting—that is, to have a supply and explosion of gas and air at each end of the cylinder and act on the piston both on its in and out stroke, each revolution of the crank. The engines may be made with single, double, or triple cylinders, with the pistons acting on the same crank at different angles during the revolution, or on cranks set at different angles on the same or coupled crank-shafts, so that no two of them may be on the dead centres at the same time.

A further improvement consists in having a double-acting suction and compressing air and gas pump, for forcing the gas and air of the proper explosive proportions into each cylinder at the opposite ends, and of a proper density or compression for explosion. This is effected immediately after the piston has expelled the waste gases of the previous stroke, and has turned the extreme end of its stroke on its forward motion, and when the crank and piston have approached their best acting position, leaving a proper space between the piston and the end of the cylinder for the explosive gases admitted to act. The one end of the pump acts as a forcing and suction pump to each end of the cylinder, so as to fill that space with the gases of a proper density. The piston of the pump would be actuated by a crank on the same crank-shaft, set at a certain angle behind the main crank of the piston of the cylinder, in order to effect the proper compression of the air and gas at the same time.

Another improvement consists in having separate inlet check-valves for the air and gas—two or more in number, for safety in preventing ignition or explosion back into the pumps—on the forcing-pipes of each pump, leading to a separate inlet-valve casing for each opposite end of the cylinder, and with quite separate exhaust-ports and passages leading from each valve casing; so that no direct action or connection can take place between the opposite ends of the cylinder or valve and ports, except from the separate air and gas pumps, or separate ends of the pumps. And, further, in having a separate valve—preferably a slide-valve—in each valve casing, for the admission of the compressed air and gas and the exhaustion or escape of the waste gases to and from the opposite ends of the cylinder.

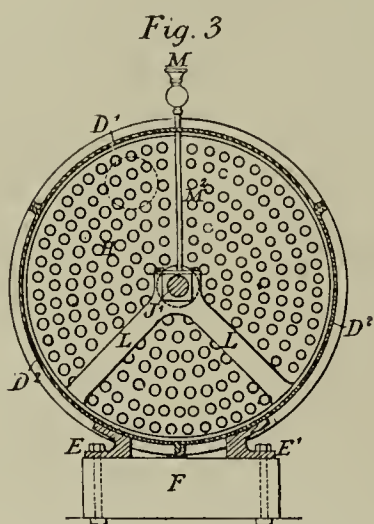
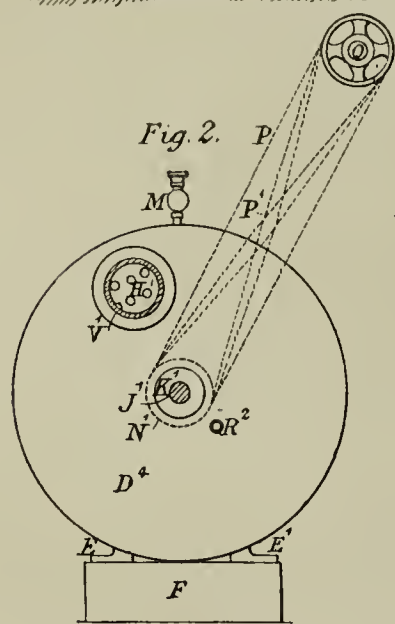
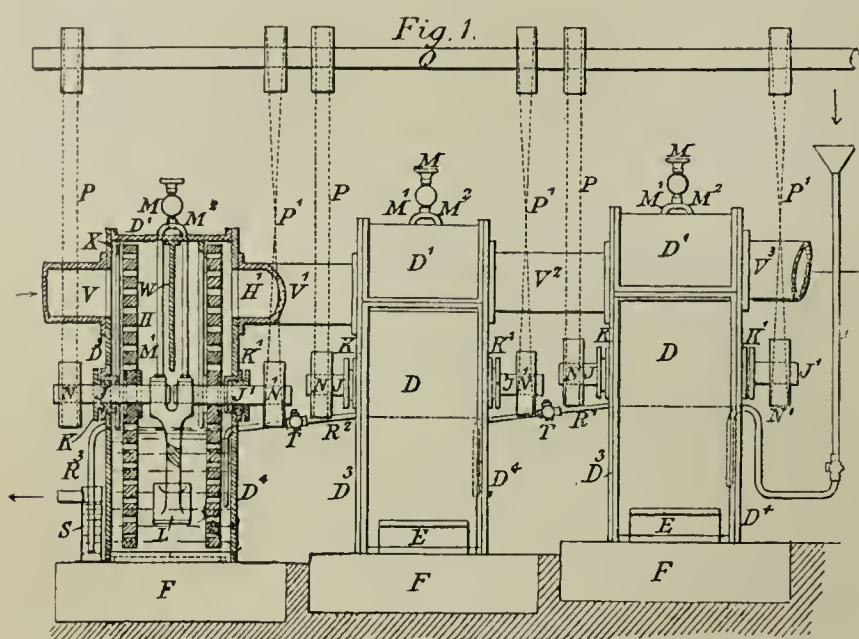
A further improvement consists in working both valves in their separate casings by the same rods and levers or wiper shaft, from a single eccentric on the crank-shaft; and in so fitting the explosive slide blocks or equivalent valves with their igniting flame ports on ported face-plates at the extreme ends of the cylinder, that these also could be worked from one eccentric for the purpose on the crank-shaft through intermediate arrangements of rods and bell-cranks.

Extracting Tar and Ammonia from Gas.—Lister, A. A., of Peckham, S.E. No. 7092; April 24, 1891.

The washer constructed according to this invention consists of a circular drum or casing standing vertically. It contains two wooden perforated discs, nearly filling the interior of the casing, arranged to revolve in opposite directions. The washers are placed in series, in line one behind another on a foundation built in ascending steps. Clean water flows into the highest washer, and leaves it by an overflow syphon-pipe at about the centre; so that the casing is always about half full of water. It then flows to the next washer, and so on in succession; emerging from the lowest one of the series, charged with the tar and ammonia removed from the gas. The gas flows through the washers in the reverse direction; entering at the lowest one, and leaving at the highest. The perforated wooden discs carry up the water; and, by reason of their revolving in contrary directions in each casing, cause the gas to thoroughly mix with the water, and so remove the tar and ammonia. Each disc is mounted on a short horizontal shaft entering the side of the casing; the inner ends of the shafts being supported in bearings carried on a central standard or cross-bar. A pulley is fitted on the outer end of each shaft; and a series of pulleys to correspond is fixed on an overhead shaft—revolution of the discs in contrary directions being obtained by means of open and crossed belts.

Referring to the illustrations on the next page, fig. 1 is a side elevation of a series of washers; the first one being shown in section. Fig. 2 is an end elevation of a washer; and fig. 3, a cross section.

Each washer consists of a circular metal drum or casing, formed for convenience of opening in three or more pieces $D D^1 D^2$, united by bolts through their flanges, and with ends closed by circular covers $D_3 D_4$, bolted on through the flanges. The casing rests upon supports $E E^1$ bolted to the foundation F . $H H^1$ are wooden perforated discs nearly fitting the interior of the casing; and each mounted on short horizontal shafts $J J^1$, passing through and working in stuffing-boxes $K K^1$ in the covers—their inner ends being journaled in bearings carried by the standard L . M is a lubricator communicating with the bearings by the pipes $M^1 M^2$. Pulleys $N N^1$ are fitted on the shafts $J J^1$; the pulley N being driven by an open belt P , and the



pulley N^1 by a crossed belt P^1 from the shaft Q . In this way, the discs H H^1 revolve in opposite directions. The washers are placed in line, one behind another; the foundations F being in ascending steps, so as to cause the water used for washing the gas to flow more readily through them. The water enters the highest washer through the pipe R ; from thence it passes to the next washer through the overflow-pipe R^1 ; and to the next, by a similar pipe R^2 . It leaves the last washer charged with tar and ammonia, by a pipe R^3 , syphoned in a suitable overflow-vessel S . These pipes are all syphoned, to prevent the exit of gas through them; and they are so arranged that the level of water in each washer is maintained at a little below the centre. A regulating-tap T is provided in each pipe. The gas passes in the opposite direction to the water; entering the lowest washer through the pipe V , and passing from washer to washer through the connecting-pipes V^1 V^2 V^3 . The perforated discs H H^1 carry up the water; and, by reason of their revolving in contrary directions, cause the gas to thoroughly mix with the water, and so to remove the tar and ammonia therefrom. The patentee proposes to sometimes place a partition W in the casing, so as to bring the gas more completely in contact with the wet perforations and surfaces of the discs. Strips X may also be fixed in the casing against the discs, to hinder the gas from passing over their edges. The discs H H^1 and their perforations are preferably left rough, in order more effectually to carry up the water.

Indicating the Presence of Gaseous Compounds in Rooms, &c.— Egger, B., of Vienna. No. 7846; May 6, 1891.

This invention relates to apparatus for indicating automatically (according to volume percentages), outside of a given space normally occupied by a gas or gases, the presence in or absence from such space of other or foreign gas or gases of different specific gravity from that of the usual gaseous contents of the space.

Fig. 1.

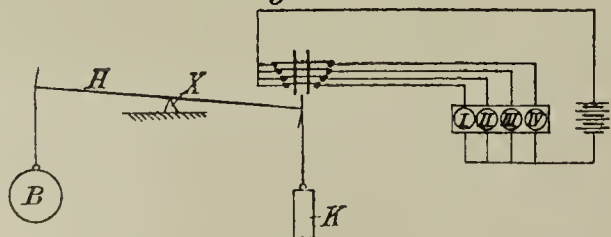
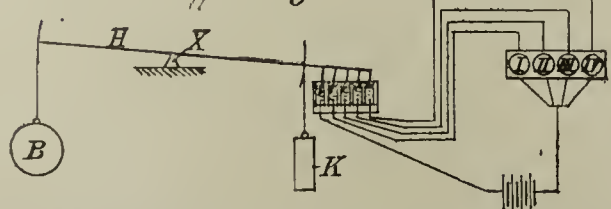


Fig. 2.



The apparatus comprises a vessel filled with a gas of known specific gravity suspended from one arm of a balance-beam, the other arm of which carries a weight for balancing the vessel, and it is connected

with a suitable electrical contact device. The weights of the parts are so adjusted that the balance carrying the gas vessel will be in equilibrium when the apparatus is immersed in gas of the specific gravity of that normally occupying the space in which the apparatus is to be used. When gas of a specific gravity other than that of the gas enclosed in the vessel, enters the space in which the apparatus is located, or the gas passes out of the space or is displaced by another gas, the vessel will, as its buoyancy varies by the difference of the specific gravities, sink or rise according as a gas of less or of greater specific gravity surrounds the vessel. The consequent movement of the balance-beam will cause, by means of the contact device above referred to, the interruption, or the completion, as the case may be, of an electric circuit in which a signalling or indicating device situated at a suitable point is included. A series of contacts is provided, each of which is arranged to be operated by a predetermined difference of specific gravity; and thus the quantity of the foreign gas liable to enter the space in which the apparatus is placed will be indicated automatically according to percentages of volume.

Figs. 1 and 2 show diagrammatically two modes of construction of apparatus according to this invention.

A vessel B , filled with a gas of known specific gravity, is suspended from one arm of a very sensitive balance-beam H , pivoted at x . The other arm of the balance-beam carries a counterweight K , so that the balance is in equilibrium under normal conditions. Since the vessel B must not be sensitive to the pressure and temperature variations of the gas surrounding it, and in order that its volume may vary according to the tension of the gas, and that there may always be the same pressure within and outside the vessel, a portion of or the entire vessel (which may in other respects be of any suitable form) is made advantageously of flexible material. The right arm of the balance-beam H is arranged to act upon a contact device included in the circuit of a suitable signalling or indicating device. This contact device consisting either, as shown in fig. 1, of a series of contact plates which are raised successively corresponding with the percentages of volume of the gas entering the space; or there is provided, as shown in fig. 2, an extension of the right arm, furnished with a series of contact pieces of different lengths, each of which dips into a cup filled with mercury or other suitable conducting liquid. These contact pieces are lifted out of the cups in succession as the arm rises, according to the increase in the percentages of volume of the foreign gas of less specific weight entering the space. By the removal of the contact pieces from their respective cups, the circuits connected therewith are broken, and the signalling or indicating appliances connected therewith are successively set in operation.

Prepayment Gas-Meters.—Cowan, W., of Edinburgh. No. 8444; May 16, 1891.

This invention in prepayment gas-meters (either wet or dry) consists of improvements in, modifications of, and additions to two previous inventions by the same patentee—No. 11,537 of 1890, and No. 3575 of 1891. An illustrated description of the latter appeared in the JOURNAL for March 29, p. 577; the former, in the JOURNAL for Sept. 8 last, p. 445.

The present invention provides, first, improved means for giving the necessary friction to the slip driving-wheel of the prepayment wheel and pointer shaft. Secondly, an improved form of pusher, whereby the fraud known as "pumping" (that is, moving the handle slightly backwards, and so gearing and ungearing the pawl into the prepayment wheel, which, by this operation, would enable the consumer to obtain more gas than the value of the coin) is prevented, and other advantages are secured. Thirdly, an improved compound "stop" arrangement, whereby the same stop answers the double purpose of bringing the mechanism of the meter to a stand (and so shutting off the supply of gas), if the pusher be not returned to its normal position, and also when the quantity of gas paid for has been supplied. Fourthly, an improved prepayment wheel and pawl arrangement, which enables the teeth of the prepayment wheel mechanism to be made as coarse as may be found necessary for secure working, and so lessen the tendency to "miss" which might be experienced when very finely-cut teeth are employed.

Fig. 1.

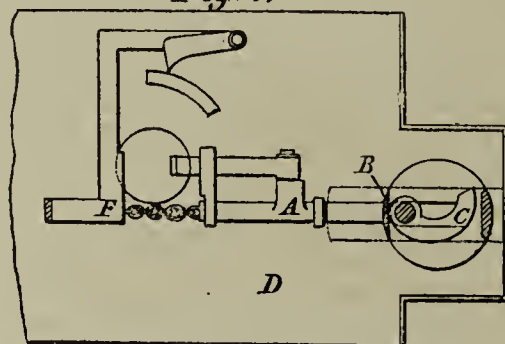


Fig. 2.

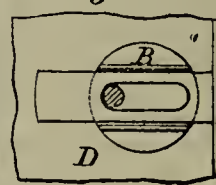


Fig. 3.

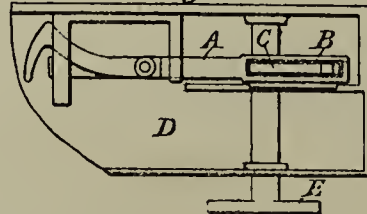
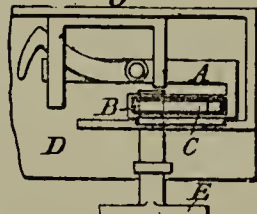


Fig. 4.



The means for giving the necessary friction to the slip driving-wheel of the prepayment wheel and pointer shaft consist in forming the shaft with a ground tapered plug or key, over which the driving-wheel is placed; the boss of the wheel being provided with a correspondingly tapered hole or barrel, and the two sufficiently bound together by a nut or nuts, screwed on to the shaft. Or the ground plug or key may be formed on the outside of the driving-wheel's boss, and the tapered hole or barrel on the one end of the shaft, or on the boss of the pawl-actuated wheel or of the grooved valve lever operating wheel. Whichever plan be adopted, the plug or key and the hole or barrel would be

bound together by means of a nut or nuts; thus providing an arrangement which, while allowing the index to drive the prepayment shaft and its connections, at the same time allows or leaves the shaft free to be revolved independently without actuating the index.

The improved form of pusher is shown in part elevations (figs. 1 and 2) and part plans (figs. 3 and 4). The pushing-bar A is provided with an eccentric box or track B, which may be in line with, or lie alongside, the bar. Inside this box or track is mounted an eccentric or cam-shaped lever C, which is keyed or otherwise secured to a cross-shaft carried by guides or brackets, and having its front end projecting through the front of the index-case D, where it is provided with a suitable knob or handle E. In order to operate the pawl bar F in a backward direction—that is, to replace it in its normal position—it is connected to the pushing-bar A by a chain or a one-way actuating slip rod; thus dispensing with the use of springs as heretofore, as well as of the stationary rack, pawl, and mercurial tumbler.

In using the foregoing with meters like those described in patent No. 3575 of 1891 (that is, in meters where the pawl is mounted on the front end of the coin slot-piece, tubular extension, or rods thereof, as before, so that on the pusher being operated it carries the coin, the coin slot-piece, and the pawl with it), the inventor proposes to proceed as

Fig. 5.

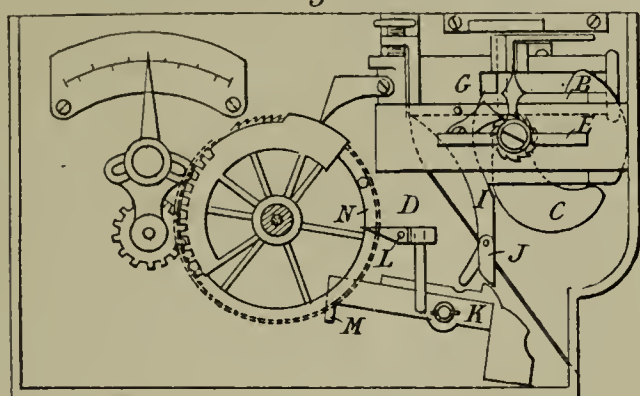
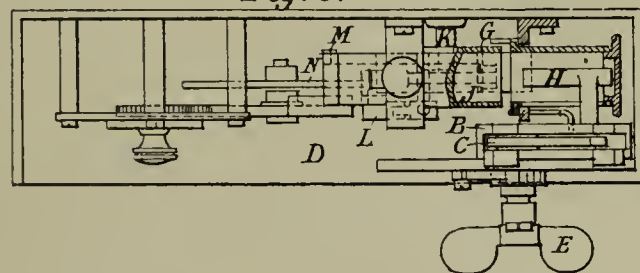


Fig. 6.



shown in figs. 5 and 6; *i.e.*, in lieu of employing a pusher, he uses an eccentrically actuated device, preferably formed by mounting alongside the slot-piece G an eccentric box or track B, which works longitudinally in one or more guides. Inside this box or track is mounted an eccentric or cam-shaped lever C, which is secured to a cross-shaft carried by guides or brackets, provided with a knob or handle at its outer end, as already described. The eccentric box or track has a projecting stud or pusher H formed on or attached to the side next to the slot-piece, which is provided with a longitudinal slot or opening on its side or extension, so as to enable the stud or pusher to work in and so grip the coin.

The compound "stop" arrangement (as shown in these illustrations) is obtained by providing the slot-piece G with a lower arm or tail piece I, which is provided near its lower end with an auxiliary pivoted arm or tail piece J, both of which have their lower ends working on a suitably-shaped track, provided on the top side of a pivoted lever K, which has one end weighted, and its other bent in such a manner as to engage with the point of the ordinary tangent of the dry meter. The object of this pivoted tail-piece is to force down the weighted end of the pivoted lever, in the event of the weight being inadequate to take the stop end M out of the position in which it obstructs the progress of the tangent or other part of the meter's mechanism. The tail-piece J only yields in one direction—that is, when it is going inwards with the pusher; but it is rigid on the backward journey when it meets with a rib or wall on the upper surface of the pivoted lever K, against which it presses and forces the lever down and so removes the stop. The lever K is also provided with a bent upright rod or bracket, which has mounted at its top end a one-way yielding arm or projection L, which may be jointed on or hinged thereto, and against which a stop or projection on the pawl-actuated wheel N works, and so causes the bent end of the lever to fall into the track of the meter's tangent, and thereby shut off the supply of gas. This forms a compound "stop" arrangement, which answers the double purpose of bringing the meter's mechanism to a stand if the pusher be not returned to its normal position, and also when the quantity of gas paid for has been supplied.

Gas Motor Engines.—Abel, C. D.; communicated from the Gas Motoren Fabrik Deutz, of Köln-Deutz, Germany. No. 8469; May 16, 1891.

This invention relates to four-stroke-cycle gas motor engines, so operated as to obtain, during the working stroke, any desired degree of expansion of the hot combustion gases, whereby a considerable economy in the expenditure of gas is claimed to be effected. At the same time, the arrangement is such that the premature firing of the combustible charges while they are being drawn in—which frequently occurs in four-stroke-cycle gas motor engines of the present mode of construction—and the consequent violent explosions, is entirely obviated. Lastly, the arrangement admits of the easy starting of the engine from a state of rest.

The arrangement and mode of operation consists essentially in drawing in a charge of air alone, through an air-inlet valve, during the suction stroke, so that no explosive mixture is at that time introduced into the cylinder; while during the following compression stroke, part of the air drawn in (which mixes with the residue of combustion gases remaining in the cylinder) is driven out of the cylinder again during

the first part of such stroke—the remainder of the charge being then compressed during the completion of the stroke. At the same time combustible gas is injected into the charge of mixed air and combustion gases, so as to form an explosive mixture. The explosive charge thus produced, being in a compressed condition at the end of the instroke, is then ignited in any suitable way. On the following working stroke of the engine, there will consequently occur an increased expansive action of the hot combustion gases on the piston; the degree of expansion being the greater, the greater the volume of air and combustion residues expelled from the cylinder during the previous compression stroke. On the completion of the working stroke, the combustion gases are expelled from the cylinder by the following expelling stroke in the usual manner, thus completing the four-stroke-cycle.

Manufacture of Ammonia and Tar from Nitrogenous Organic Substances.—Thompson, W. P.; communicated from Dr. P. Kuntze, of Aschersleben, Germany. No. 9052; May 28, 1891.

This invention relates to the manufacture of ammonia and tar from nitrogenous organic substances, whereby, as a source of nitrogen, the extensive turf moors and peat bogs are principally thought of. The treatment referred to consists (a) in subjecting the broken up and dried material to charring in a furnace, heated by producer gases, generated at a later stage of the process, while the resulting mixture of tarry, aqueous, and nitrogenous vapours is submitted to an igniting process, for decomposing the organic nitrogenous vapours, in the presence of superheated steam and great surfaces of light red-hot porous refractory matter, into ammonia and hydrocarbons, which are separated and absorbed in any well-known manner; and (b) treating the residue from the charring process in a generator situated below the charring furnace, by means of hot air and superheated steam, in order to liberate the fixed nitrogen and convert it into ammonia; the resulting mixture of ammonia and permanent gases being separated in any well-known manner, and the gases applied for heating purposes.

Gas-Engines.—Leigh, H. H., communicated from P. F. Forest and G. Gallice, of Paris. No. 22,559; Dec. 24, 1891.

This invention has for its object to provide for the complete utilization of the gaseous products of combustion before they are expelled from the cylinder.

The indicator-diagrams taken on engines made according to the present invention, the patentees remark, show that the exhaust has a pressure varying between three and four atmospheres. This represents a considerable loss of energy—due firstly to the pressure not used, and secondly to the power used to expel the exhaust. To remedy this drawback, it would be necessary to make the stroke of the piston long enough to allow the gases to expand to atmospheric pressure. But it would also be necessary for the charge of gas and air to remain in the cylinder the same time. Now, if the piston stroke is lengthened, the volume of the charge is increased accordingly, and the final result will be exactly the same. What is therefore required is to be able to increase the piston-stroke during the expansion period—keeping it as before during the charging and compression periods; or, what comes to the same thing, to reduce the stroke during the charging period, keeping it as before during the expansion period, or in a word to reduce the charge, keeping the other matters as previously. This being arranged for, and it being borne in mind that in four-cylinder engines one of the pistons always begins to draw in a charge while another of them commences to compress, this invention in its widest sense relates to the returning into the former cylinder a portion of the compressed charge.

The specification describes the application of the invention to a reversing Pilon engine with electric ignition; but it is distinctly stated that this is only one example, and that it is equally applicable to any type of four-cylinder engine.

The invention acts in the following manner: The first cylinder having finished its feeding stroke, and the third cylinder beginning its stroke, the first lever operated by the cam swings on its fulcrum and presses upon the spindle of the valve, which it keeps open for a determinate time. During this latter the return stroke of the piston drives the charge past the valve into a pipe, from which it is drawn into the third cylinder. This latter in its turn sends a portion of the contents into the second cylinder, which in its turn delivers into the fourth cylinder, and so on. The volume returned is adjusted so that the exhaust shall be at atmospheric pressure. Such a construction is equally adapted for the purpose of utilizing the exhaust in slow-speed engines; in fact, with such engines the exhaust takes place at half-stroke, with a corresponding loss. But, according to this invention, the energy lost is, instead, led into the next cylinder, and a corresponding economy effected.

APPLICATIONS FOR LETTERS PATENT.

- 6655.—MORANI, F., "Gas motors." April 6.
- 6733.—RYLANDS, D., "Utilizing gas for warming or heating purposes." April 8.
- 6783.—HOWLDEN, E. F., "Controlling the gas supply from reservoirs to burners on railway trains." April 8.
- 6877.—WOODWARD, J., "Charging gas-retorts." April 9.
- 6908.—COLLET, H., and MERICHENSKI, M., "Mixture intended for use in carburetted air or enriching combustible gas." April 11.
- 6909.—COLLET, H. and MERICHENSKI, M., "Carburettors." April 11.
- 6917.—SIMONS, F. A. A., "Prolonging the durability of incandescent gas-lamps." April 11.
- 6952.—DAWSON, H. T., "Gas-engines." April 11.
- 6989.—M'MULLEN, J. A., "Conduits applicable for combined use as casings for electrical conductors and for gas supply, or for either use separately." April 12.
- 7079.—COLLINS, C. R., "Gas-making apparatus." April 12.
- 7167.—DONNELLY, J., "Gas welding appliances." April 13.
- 7210.—LEWIS, J., "Gas-valve for blast-furnace regenerative stoves, applicable also to gas-fired boilers." April 14.
- 7310.—FLETCHER, A. T., "Automatic extinction of gas-lights." April 16.
- 7320.—SOUTHALL, J., "Gas and oil motor engines." April 16.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

The Minimum Size of Water-Mains and the Laying of Mains, Hydrants, &c., for the Protection of Property from Fire.

SIR,—Although little new may be advanced on the above subjects, yet by directing attention to them, it may be possible to draw from those who are at present engaged in the work expressions of views that may lead to practical conclusions not before noted in the JOURNAL.

A town may possess a water-works, but this is not always a proof that it has the capability of giving ample protection during a great conflagration; therefore it behoves the proprietors of such works to provide pipes and hydrants of sufficient diameter to allow a large margin for accidents. A pressure of 80 to 100 lbs. per square inch is a far more preferable safeguard than a good equipment of fire-engines. Having secured for the erection of the reservoirs the highest elevation in the district that will give the maximum pressure necessary to cope with the largest fire that may probably take place, care must be taken to make the outlets from them of sufficient size to provide for the future increase of the population, manufactures, &c. These pipes may be reduced at a suitable distance outside the reservoir grounds; and when the requirements of the town demand it, larger mains can readily be attached to the outlet-pipes.

A good topographical map, on a large scale, of the mains to be laid down in all the streets is of the first importance, as this graphic manner of showing the difficulties to be overcome will prove most advantageous and economical. The scale should be large enough to show all the bends, angles, and connections, main cocks, hydrants, and large meter supplies.

In laying out a new water-works, the first consideration is the present needs of the town for all purposes, and not least is that of a full supply for the protection of property from fire at a maximum pressure. This will refer first of all to the main carriers from the reservoirs; but still greater discrimination is required in laying out the distributing-mains through every street, which shall command all the by-ways, courts, and alleys. An estimate must also be made of the probable extension of the town, and its many requirements, for sanitary and manufacturing purposes; not forgetting that the greatest proportion of the water will be used in from eight to nine hours. These points are too often sadly insufficiently considered. When we look at the growth of towns as shown by the last census, it must be obvious to everyone that the small pipes which are still being laid must in the near future be duplicated or larger mains substituted. The maximum calculated rate of consumption must be added to the probable quantity that may be required at an extensive conflagration; and the whole of the mains should be large enough to cope with such an emergency.

Some engineers have estimated the required quantity of water for extinguishing fires at 1-12th of a gallon per head per day. Although this quantity seems small in comparison with the other uses for water in a town, yet it proves that, in order to be properly provided with mains of a sufficient size, the capacity must exceed the requirements for the remaining consumption. Fanning states a case as follows:—

Take 1200 feet of distribution-pipe in a closely built-up section. We find on the 1200 feet length (say) 40 domestic service-pipes, and consumption of (say) 750 gallons each per day = 30,000 gallons per day. Making due allowance of 50 per cent. increase of flow at certain hours, we have a required delivery capacity of 1.5 cubic feet per minute to cover this whole consumption. On the same 1200 feet of pipe, there are (say) four fire hydrants. If, in case of fire, we take from these hydrants only four streams in all of 20 cubic feet per minute each, we require a delivering capacity of 80 cubic feet per minute. In this case, which is not uncommon, the required capacity for fire service is to that for the remaining service as 80:1.5. If the given pipe 1200 feet long is a 6-inch pipe, supplied at both ends, then the delivery for fire at each end is 40 cubic feet per minute. If the 80 cubic feet per minute must all come from one end of the pipe, then the pipe should be 8 inches in diameter.

Although somewhat of a digression, it is well to state that, seeing there is a considerable increase in the cost of all the plant required, principally because of the pressure and the increased quantity of water demanded on a sudden outbreak of fire, and the sizes of mains having to be augmented, it is only reasonable that the people who are thus protected should pay for the use of the hydrants the repairs thereof. These large numbers of main-cocks, hydrants, and fittings, would not be required but for protection from fire; and if the law enacts that water shall be supplied gratis for this purpose, the expense and maintenance of the apparatus should be borne by the public. This is not now the case in several towns. It must always be remembered that four-fifths of the fires are extinguished by the pressure in the mains before the fire-engines arrive.

Take an instance of a big warehouse, hotel, or large school. A 4-inch fire-main is usually run into the building, and carried up the centre to the second or third floor, with hydrants on each floor. This pipe may be connected to a 4-inch or 5-inch main in the street. On the arrival of the fire-engines, it is found that the hydrants on the main in the building are taking most of the water, and that there is not sufficient to supply the engines. In the excitement, a fireman has attached his hose to a hydrant near the building; and no one has sufficient pressure to carry a jet any distance to be of service. Suppose there are in the same street a lift or two, or a manufactory using water, what chance is there for the firemen to extinguish a large fire? I recently read of a case where a house was on fire and two engines came up readily enough. The main was only a 4-inch one, and of considerable length. Both firemen attached their hose, and, of course, they had not sufficient pressure. As neither fireman would give way, the house was, in consequence, completely destroyed. One hose carrying a full pressure would have been sufficient to save the property in this instance. The use of 4-inch pipes in towns should be condemned as too small. A short length of 4-inch pipe may, while new, give a moderate supply to two short lengths of hose under a pressure of 100 lbs to the square inch; but often the 4-inch main is corroded greatly, and it is not equal to a 3-inch one. The friction in the hose alone is really enormous. With a

discharge of 150 gallons per minute, it absorbs 3 inches of head for every foot of the hose.

Where an efficient service for extinguishing fires is required, a 6-inch main is necessary; and this size must be restricted to a certain length in accordance with the class of property to be protected. Of course, the length of the main and the pressure at hand have to be fully considered. It must be borne in mind that, even in moderate-sized towns, two and three fires may occur at one time; and there are usually four or five jets called into requisition at each fire. Although the pipes may not have to withstand a pressure of more than 40 lbs. per square inch in the usual way of working, yet with the increased heights of buildings and the use of numerous lifts, an augmented pressure will ultimately have to be maintained. It is therefore desirable always to put in pipes tested to four times the pressure generally employed. In some soils the pipes quickly deteriorate, and become as soft as plumbago. The iron may then be cut with a knife. The question of water-hammer must also be considered; as well as the constant demand for water for use in motors, street watering, flushing, &c.

In many towns there is a high and a low pressure service. The mains being so very small, they will not carry sufficient water at times to supply the population in the district. Recourse is then had to high-service supply to sustain the pressure; and this causes great expense, as every extra foot in height that water is raised entails a needless waste of fuel, when the low pressure would have been sufficient if the pipes had been large enough to supply the consumers and keep up the pressure. The constant charging of the mains at a higher pressure often leads to the bursting of the pipes; and when such an accident occurs during the progress of a fire, the situation is very serious, and must lead to distressing results. The fire brigades are constantly increasing the number of their engines and plant; and in a few years the sizes of pipes in many towns will have to be considerably enlarged to be in a position to supply them with water. There should be a better understanding between the brigades and the water companies, who supply the water gratis, as it often happens that the inspector or turncock would be of incalculable service, not only in pointing out the location of the hydrants, but in informing the chief fireman as to what quantity of water could be drawn from a certain district, having a small main which could not be known to them.

The number of fires constantly occurring, and the vast sums of money lost annually, are abundant proofs of the importance of the scientific study of the smallness of mains still being laid and of the present state of the whole of the distribution plant in regard to protection from fire. Proper hydrants open to the right hand; but some open to the left. Why the latter plan is adopted, I have never been able to satisfactorily ascertain. I have but one left-handed valve in the town with which I am connected; and, of course, each individual turncock will turn it the wrong way, although it is known to have a left-handed screw. There is sometimes a difficulty in finding the hydrants. I fix them with regularity at the corner of every street 3 feet from the curb-line, with the box placed in the footpath, and a white plate attached to the house opposite to it. I can always find them in the dark, or if covered with ice and snow. No matter how great may be the excitement at a fire, there is no time lost in finding the hydrants when they are placed in this manner.

Hose couplings do not always fit the hydrants, especially when they are supplied by more than one maker. Some will be just a little too tight; others are so loose that it is with difficulty they are kept on. It therefore becomes necessary that every hydrant should be accurately measured and tested before being fixed, and the standard mesh only accepted. There should be a sufficient number of blow-offs fixed underneath the mains, for emptying and scouring out; one being placed at every dead end. Hydrants are of little use for this purpose, as the top water only is blown out, and much of the sediment is left in the mains. It is necessary that the pipes should be first emptied, and then the full pressure turned on, as this will scour out all dirt through the bottom wash-out pipe. This is equally necessary to keep the pipes free from deposit and incrustation, so as to have the benefit of a full-bore pipe in case of fire, as well as for the purpose of giving a pure supply. A main-cock and hydrant placed at the corner of every street may be said to be a waste of money; but one never knows which may be required, or when. They are essential for shutting off each section of the street for repairs, and for testing and flushing; they may also, in case of a large fire, be used to concentrate all the pressure around the street where the fire is raging. The benefit of having these main-cocks may be exemplified at the very first conflagration; and they may prove to be of more value than the total number fixed. I am sure it will be found that the advantages will more than counter-balance the cost.

April 22, 1892.

INSPECTOR.

The Fourness Gas Process Syndicate, Limited.—This Company has been registered with a capital of £2000, in £50 shares, to carry into effect an agreement made between J. Barclay and W. V. Hamilton, H. Fourness, the several persons mentioned in the agreement, and the Company, for the acquisition of certain patents relating to improvements in the manufacture and storage of illuminating and heating gas, and to develop and work them.

Sale of Shares.—At West Hartlepool last Wednesday, 500 shares of £10 each in the gas capital of the *Hartlepool Gas and Water Company*, on which the maximum dividend is 7 per cent., and also 172 £10 shares in the water capital, were disposed of by auction. Only £2 was to be paid up on the water shares; the remaining £8 to be called up as required. The prices realized for the gas shares ranged from £15 16s. to £16 17s.; and for the water shares, from £5 10s. to £5 16s. 6d.

Water-Works for Millbrook.—Mr. T. Codrington, C.E., one of the Local Government Board Inspectors, held an inquiry at Millbrook, near Plymouth, last Tuesday, concerning an application by the St. Germans Sanitary Authority for a loan of £6000 for works of sewerage and water supply. It was stated that it was proposed to obtain a supply from the Bridgemoor stream, and that a reservoir would be constructed capable of containing 54 days' supply, amounting to about 2 million gallons. The total cost of the scheme was estimated at £5150. At the conclusion of the inquiry, the Inspector visited the site of the reservoir.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS COMMITTEE.

Thursday, March 31.

(Before Mr. CAMPBELL-BANNERMAN, Chairman; Sir W. HOULDSWORTH, Sir H. STAFFORD NORTHCOTE, Mr. R. K. CAUSTON, Mr. S. GEDGE, Mr. P. STANHOPE, Mr. POWELL WILLIAMS, Mr. W. JAMES, and Mr. E. H. LLEWELLYN.)

BIRMINGHAM CORPORATION WATER BILL.

This Bill, by which the Corporation of Birmingham seek power to carry out a large scheme for furnishing a supply of water to the city from the Rivers Elan and Claerwen, in Radnorshire, came on the above-named day before a Select Committee constituted as set forth. The measure is being strongly opposed.

Mr. POPE, Q.C., Mr. BALFOUR BROWNE, Q.C., Mr. CRIPPS, Q.C., and Mr. G. A. R. FITZGERALD appeared for the promoters. The following Counsel represented parties opposing, or desiring to be heard against the Bill: Mr. PEMBER, Q.C., and Mr. FREEMAN, the London County Council; Mr. A. T. LAWRENCE, the Hereford Corporation; Mr. C. J. EDWARDS, owners of property in Birmingham; the Hon. A. LYTTLETON, Mr. J. LLOYD, Mr. MOON, and Mr. R. L. WILLIAMS, various other petitioners whose interests are affected by the Bill.

Mr. POPE, in opening the case, said the Bill before the Committee was to enable an important Corporation to spend a considerable sum of money for the purpose of securing the present and future supply of water to a great industrial community. The first proposition on which he would submit evidence, and which he quite believed he would be able to substantiate in the most absolute manner, was that Birmingham was in immediate need of a further quantity of good water, and that this must come from some fresh sources. Until the year 1875, Birmingham was supplied with water by a Company, which was incorporated in 1826, and commenced business in 1831. In 1875, the Corporation were authorized to acquire the undertaking, and become the Water Authority. The Act which sanctioned this was amended in 1883 by an Act under which the area of distribution was increased to 82,221 acres; and a recent extension of the borough had further enlarged that area to 86,000 or 87,000 acres. Witnesses would place before the Committee detailed figures, showing that, in the three decades ending respectively in 1871, 1881, and 1891, the population of the area of distribution rose from 450,000 to 561,000 and 648,000; while the inhabited houses increased from 89,457 to 110,000 and 129,000. Birmingham was a community exceptionally situated as regarded its industrial interests. It was not dependent upon one large industry; it was a district of which the industries were so varied and so different that periods of depression very rarely affected them alike, or all at one time. On the whole, therefore, the progress of the city and its industry might be regarded as being pretty constant. The water supply had increased in proportion to the population. In 1876, the total supply of water within the area was 3031 million gallons a year; the daily average being 8,300,000 gallons, and the water-rental £93,527. In 1891 the consumption had risen to 6141 million gallons a year, or 17 million gallons a day; and the water-rental to £136,964. The present sources of supply were mainly two—rivers and sandstone wells. The rivers were the Perry and Witton streams, Plant's Brook, and the Rivers Blyth and Bourne. The Tame was one of the sources utilized by the old Company; but its increasing pollution led (in 1866) to the passing of an Act which provided for the gradual cessation of its use, and it had been abandoned since 1872. In the red sandstone formation there were six wells—at Aston, King's Vale, Short Heath, Perry, Selly Oak, and Longbridge. The minimum yield of all these sources together was about 17½ million gallons per day; and the average about 21 millions, or rather more. But for purposes of water supply to a large community, it was a dangerous thing to take averages as a guide to quantity, because it might be overtaken by periods of drought, when the average would no longer hold; so that the point of safety was, of course, the minimum. Scientific witnesses would tell the Committee that the demand in the year 1900 would certainly overtake any present possible supply—that was to say, that, in eight years' time, if in the meanwhile there was no period of drought, Birmingham would be at the end of her tether in this particular. He need not point out that such a state of things was not tolerable for a community of so much importance as Birmingham. Eight years! Supposing they were to obtain the sanction of Parliament to an immediate increase of the supply, wherever it was to come from, the preparation and construction of the works must at least occupy that period. This circumstance alone constituted one of the strongest cases he remembered for immediate legislation. In truth, no other community of this magnitude had ever been questioned as regarded its prudence, under such circumstances, in coming for immediate relief. Parliament, in dealing with Manchester in 1879, and with Liverpool in 1880, recognized to the full the duty of the Municipal Authority to ensure the supply of a necessity of life by an early application. Nothing was further from the truth than to say that Birmingham was now before Parliament in order to anticipate somebody else in the acquisition of a territory which it did not need. In fact, the Water Committee of the Corporation had had this question before them for several years past. They had not started it, as had been suggested, because the London County Council or any other body was looking for further supplies on account of the insufficiency of the Thames Valley; for it had been discussed and reported upon long before any such suggestion was made. Although he was far from saying that such a suggestion did not create a certain amount of alarm, lest the demands of the enormous interests and population of London might throw a weight into the scale which would prevent Birmingham from obtaining that which was absolutely necessary for their own existence, yet it was not the operating motive in the promotion of this Bill. Various suggestions were made as long ago as 1871 by Sir Robert Rawlinson; but lately, determined to act upon the best possible advice, the Water Committee of the Corporation passed a resolution by which they placed the question in the hands of Mr. James Mansergh, one of the most

distinguished water engineers of the day. The present Bill was the result of his advice. It had received the approval of high authority besides, and the absolutely unanimous voice of the Birmingham City Council. With the exception, moreover, of a certain number, who, he could not help thinking, understood the question imperfectly, it was practically the demand of the people of Birmingham themselves. Mr. Mansergh's reasons, stated briefly, were these: The area of supply varied in level from 290 to 600 feet above Ordnance datum; and if water was to be supplied to the district by gravitation, a source must be sought of which the elevation was high. Of course, the distribution might be effected by pumping; but pumping was costly, and, for a large community, not a defensible method. As to the rate at which the consumption had increased, it had, during the early history of the supply, been abnormal, because, in the exercise of their duty, property-owners and others had been forced to abandon the use of wells which were thought to be unfit for public consumption. Although, therefore, the rate of increase had been 4½ per cent., Mr. Mansergh took 3 per cent. as a measure of the future augmentation; and as time went on, he still further reduced it at the rate of ½ per cent. every ten years. On this scale the quantity of water required per diem in 1915—i.e., 25 years hence (a period always contemplated in the most limited calculation for water-works)—would be nearly 30 million gallons; and in 1940, it would be 51½ millions. The present supply would be exceeded in the former year by 9 million gallons a day; and in 50 years hence, by 33 millions. He had said that 25 years was always taken as a most moderate calculation. But, in dealing with all large communities, Parliament had hitherto acted with much greater wisdom, because it had foreseen that a hand-to-mouth policy—the policy of patching up an existing source of supply by the expenditure of capital which could only last over a few years, and which must ultimately be wasted—was not a prudent one. Hence, when Manchester and Liverpool went to Parliament, they received sanction to the acquisition of rights enabling them to cover a period of a couple of generations, within which time the capital they proposed to lay out might be supposed to be remunerative. Look, again, at Glasgow. Glasgow had become famous for the extent and excellence of its water supply. Would this have been possible if Parliament had, with a niggardly hand, prevented her from bringing water from Loch Katrine to an extent far in excess of what the people had before thought necessary? He owned that it seemed to him that one of the glories of the municipal government of Glasgow was that the supply of water was more plentiful and more unstinted than in any other community in the kingdom. In considering, then, how the future case of Birmingham should be met, Mr. Mansergh satisfied himself first of all that there were no local sources worthy of real consideration. No doubt it might be possible to construct upon the River Bourne four impounding reservoirs which should hold altogether 1100 million gallons, and yield about 7 million gallons a day. But if new powers were now being sought over that river, a part of the water which could be impounded would, of necessity, have to go in compensation to the streams, and the residue left for Birmingham would be so insignificant as not to be worth the capital expended upon it. The River Blythe was a larger stream, but one which was very unfavourable for the construction of storage reservoirs. Moreover, the Bourne, the Blythe, and Plant's Brook together would only supply the wants of the district for some 15 or 20 years; and this, they thought, was not a sufficient time to provide for. But there was another, and it seemed to him, a fatal objection to the utilization of these streams. Dr. Frankland and Professor Dewar would tell the Committee what they thought of the probable future quality of the water these streams would yield. Birmingham had at present a healthy community; and even now it was not so because of the purity of the water. As far as the chemists were concerned, they would say, without hesitation: "If we were asked whether that is a suitable supply for a community such as Birmingham, we should condemn it." He did not mean to say that the existing impurities were such as to give rise to any alarm. But all these streams ran through highly-manured agricultural country, with many villages and farms; and before very long, public opinion would condemn water distributed from such a source. At all events, the expenditure of capital in increasing the supply from this source would be a financial operation of questionable wisdom. Of the wells, some were rather disappointing; but they furnished in the aggregate about 10 million gallons a day. Mr. Mansergh thought that, if it were desirable, within a reasonable distance of Birmingham five more could be sunk, which would yield very much the same quantity as the existing five. He would even go farther. He might almost admit that, if Birmingham had been a town with a present population of 250,000, growing but slowly, a well supply might have been considered. But the circumstances rather resembled those of Liverpool; and what was the experience of Liverpool with regard to such sources? For domestic uses, nobody had any fault to find with the Liverpool supply of well water in respect of its quality, though its quantity was variable. But that which had been found at Liverpool, and was now found at Birmingham, was that pumping from the red sandstone formation resulted in the gradual deterioration of the quality of the water, and remarkably so as regarded its hardness; so that at this moment the well water supplied to Birmingham had become so hard that it was absolutely unfit to be used alone for any trade or manufacturing purpose whatever. If, therefore, the supply must be by gravitation, Birmingham, standing on a higher level than any of the other large communities, was reduced to a more limited range of selection in looking out for gathering-grounds, because these must be correspondingly high. There were hundreds of thousands of acres of good ground which, in the event of the Thames Valley proving insufficient for the requirements of London, would be suitable for that community; but the number of spots which could be made available for Birmingham was very much smaller. If he rightly interpreted that utterance by Sir Thomas Martineau which had so much fluttered the Londoners, it had amounted simply to this—that the desire of Birmingham was not to take possession of ground available for the supply of London or of any other community, but that they should not themselves be anticipated in the acquisition of the only, or nearly the only land which was available for them, while there still remained for other communities the abundant area which might be utilized for their

purposes. Moreover, the request for delay by the London County Council was most unreasonable and most dangerous. They asked that the House should first have before it the report of the Royal Commission now sitting with reference to the London Water Supply. The suggestion was absurd. A year's postponement meant such a further delay that, if it was to be imposed upon Birmingham, the actual calamity would happen of that city being short of water. But what was the nature of the reference to the Royal Commission? The Commission would merely report whether, in their judgment, the Thames source was such as, in quantity and quality, could be made additionally available for the supply of the capital; but it did not lie within the scope of the Commission to recommend what area should be appropriated for London. How long would it take the London County Council to make up their mind where to go? Before they could act at all, they must come face to face with such difficulties as he was now discussing on behalf of the Birmingham Bill. They must go before a Special Committee of the House of Commons. So that, even if the report of the Commission were such as to satisfy the most ardent spirits of the County Council, and to condemn the Thames supply utterly, some years must elapse before the Council could make good their appropriation of any area. If the Elan and Claerwen valleys, to which Birmingham proposed to go, were chosen, they would not be sufficient in themselves; they would only be part of a wider scheme. They would not naturally be selected from London, because they were needlessly high. Therefore it certainly seemed to him to be a most dangerous and unjust request that, if there did exist this immediate demand for a supply in Birmingham, it should be postponed for the reason that some possibility might arise of some other community—not necessarily, but exercising a choice—might come in with a preference for this particular district, although it would not be sufficient for the purpose. The learned Counsel went on to say that the estimated cost of the scheme was £5,851,000; and the capital asked for to cover contingencies was £6,600,000. It was a large scheme; but the Water Committee, of course, designed that it should be economically administered, and that it should not be developed at one stroke, but gradually. They proposed to acquire the land itself. Their object was not to extinguish any rights vesting in anybody, so far as these could be exercised with due regard to the protection of the soil from pollution. The Corporation of Birmingham did not desire to become land-jobbers; they merely hoped to secure efficient control.

The CHAIRMAN: Is it a usual or an unusual thing for a Corporation to acquire the actual soil?

Mr. POPE said that, in the case of large communities, it had of late years become frequent, though he would not say common. Manchester acquired it in taking Thirlmere; and Liverpool very largely in taking the Vyrnwy. He had received two reports with reference to the Bill—one from the Board of Trade, and the other from the Home Office. The former had reference to compensation water, and bore also upon the question of fisheries. It suggested that, in view of the difficulty of constructing such fish-ladders as would not at all interfere with the spawning, it would be best that the compensation on this head should take the form of money. As to the compensation water, it was based on similar calculations to those which Parliament sanctioned in connection with the Liverpool and Manchester schemes. The Home Office report he would deal with later, as it had not been printed. Passing on to the petitions, he said he should ask the Committee to set that of the Hereford Corporation aside, as having been drafted in needless alarm for the River Wye. Of the petition against the Bill presented by certain Birmingham property-owners, he said he had supposed that the suggestion it contained of a dual system of supply had been long ago exploded in the mind of everybody of common sense. To him, familiar as he was with most of the discussions which had taken place of late years, its appearance was like a revival from the Middle Ages; and he would wait with some curiosity to hear what fossil owner of property in Birmingham would venture to come forward and say he still entertained the opinion that this dual supply was a practicable idea.

At the conclusion of the learned Counsel's address, evidence in proof of the preamble of the Bill was then given.

Sir T. Martineau, examined by Mr. BALFOUR BROWNE, said he was Chairman of the Water Committee of the Birmingham Corporation during the mayoralty of Mr. Alderman Avery; and at the end of his own term of office as Mayor in 1887, he was again appointed Chairman, and had been so ever since. The water-works had been the property of the Corporation since the end of 1875; and the Water Department was regulated by the Consolidation Act and the general statutes incorporated with the Local Act. Under the latter Act, no water-rate was levied on ratepayers in the city. Witness described the water area comprised within the present limits of supply; the total extent of the district being 83,221 acres. He put in the details referred to by Mr. Pope, in his opening address, as showing the increase of inhabited houses and population in the area of distribution during the three decades ended 1871, 1881, and 1891. Proceeding, he said the increase in population was not, on the whole, so large between the years 1881 and 1891 as between 1871 and 1881; and it was very unevenly distributed. In the districts which were within the city, as well as in several of the large suburbs, enormous increases had taken place. There was no suburb of Birmingham which was not within the water limits. When all the land in the city and suburbs became occupied, there would remain inside those limits a belt of pure country which might gradually assume a more or less suburban character. Therefore, speaking generally, every house that was built, whether in the city, in its present suburbs, or in the suburbs of the future, would require a supply from the Water Department. The growth of Birmingham during the century had been enormous; and he saw no reason why it should stop. He believed, notwithstanding fluctuations in trade, it was, altogether, a thoroughly thriving and prosperous place, and likely to continue so. Birmingham had, in an especial degree, this element of steadiness about it—that its prosperity did not depend upon any one trade or branch of trades. Witness proceeded to show how, mainly in consequence of the increase of population, the quantity of water supplied had augmented. He also repeated the account given by Mr. Pope of the present supply. He added, on this point, that, in view of long-continued drought, the Water Committee were hardly able even now to meet the demand. As

to future requirements, the estimate of the Water Engineer (Mr. Gray) showed the following figures:—

	Total.	Average per Day.	Maximum per Day.
1893 ..	6,387,000,000	17,500,000	22,000,000
1900 ..	7,665,000,000	21,000,000	26,000,000
1915 ..	10,950,000,000	30,000,000	36,000,000
1941 ..	16,425,000,000	45,000,000	60,000,000

Continuing, witness said he believed Mr. Mansergh placed the average in 1941 at a much higher figure. According to this calculation, the present means of supply would be insufficient to meet the consumption of 1900. If there should be a serious drought, even several years earlier than that, the Water Committee would be quite unable, with the present means, to meet the demands on their resources, and would be obliged to curtail the daily supply to the inhabitants. Liverpool obtained its Act for the Vyrnwy scheme in 1880; and Manchester, for the Thirlmere scheme, in 1879. In neither case were the works yet quite complete. If, therefore, Birmingham was to deal with this matter by a comprehensive scheme, it had not a day to lose. Proceeding, witness traced the various steps taken by the Water Committee in view of the approaching need for more water. The suggestion of the Rivers Elan and Claerwen as sources of supply for Birmingham was not new. In the year 1871, while the water undertaking was in the hands of the original Company, Mr. (now Sir Robert) Rawlinson was consulted by the Public Works Committee of the Corporation on the whole subject. He prepared an elaborate report, in which, discussing the possible local sources, which he condemned as either unsatisfactory or insufficient, he dealt with those at a distance, and concluded with a strong recommendation that a supply be obtained from the rivers named. The report was before the Water Committee during their investigation a year ago. The reasons that guided them to their conclusion were these: (1) There were no local rivers, beyond those now used, which were available. (2) The development of the Bourne supply was unsatisfactory, as it would not suffice for more than 20 years, and would probably cost a sum approaching £1,000,000, which would be wasted if (as seemed inevitable) a supply from distant sources would sooner or later be necessary. (3) If the fouling of streams now utilized should require the abandonment of some of them (as had already been done in the case of the Tame), the new works might prove insufficient long before the expiration of the 20 years. (4) As to deep wells, while good water had been derived from them, experience had taught that this source of supply was most uncertain; and it was impossible to calculate what quantity of water could be expected from any new well. In the time of the Company, there was a great failure at the King's Vale well, which was expected to yield 6,000,000 gallons a day, and produced—and still continued to do so—only 300,000 gallons. It was this failure which led Mr. Gray to advise the Company to go to the Bourne and Blythe. The Selly Oak well was expected to produce 2,000,000 gallons a day; and the engines were constructed to pump this quantity. The result at first was only 800,000 gallons. This, by driving headings, was afterwards increased to 1,200,000, at which it now stood. In 1888-9, the Committee tried borings in a site which, from its geological position, appeared most eligible, on the confines of Edgbaston and Harborne; but, after losing a good deal of time and some money, they had to abandon it altogether, as no supply could be obtained to make it worth while to go on. The Longbridge well, though not fully tried, did not promise to yield so much as had been expected. (5) The new scheme seemed to meet the peculiar physical difficulties of their situation, arising from the elevation of the city above the level of the sea. (6) The water from the proposed sources promised to be all that could be desired as to quantity, quality, and freedom from the chance of pollution. (7) The financial part of the scheme seemed well within the resources of the Water Department.

On the following day, Sir T. Martineau was further examined by Mr. Balfour Browne, and cross-examined by Mr. Pember and other Counsel for the opponents. The Mayor of Birmingham (Mr. Lawley Parker) then gave evidence in corroboration of that of Sir T. Martineau; and the Committee adjourned. On Monday, the 4th inst., the engineering part of the scheme was opened—Mr. James Mansergh, M.Inst.C.E., being the first witness. He was under examination and cross examination all day. On the following day his cross-examination was concluded; and witnesses were called to give geological and chemical evidence in support of the Bill. Mr. Gray, the Water Engineer of the Corporation, followed; and subsequently Mr. Thos. Hawksley and Mr. G. H. Hill. The promoters' case was then brought to a close; the opposition of the Wye Fishery Board and the Commons Preservation Society having in the meantime been withdrawn as the result of an arrangement. These matters engaged the Committee's attention till the time for rising on Thursday, the 7th inst. The next day—the seventh of the inquiry—Mr. Pember and Mr. Lawrence opened the caess of the London County Council and the Hereford Corporation; and at the conclusion of their addresses, the Committee adjourned until the 2nd of May. The proceedings here briefly summarized will be reported in subsequent issues of the JOURNAL.

Bombay Gas Company, Limited.—In the report to be presented to the shareholders of this Company at their meeting on the 5th prox., the Directors state that the gas and meter rental for the twelve months ending Dec. 31 last shows an advance on the previous year of £2354. The returns for residual products and the profits on the sale of fittings have been less favourable. The loss on exchange amounted to £18,812, which has been charged to profit and loss. The profit was £17,925; and including the balance brought forward, £18,394. After deducting the interim dividend at the rate of 3½ per cent., the balance available is £9994, from which the Directors recommend a dividend of 4 per cent., tax free, making 7½ per cent. for the year, and leaving £394 to be carried forward. The Directors announce with regret the retirement of Mr. W. B. M. Lysley as a Director. They have appointed Mr. H. E. Jones, M.Inst.C.E., one of the Auditors of the Company, to fill the vacancy; and Mr. Jones is succeeded by Mr. Magnus Ohren, Assoc.M.Inst.C.E. Both of these gentlemen will retire at the meeting, and offer themselves for re-election.

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Tuesday, April 5.

(Before the MASTER OF THE ROLLS and Lords Justices FRY and LOPES.)
 The Attorney-General (on the Relation of the Local Boards of Chadderton, Royton, Crompton, and Failsworth) v. Mayor, &c., of Oldham.
 The Gratuitous Supply of Gas for Public Lighting.

This was an appeal from a decision of Mr. Justice Collins on Oct. 29 last year, in an action brought by the above-named Local Boards to compel the Corporation of Oldham to bring into their accounts, as part of the finances of the gas undertaking, the cost of lighting the public lamps in the borough, which are supplied gratuitously. The proceedings in the Lower Court were reported in the JOURNAL for Nov. 3, 1891 (p. 804); and they resulted in a judgment for the defendants. The plaintiffs appealed; but, as already stated, they failed to sustain their contentions. The following short report of the arguments and judgment is now given to complete our record of this important case.

The ATTORNEY-GENERAL (Sir R. E. Webster, Q.C., M.P.) and Mr. DANCKWERTS appeared for the appellants. Sir H. James, Q.C., M.P., was in attendance as representing the respondents; but he was not called upon, except occasionally, to indicate their case. They admitted that they had not since 1887 included the cost of supplying their streets and public buildings with gas; but they denied that this was in contravention of the Act.

The ATTORNEY-GENERAL said he appeared for the Local Boards acting as the Sanitary Authorities for the four outlying districts to Oldham of Chadderton, Royton, Crompton, and Failsworth, which receive their gas from the works of the Oldham Corporation. They were seeking, in substance, to restrain the Corporation from supplying the public lamps there without bringing into their accounts the value of the gas so consumed, and so giving the outlying districts the benefit of these receipts. The gas was originally supplied by the Oldham Gas and Water Company, whose undertaking had passed into the hands of the Corporation, which during the last four or five years had omitted to carry the cost of lighting their lamps—amounting to something like £6000 a year—into their accounts. They thus prevented the reduction in the price of gas, to which the relators contended they were entitled, under an Act of 1886, on the charge made to the outlying districts of £2 per lamp per annum; the Corporation not having the power to make a profit out of those districts, which were once charged 2d. per 1000 cubic feet more than the price paid in the borough—a provision which was repealed by a later Act, under which the Corporation were only entitled to accumulate a reserve fund of some £50,000 to pay off certain annuities created on the acquisition of the works; with a sum equal to 6 per cent. upon their outlay, following which the outlying districts would be entitled to a *pro rata* reduction in the charge to them for their gas supply. The present position was brought about in the following way: A Gas and Water Company for Oldham was incorporated in 1826 as a joint-stock undertaking; there being no limit to the price that could be charged for gas, and the principle of the sliding scale had never been enforced in the town. The undertaking was transferred to the Corporation of Oldham in 1853, the shareholders receiving £10,000 a year perpetual annuities, payable by the Corporation and chargeable on the borough funds, through a sinking fund, by an Act granted to the Corporation in that year. In 1855 the Corporation obtained a second Act; and by it the price of gas was, for the first time, limited to 5s. 6d. per 1000 cubic feet. In 1865 the Oldham Borough Improvement Act was passed. It repealed the Act of 1826, and the later Act of 1853, except in regard to the obligation relating to the annuities; and it reduced the price of gas to 4s. 6d. per 1000 cubic feet. The learned Counsel proceeded to critically and exhaustively pass in review the provisions of this measure, with the object of showing that the Corporation were empowered to light the streets and public buildings of the borough, to contract with outlying authorities for similar purposes, and also to supply gratuitously third persons who would otherwise have to pay for gas both within and beyond the borough, subject to certain restrictions as to the class of institution (hospitals and the like) to whom this should apply. But, he said, they were to keep accounts; and, as a matter of fact, they so kept them until 1887. In that year they reported that, prior to their further Act of 1886, their gas profits, ranging over a period of 20 years, averaged about £11,000 per annum; but since then the street lamps and municipal buildings had been supplied with gas free. He submitted that the Corporation could not, under their statutory powers, practically make the outlying districts contribute to this supply to the streets and public buildings of Oldham, which was what the relators complained of—the Corporation not having, since the first half of 1887, brought into account a single penny for the gas so consumed; the effect being to call upon the outlying districts to contribute to this cost. He submitted that, on the face of the Acts (from which he gave copious quotations and comments), it was intended that the gas undertaking of the Corporation should be conducted in identically the same way as a company would conduct it; otherwise the outlying districts would not get the protection to which they were entitled. The Corporation admitted in the Court below that if they burnt coke in the fire-places of the offices belonging to the Corporation they must bring it into account; and why should they not also include the value of the gas consumed for the public lighting? Under the existing system, the outlying districts were charged with £6000 a year for public lighting, as distinguished from private gas supplies; and the borough paid nothing. The learned Counsel continued his arguments at great length.

Mr. DANCKWERTS followed; and read the judgment of Mr. Justice Collins in the Lower Court, to the effect that the case turned upon the construction of the different Acts of Parliament under which the operations of the Corporation were conducted. The section most discussed was the 96th of the Act of 1865, which provided that the

Corporation might supply gas or water gratuitously for any purposes of public advantage within the limits of the Act, and might supply gas gratuitously for lighting, and water for domestic and sanitary purposes to any hospitals and infirmaries, public baths, and washhouses, maintained at the expense of the Corporation, or out of the rates for the relief of the poor. His Lordship came to the conclusion that, as long as the outside districts were charged no more than the statutory price for gas, they had no *locus standi* to inquire whether the Corporation gave away their gas or charged other people more or less than they charged them. He consequently gave judgment in favour of the Corporation.

At the conclusion of the arguments,

The MASTER of the ROLLS said he was of opinion that the appeal should be dismissed. It must be clear to everybody that down to 1886 the outlying districts had no right to look into the Corporation accounts. All they had to do was to pay what they had contracted for within certain defined limits. But in 1886 they obtained a right to see what were the "profits" made by the Corporation on their gas undertaking; the charge to them for gas, being reducible *pro rata* on the following provision in the Act: "The Corporation shall not, after the year 1887, make out of their gas undertaking a greater profit than the annual amount for the time being payable"—first, by way of annuities created for the purchase of the undertaking, next for something else, together with a sum of 6 per cent. per annum upon yet another thing; it being added that the expression "profit" was to mean the profit made by the Corporation out of their gas undertaking after paying all the expenses of the manufacture and distribution of gas and all rents. Proceeding to review sections 96 and 97, which had been frequently quoted in the arguments, his Lordship said it was obvious that in neither case did the Corporation make a "profit;" for lighting the streets or supplying public buildings might be a benefit, as had been told them often enough, but it could not be called a profit which could be carried into an account. This appeared to be the principle on which Mr. Justice Collins had based his judgment, which he thought should be upheld, and the appeal dismissed.

Lords Justices FRY and LOPES concurred.

The appeal was therefore dismissed, with costs.

STAFFORDSHIRE QUARTER SESSIONS.—Wednesday, April 20.

(Before Mr. T. F. TWEMLOW, Chairman, and a Bench of Magistrates.)

The Assessment of the Birmingham Corporation Gas-Mains.

A special adjourned sitting of the Court was held to-day to hear an appeal brought by the Gas Committee of the Birmingham Corporation against the assessment by the Assessment Committee of the King's Norton Union of gas-mains in the parish of Harborne.

Mr. DANCKWERTS and Mr. KETTLE appeared for the appellants; Mr. YOUNG, Mr. PRITCHETT, and Mr. SHAKESPEARE for the respondents.

Mr. DANCKWERTS, in opening the case, said the assessment appealed against was £480 gross and £400 net; and the Corporation held that the proper assessment was about £200. The appeal involved the rateability of the Corporation in respect of such part of their gas-mains as were in the parish of Harborne, in the union of King's Norton; but although only one parish was involved in the present case, in substance it had an indirect bearing on the rateability of the Corporation in other parishes and in other counties. Hence the importance of the appeal. If it were merely a question of Harborne, it would perhaps not be worth fighting. But it involved ulterior matters; and the Corporation were compelled to come before the Court and seriously contend as to what was their real rateability. There were no works in the parish, nor any indirectly productive mains; they were solely non-productive mains as to which the appeal was taken. The rateable value of the indirectly productive works was £39,644; and this, at a rate thereon of 6s. in the pound, realized £11,927. This would give them a total value of the works and dead mains of the Corporation, *plus* rates, of £51,571. The former rating of the Corporation in the parish of Harborne was £272 net; and that was fixed in 1885 between the Secretary of the Gas Committee and Mr. Matthews, who then acted for the parish, there being an agreement that the figures should continue for five years. The above amount was arrived at upon the average of the rates, calculated on the actual working of the concern in the years 1883 and 1884. On Feb. 25, 1891, the Corporation received notice under the Union Assessment Committee Amendment Act of 1864 that a supplementary valuation list had been deposited; and in this the Corporation were rated in the parish of Harborne at £400 net and £480 gross. They immediately made inquiries, and found that the Assessment Committee sat on June 17 to hear appeals; and the Corporation appeal was heard, but all relief was refused. The rate against which they were appealing was made on April 10, 1891; and this was an important date to be borne in mind. Owing to the passing of the Local Government Act and the arrangements in connection therewith, the Corporation changed their financial year from the calendar year to March 31. This took place in 1891. They proposed to work out their assessment upon the accounts for the calendar year 1890; and they also intended to ask the Bench to look at the accounts as worked out for the year ended March 31, 1891, which was the complete year immediately before the rating. They asked the Bench to fix something between the two as being fair. The greater part of the profit for 1890 was made in the first quarter of that year; and in the remaining three quarters of the year, the profits fell very much, and continued to fall for the first quarter of 1891. The fall was still going on; the reason being connected with the price of labour, coal, and residuals. The gross profits on 1890 were very much larger—some thousands—than the profits in the year ended March 31, 1891; and if the latter year were taken for the assessment, it made a considerable difference in the amount they would have to pay for Harborne.

Mr. YOUNG remarked that he thought the proper year to be taken was 1890—from Jan. 1 to Dec. 31.

Mr. DANCKWERTS said he did not know whether it made any difference; but he believed the accounts for the year ended March 31, 1891, were not published by the Corporation until May, or a month or

so after the rate was made. In 1875 the works belonged to two Gas Companies; but they were acquired by the Corporation. The price of gas then was very much more than now. There had been four reductions since the acquisition, and one increase in 1887—the rate being the same now as in 1887. The Corporation supplied gas not only to the city, but to various outlying districts; one of these being Harborne. In the Act of Parliament, they were expressly prevented from charging consumers outside the city more than consumers inside. There was also power given to the outlying districts, for the first time taken into the area of supply, to cut themselves off on certain terms. One very practical question in connection with the outlying districts was that one-fourth of the whole supply was taken by districts outside the city; and the Corporation had, with a view to future contingencies, been obliged to invest capital in extending their works beyond the city to a very great extent. It was of the utmost importance that the price of gas should not be driven up with a view to benefiting the Corporation fund; and thereby inducing the outlying districts to themselves take steps to have their own supply, and so diminish the value of the Corporation works. There were several competing factors to be taken into consideration, such as electricity and oil; and the latter was a most powerful competitor. Consequently, the Corporation dared not raise their prices unduly. Again, they had to stimulate consumption by opening up a future for gas in the way of heating and cooking, and for manufacturing purposes; and this could only be done as long as the price was low. Directly the charge went up above a certain ratio, the manufacturer could not use it; so that, by increasing the rates, they would be “cutting off their nose to spite their face.” The artisan classes, too, could only get the gas if it were cheap. If it were not, they would burn oil; and this had to be taken into account in fixing the price. The learned Counsel pointed out that there was a differential charge according to the amount consumed, and went on to say that they had taken the total receipts for gas, residuals, &c., and had deducted from this the total expenditure, with the exception of rates, and they then arrived at what might be called the net receipts, which for the calendar year 1890 were £134,364. For the year ended March 31, 1891, the same figures were £130,164, or a reduction of £4,200. He proceeded to deal with the deductions, and said that, in calculating what should be the tenant's capital, they had taken the usual universal 17½ per cent., which would amount to something more than £60,000. Then they took the landlord's share; and they worked it out that that, including sinking fund and repairs, &c. (which had to be borne by the landlord), amounted to £117,000. This would be the gross rateable value of the whole, *plus* rates. The net rateable value, *plus* rates, was £79,330. Deducting from this the £51,571—the amount of the indirectly dead mains—it made the rateable value of the directly-productive *plus* rates £27,775. The total receipts from gas were £435,149 for 1890; and the same figure for Harborne alone was £4385. The rates of Harborne were 5s. 3d. in the pound; and the net rateable value of the mains there in the calendar year of 1890 was £221. The same figure upon the accounts for the year ended March 31, 1891, worked out at £178. He asked the Bench to fix something between £221 and £178; and the Corporation would be satisfied. In strictness, he thought he should be entitled to say they should take the accounts for the year ended April 10, 1891; and that would bring them to £178. But they were willing, in order to secure a fair assessment, to take a figure between the two. They could not advance the price of gas, unless they could justify it by the increased price of material and labour. If the gas charges were unduly put up, the burden fell on the consumers; and the part of Harborne which consumed gas was represented by him in fighting that appeal.

Mr. H. E. Jones, Engineer of the Commercial Gas Company, said the accounts of the Birmingham Gas Committee had been put before him; and he had carefully inspected the works, tools, &c. The gross profit was 5½ per cent. on the year they had taken into account. Witness was examined at length as to the rating of the works, and the various deductions that should be allowed. He said the assessable receipts of the undertaking for the year ended Dec. 31, 1890, amounted to £567,000. The ordinary expenditure was £323,000; leaving £244,000. Repairs, insurance, and sinking fund amounted to £100,000. Therefore the gross value of the undertaking was £143,000, of which £64,000 would be appropriated to tenants' income, and £79,000 would be the rateable value of the concern. After deducting the rateable value of the works and the rates thereon, amounting to £51,000, they had £30,000, as the rateable value of the mains in all the unions. This latter sum had to be divided among the different parishes according to the rates in each parish, as compared with the receipts in that area for the whole undertaking. The figures for the year ended March 31 were: Assessable receipts, £578,000; ordinary expenditure, £341,000—leaving a balance of £237,000; gross value, £174,000. Repairs, renewals, sinking fund, &c., £100,000, of which interest and tenant's capital would amount to £64,000, leaving the whole rateable value at £73,000. The same amount, as in the year before, would be appropriated to the works, leaving £22,000 as the rateable value of the mains, to be apportioned as before. He had sought throughout not to bring out the lowest possible figures, but to arrive at fairness. Supposing he had a tenant willing to take the works at a fair rent, he should fix the figures as he had done. They could not get tenants for such large undertakings; no one short of a Rothschild could work them. He had not put a penny into the tenant's capital beyond what the Corporation had to employ being their own tenant.

The CHAIRMAN said his own impression was that the assessment must be founded on the year ended December, 1890.

In cross-examination by Mr. YOUNG, witness said he had been personally engaged for four or five months in preparing the mass of figures he had produced. He assisted his father against the Corporation when the gas-works were acquired. He was engaged on behalf of West Bromwich in the arbitration. The rateable value of the dead mains of the whole concern was £22,981; and, adding the rateable value of the live mains (£39,644), they had a total rateable value of £62,625 for the year 1890. The Corporation paid in annuities in 1890 £34,306; the interest of Birmingham Corporation stock amounted to £19,699; and the interest on mortgages and bonds, &c., £6417—making a total of £80,423.

Mr. YOUNG: Deducting the net rateable value, £62,625, it appears that the Corporation were short of £17,798 between their net annual value and the three items which they have to pay?

Witness: No, I do not see the connection. Witness further said the gross profit of 5½ per cent. was on the £2,326,261, the total expenditure; and it included the goodwill paid for the concern.

Thursday, April 21.

On the resumption of the proceedings this morning,

Mr. Jones was further cross-examined. He said he was not aware that the average annual gross profits of the gas undertaking from 1876 to March, 1891, had been £140,068. A sum of £95,610 per annum had been allotted for the discharge of annuities and so on. The average annual balance of profit carried to the improvement rate and the borough fund was £45,458.

Mr. YOUNG: This is a concern, as far as I understand the contention, that is not to make any profit?

Mr. DANCKWERTS: You must not take the last figure; it is not correct. I did not say we were not to make any profit. I said we were not to deal with the undertaking as a commercial concern, which was making as big a profit as possible.

Mr. YOUNG (to witness): Do you know the Corporation have built an Art Gallery out of the profits.

Witness: I dare say.

And paid £25,000 to the improvement scheme?—I do not know.

Has £21,679 per annum been written off capital?—I do not know.

You have had a good many months' experience in making up these accounts; do you know the Corporation have, out of revenue, been extending their works and erecting new plant and gasholders and tanks?—I am not aware that they have done so.

You have got no shrewd suspicion of it?—No; I know they have expended £90,000 a year in renewals and repairs. I know nothing about the undertaking prior to three years ago.

The CHAIRMAN: Perhaps he does not choose to know.

Mr. YOUNG: In 1881, the amount charged to revenue under the head of new buildings, gasholders, &c., partly in substitution for old ones, was £22,691.

Mr. DANCKWERTS: What have we to do with 1881?

Mr. YOUNG: We have to find out the true state of the concern in 1890 for making the basis for the rate.

Witness: I am a Justice of the Peace, and am aware of the importance of what I say. I am a professional man of some standing; and I have sworn to suppress nothing, and to confine myself to the truth. I would rather be relieved of this case, if anyone thinks otherwise.

Mr. DANCKWERTS: I am sure the Chairman did not mean what he seemed to say.

The CHAIRMAN: Oh; we have said nothing.

Cross-examination continued: The net rateable value of the mains was £22,981. In 1890, the receipts for gas in Harborne were £4385; and in 1889, £4035.

Mr. YOUNG: If there has been anything like a progressive increase in Harborne, the receipts from gas from 1885 to 1890 would increase; and that would strike you as a *prima facie* reason why the assessment of years ago was too little now?

Witness: Not unless the undertaking was working at that time at more profit.

Prima facie it would strike anybody that the rateable value in 1890 under these circumstances must be greater than in 1885?—No. In 1890 we have got into a fresh period. We have now labour and coal questions, which we had not to contend with before.

But you have raised the price of gas?—I suppose they have.

Witness further stated that he had not included £2105 for fittings under the head of receipts.

Mr. YOUNG said he contended that this ought to be included.

By a MAGISTRATE: Any tradesman could do the fitting work besides the Corporation. He took the £2105 for fittings to be profit on trade which the Corporation carried on; but consumers were not obliged to employ the Corporation to do the work. The £2105 was a trade profit, which they must not assess.

Mr. YOUNG: What about the meters?

Witness: They are different; they are essential to the supply of gas.

Mr. YOUNG: Your receipts amount to £565,843, less bad debts; and our receipts amount to £567,948—the difference between the two being the one figure for fittings.

Witness was taken at length through his valuation of the stoves, &c., at the various works, which he said did not vary appreciably from year to year. He was not aware that the Town Clerk had been asked for particulars of book debts, and had refused to give them. The sale of gas for the year ended Dec. 31, 1890, was 3,751,000,000 cubic feet; and for the year ended March 31, 1891, 3,810,418,000 feet—an increase of 59,000,000 feet.

Friday, April 22.

Mr. Jones was this morning re-examined by Mr. DANCKWERTS, upon the figures which had been put in in support of the appellants' case. He said that lowering the price of gas would be likely to increase the consumption, especially now when gas was being so much used for fuel, and to increase the price would check the demand.

Mr. G. S. Mathews said he had had considerable experience as a valuer. In 1885 he agreed on the value of the plant of the appellants at Harborne at £272 on behalf of the present respondents. He had prepared an assessment of the mains at Harborne for the year ended Dec. 31, 1890; and it worked out at £239 net rateable value. The valuation for the year ended March 31, 1891, came out at £170. He took the entire receipts for gas, less discounts, &c., at £566,725. In the expenditure, he had omitted those items which did not concern the manufacture—such as the cost of maintaining the recreation ground, and expenses on loans and annuities. He had also omitted the rates, which had to be ultimately deducted, and the repairs, which he dealt with separately; and he found the total expenses came to £323,293. He had deducted from the expenses balance of discounts on purchases, part of which was for fittings; bringing the net sum down to £244,101. From the net receipts, he deducted the tenants'

interest, 17½ per cent. on a capital of £344,786, which was £60,337; and deducting this latter item from the £244,101, he had left £183,764. With regard to repairs, he had taken what he estimated to be the average annual repairs and depreciation which had appeared in the balance-sheet for the last ten years. He found that from 1880 the average amount for repairs, renewals, and depreciation was 6·36d. per 1000 cubic feet of gas sold; and this amounted to £99,422. Previously he had always allowed 7d. per 1000 cubic feet sold; and he did this because it was a fact that in 1880 the sum spent on repairs and renewals by all the London Gas Companies amounted to about 7½d.—7d. had been the recognized figure for surveyors to take. Then he had deducted the insurance, which amounted to £3000; but he found that £94 had been paid by the Corporation for insurance of some small part of the undertaking, and deducting this he arrived at £2906. Roundly, the rateable value of the whole undertaking was £81,436. In addition, the value of the unproductive works had been agreed at as £39,644. The rates were £11,927; making the unproductive works £51,571. He deducted that from the rateable value of the whole undertaking; and this left the rateable value of the mains at £29,865. The corresponding figure for the year ended March 31, 1891, was £20,996. He then had to find the rateable value of Harborne. The gross receipts for the whole undertaking were £435,149; and the gross receipts in Harborne £4385, which gave him a proportionate rateable value of mains for Harborne of £301. Deducting rates at 5s. 3d., brought the rateable value down to £239. For the year ended March 31, 1891, the rateable value was only £170.

Cross-examined by Mr. PRITCHETT, witness said the fair valuation arrived at in 1885 was not based on any one year. The receipts for Harborne in 1884—the account year on which he based his decision—were £3438; and they had since increased to £4300. His valuation on the 1884 accounts was £220.

Mr. PRITCHETT: How did you get up to £239?

Witness: I decline to be bound by the figures that were put before me, because I saw that the general accounts in the previous year showed a very much higher profit; and I would not accept that. I was making an arrangement that was to last for five years; and I fixed £239. The gross profit on the undertaking in 1884 was exceptionally low, and only amounted to £125,000. In 1890 the gross profit was £136,000; and in 1883, £152,000. I cannot say whether a hypothetical tenant working the concern would be likely to make a larger profit than the Birmingham Corporation.

What would be a fair percentage in the way of rent from a tenant who does his own repairs?—I think the landlord ought to get (say) 4 per cent.

Do you agree that the value of the landlord's part of the undertaking has not depreciated since it was taken over by the Corporation. Supposing the Corporation sold again, would they get a less amount than they gave?—I cannot say that. The value of the works is about a million and a half; and the proper interest for the value of the works is about 5 per cent.

My calculation is that your valuation carried out on a capital of £1,800,000, works out at 3·44 per cent. Is that sufficient for the landlord's capital invested in the concern?—I should think it was scarcely enough.

I am trying to show the *prima facie* unreasonableness of your valuation, which only gives the landlord 3·44 per cent. on his outlay?—I should think he ought to get a little more than that.

The CHAIRMAN said that whether right or wrong, the accounts presented by Mr. Mathews were understandable; and he thought they might close the case for the Corporation that day, and when they met again they could go on with the respondents' case.

Mr. DANCKWERTS: After what has fallen from the Bench, I do not think I will call another witness.

The CHAIRMAN: I understand Mr. Mathews's figures, whether correct or not; and we can digest them at leisure.

Witness was then re-examined by Mr. DANCKWERTS, and said that gas affairs had not improved since 1885. The profits had fallen, notwithstanding a very largely-increased make and sale of gas, due to the fall in the price of residuals, and an increased price of coal and labour. He did not think the Corporation did badly when they obtained 3·44 per cent. as rent on outlay and capital.

Mr. YOUNG then addressed the Court for the respondents; saying that he agreed with Lord Esher that these rating cases were made to puzzle mankind. If Lord Esher had been here when they commenced the case, and had had handed to him the valuation with the various schedules of Mr. Jones, he could hardly venture to predict what additional observations of force he might have made with respect to rating cases. In 1885, Mr. Mathews, acting on behalf of the rating authority, and Mr. Edwin Smith, the Secretary of the Corporation Gas Committee, put their heads together for the purpose of arriving at the rateable value of that part of the undertaking situated at Harborne at a figure to inure for five years. The assessment was fixed at £272, and at that time the receipts were only £3438; whereas in 1889 they were £4035, and they had further increased to £4385 in 1890. There ought, therefore, to be an increase in the rateable value of the Committee's undertaking in Harborne. The profits of the whole concern in 1890 were £136,000, or £900 more than in 1885. There was no doubt that in 1890 the price of coal went up very much; but if coal had remained at its normal price, the £136,000 profit would have been much larger than it was. He was aware it was said that labour and material had risen in value. But the price of coal was inordinately high throughout 1890; and this would account, to a great extent, for no higher profit being made. Bearing this in mind, it was a remarkable thing to find that the receipts had gone up by more than £900, between 1885 and 1890. The rateable value, according to Mr. Jones, on the 1890 accounts, was only £221; so that, instead of the rateable value progressing hand-in-hand with the increase in the receipts from the parish, the appellants made it out that, although they had gone up, they yet resulted in a diminution of the rateable value. He did not think any possible dealing with the accounts could ever establish the proposition that the rateable value ought to be less at the present time than in 1885.

The Court adjourned before the completion of Mr. Young's address, and will not meet again until May 17.

MISCELLANEOUS NEWS.

GAS SUPPLY IN THE COLONIES.

In the JOURNAL for the 29th ult. (p. 588), we gave some particulars as to the working of certain Colonial gas undertakings, extracted from reports and balance-sheets which had lately come to hand. We have since received a report of the annual general meeting of the Christchurch (N.Z.) Gas Company, on which occasion the Directors stated that the business of the Company continued fairly satisfactory. The balance-sheet showed the revenue for the past year to have been £29,918, as against £27,916 in the preceding twelve months. The balance to the credit of the profit and loss account, with the amount brought forward, stood at £10,852. Last July an interim dividend of 5 per cent. was declared, which absorbed £5000; and the Directors recommended the payment of a further dividend of 5 per cent.—making 10 per cent. for the year, and leaving £852 to be carried forward. The Company have 61 miles of mains; and the number of public lamps is 561. As to the quality of the gas supplied, the average was 18 candles. During the year additional coal storage accommodation was provided, which now enables the Company to keep a stock of raw material sufficient for several months' use. The retort-house has been extended; and the number of retorts is being increased for future requirements. The Company have a show-room for gas appliances; and they have found it to be a very successful means of bringing before the public the advantages of gas for culinary, heating, and industrial purposes. The Chairman of the Company (Mr. E. G. Wright), in the course of his remarks when moving the adoption of the report, stated that the business of the Company had increased to the extent of about 7 per cent. as compared with the year 1890. This being the case, the amount to the credit of the profit and loss account might not be so great as some had anticipated; but there were two or three causes which had militated against a larger profit being earned. In the first place, there was a considerable accumulation of inferior coal, the outcome of the strike in 1890, when, as the Grey Valley Company's mine was closed, coal had to be obtained wherever possible. In the next place, there had been an exceptionally heavy expenditure in repairing the plant, all of which the Directors had very properly decided to charge to current account. The third item was an increase in the wages paid to the stokers, the outcome of the eight-hour system adopted in 1890. Notwithstanding these sources of expenditure, the prospects of the Company were very satisfactory. The report was adopted, and the dividend recommended declared. A vote of thanks was accorded to the Secretary (Mr. C. W. Bishop), the Manager (Mr. D. B. Mackenzie), and their various assistants; and a similar compliment to the Chairman and Directors brought the proceedings to a close.

The other Colonial Gas Company whose progress calls for brief notice is the Latrobe, of which Mr. T. S. Cleminshaw, C.E., is the Consulting Engineer, and Mr. H. S. Wark the Manager. This is a small concern; the receipts for gas amounting last year to only £1043, and the total income to £1286. After paying expenses, there was left a sum of £434 to go to the profit and loss account; making, with the balance of £256 standing over, a total of £690. But as dividend and interest to the amount of £425 had been paid during the year, there was a balance of £265 only to be dealt with at its close. Out of this the Directors recommended the payment of a dividend for the second half of the year at the rate of 7 per cent. per annum; amounting with the tax to £191, and leaving £74 in hand. The quantity of coal carbonized in the twelve months was only 179 tons; the production of gas being 1,593,000 cubic feet, or 8900 cubic feet per ton. The Company have reduced the net price of gas to 13s. 4d. per 1000 cubic feet, as from Jan. 1 last.

BOSTON (U.S.A.) GAS SUPPLY.

An Official Inquiry into the Boston Gas Company's Affairs.

In the JOURNAL for the 8th ult. (p. 448), we gave, on the authority of a local correspondent, some "Facts about the Boston Gas Companies." We learn, from communications since received, that an inquiry has lately been going on by the Board of Gas and Electric Light Commissioners into the affairs of the Boston Gas Company. They were set in motion by an order from the Massachusetts State Legislature, dated the 26th of February last, to report, within 30 days, on the following points: "(1) Whether or not the Boston Gas Company has within the past six months made any advances in its charges for gas. (2) At what price the Boston Gas Company can manufacture gas delivered in its holders and at the meters of its consumers and pay dividends of 8 per cent. on its capital stock, and provide for all needed renewals and extensions of its plant. (3) To what extent the Boston Gas Company is hiring the use of pipes from another corporation at an excessive rental, and to what extent the Company is paying another corporation \$1 per 1000 cubic feet for gas, which it could manufacture for a less sum per 1000 feet. (4) As to whether the Bay State Gas Company diverts the surplus earnings of the Boston Gas Company into the treasury of a foreign corporation known as the Bay State Gas Company of Delaware." These matters were duly investigated by the Commissioners, who were empowered to order the production of books and papers, and to compel the attendance of witnesses; and, on the 25th ult., they presented a report, of which the following are the principal portions.

The Commissioners found that on Nov. 11, 1887, the Directors of the Boston Gaslight Company authorized three-year contracts at \$1 per 1000 cubic feet with all consumers whose bills had theretofore exceeded \$2000 per annum. Under this authority, contracts at that rate were made with 42 consumers—mostly managers of theatres, hotels, railroads, newspapers, and large retail stores—by which, in consideration of this concession, they bound themselves to purchase gas of the Company exclusively for the period named. All these contracts expired on or about Jan. 1, 1891; but the Company continued to

supply these parties with gas at \$1 per 1000 cubic feet until the 1st of January, 1892, at which time the price was advanced to \$1.30. These consumers, in the year 1891, paid for 124,394,300 cubic feet of gas \$124,394.30. With the rate of \$1.30, and the same consumption, the bills would amount to \$161,712.59—an increase of \$37,318.29. On Nov. 28, 1887, the Directors decided that, from and after Jan. 1, 1888, a reduction of 10c. per 1000 cubic feet should be allowed to consumers whose bills were between \$1000 and \$2000 per annum. On April 10, 1889, it was voted "that the rebate of 10c. per 1000 feet allowed to large consumers be continued for the present." No other action has been taken with reference to this rebate. The last payments under these votes were made on March 24, 1891, for the consumption of 1890, at which time 54 consumers received rebates amounting to \$7569.42.

Referring to the first part of the third question, the Commissioners reported that the Bay State Gas Company of Massachusetts have laid, at their works and in the streets of the city, 15 miles 3070 feet of mains, varying in diameter from 30-inch down to 4-inch. In the opinion of the Board, a fair estimate for the cost of these pipes is about \$208,500. On or about July 1, 1889, the Boston Gas Company began to use 24-inch and 12-inch pipes for the purpose of sending gas into the city. Late in October of the same year, they began to use 30-inch pipe from their works to Shawmut Avenue. Only a small portion of the 4-inch, 6-inch, and 10-inch pipes have been used by the Boston Company; and for this they paid to the Bay State Company \$100,000 on Dec. 20, 1889, for the year 1889, and \$100,000 on Oct. 31, 1890, for the year 1890—making a total of \$200,000. Some question has arisen in reference to this last item; and there is some confusion in regard to it in the books of the Boston Company. The cash-book of the Company shows that on Oct. 1, 1890, a sum of \$100,000 was paid to the Bay State Company for the use of mains; and this amount was immediately charged to profit and loss. On June 30, 1891, the entire amount was taken out of profit and loss, and charged to a new account—"Rent of mains"—opened for the purpose, on the ground that the rental was for two years, and that the previous charge of this sum to profit and loss was an error. In the return to the Board, under date of June 30, 1891, the full sum of \$100,000 was included in the assets of the Boston Company, as though the payment had been made for a use to be enjoyed at some period wholly subsequent to that date; but it was not shown as a liability in the return of the Bay State Company. This sum also appears, in the same way, in the balance-sheet of the Boston Company of Dec. 31, 1891; but not in that of the Bay State Company of that date. The entries of this transaction in the accounts of the latter give no indication of the period for which the money was received; but the receipt for the \$100,000 filed with the vouchers of the Boston Company, and the records of the meetings of the Directors of both corporations, state clearly that this sum was in payment for the use of mains in 1890.

In relation to the purchases of gas referred to in the last part of the third question, the Commissioners reported: The Boston Gaslight Company have purchased from the Bay State Gas Company of Massachusetts, at \$1 per 1000 cubic feet, as follows:—

	Cubic Feet.	Value.
Jan. 1 to June 30, 1890 . . .	84,285,000 ..	\$84,285
July 1 to Dec. 31, 1890 . . .	306,446,000 ..	306,446
Total for the year, 1890. . .	390,731,000 ..	\$390,731
Jan. 1 to June 30, 1891 . . .	319,038,000 ..	\$319,038
July 1 to Dec. 31, 1891 . . .	470,326,000 ..	470,326
Total for the year, 1891. . .	789,364,000 ..	\$789,364
The accounts show a rebate for gas bought during the last six months of . . .		70,000
Making the cost for that period 85.7c. per 1000 cub. feet, and the net expenditure for the year . . .		\$719,364
Year 1892.	Cubic Feet.	Value.
Month of January . . .	91,821,000 ..	\$91,821
Month of February. . .	76,708,000 ..	76,708
Total for two months . . .	168,529,000 ..	\$168,529
This expenditure exceeds that of the first two months of last year by. . .		37,181

These prices were for the gas delivered in the mains of the Bay State Company leading to the works of the Boston Company, in whose holders it was stored. If this gas had been made at the Boston Company's works, its cost should not have exceeded 55c. per 1000 feet.

In replying to the fourth question, the Commissioners say: A strict construction of the term "surplus earnings" would probably include only that sum which remained after all the expenditure had been met, including interest and dividend charges. Upon this meaning of the term, it appears that all such earnings have remained in the possession of the Boston Gaslight Company, invested in its works or employed in the ordinary conduct of its business. The Board has assumed that the inquiry was designed to have a broader scope, and to include all those funds of the Company which may have passed from it to the Bay State Company of Delaware through the Bay State Company of Massachusetts, but to exclude any sums which may have passed otherwise, directly or indirectly, to the Delaware Company. As the income of the Bay State Company of Massachusetts has been derived almost exclusively from its transactions with the Boston Company, it is fair to say that practically its entire profits are from the earnings of the latter Company. The Board has therefore endeavoured to answer the inquiry by ascertaining what portion of these profits has been paid to the Bay State Company of Delaware. Some time in the year 1885, the Bay State Company of Massachusetts, by authority of the Directors, executed and delivered in part payment for the works or plant to be thereafter constructed, a bond or written obligation dated March 11 of that year, for \$4,500,000. By the terms of this obligation, interest must be paid on this sum as often as once in six months from its date, at a rate equal to nine-tenths of the net profits of the business of the Bay State Company. For this reason the Directors have found it necessary, when declaring a dividend upon the \$500,000 of stock, to declare interest at the same rate on the \$4,500,000 bond. The Bay

State Company of Delaware is not a holder of stock in the Bay State Company of Massachusetts; but by assignment dated Aug. 13, 1889, it became the sole owner of the bond, and all payments of interest have been made directly to the former corporation. Interest has been declared on this bond to the amount of \$315,000 for the year 1890, \$360,000 for the year 1891, and \$112,500 for the portion of 1892 up to March 14; making a total of \$787,500. Cash payments on account of this interest have been made to the amount of \$780,310.50; leaving a balance unpaid of \$7,189.50. So far as the Board is aware, no other earnings of the Boston Company have passed through the Bay State Company of Massachusetts to the Bay State Company of Delaware.

Proceeding next to deal with the question of price (the second subject in the order), the Commissioners point out that it is one of much difficulty, demanding for its full and fair consideration a large amount of careful investigation. The price at which gas can be supplied, whether in the holder or at the meter, is not, they remark, a fixed and obvious one, in every place the same; but many items of expense are so affected by local conditions and the volume of the business, that it is impossible to exactly determine at what price a company can make and supply gas, without an intelligent and exhaustive examination of all its affairs. With regard to the company specially concerned, they say: The Boston Gaslight Company disburses annually nearly \$2,000,000 in many thousand transactions; and from computations based on the statements in the sworn returns made to this Board by the Boston Company, for the year ending June 30, 1891, it appears that it cost for coal, 36.27c. per 1000 cubic feet. Reducing this by the amount received from residual products, 13.09c., leaves 23.18c. per 1000 cubic feet for the cost of coal. The amount of the other items making up the cost in the holder—including enrichers, purification, wages at works and repairs, was 36.8c.; giving a total of almost 60c. for the cost of gas in the holder. For the cost from the holder to the consumer's meter, including wages, main and meter repairs, Directors' allowances, salaries, office expenses, taxes, claims, law expenses, and incidentals, the amount was 21c.; making 81c. To this sum should be added about 5 per cent. of the cost in the holder for gas which is used in carrying on the business, and that which is invariably lost in the process of distribution (commonly known as leakage, or unaccounted-for gas); making a total of 84c. In the opinion of the Board, this amount is too large; and may readily be reduced without embarrassment to the Company. In the spring or early summer of 1890, the Boston Company abandoned its former custom of buying coal directly from coal companies, or their regular agents, and has since then (with the exception of something like 1000 tons bought of the Dorchester Gas Company) purchased exclusively of the Bay State Gas Company of Delaware, at what seems to be a uniform advance over the market price, and adding, for the year to June 30, 1891, about \$33,700 to the cost, or about 4c. per 1000 cubic feet to the cost in the holder. A different treatment of the residual products would probably increase the revenue from this source, and correspondingly reduce the cost of the gas. During the year mentioned, all the tar sold from the North End station was marketed by the Bay State Company of Massachusetts, at a profit to that Company of about \$8000, or 1c. per 1000 cubic feet. An important item in the 36.8c. mentioned above is that of enrichers or oil. The experience of other companies would indicate that a reduction of 2c. per 1000 cubic feet might be made in this item. No special investigation has been made of the other items looking to a reduction. Deducting from the 84c. mentioned as the cost at the consumer's meter, the 7c. just referred to, leaves 77c.; and taking the same amount (7c.) from the 60c., leaves 53c. as a fair estimate of the cost in the holder. The proper amount needed to provide for renewals and extensions is perhaps the most difficult of all to accurately determine, and the one concerning which opinions would differ most widely. Very much depends upon the present condition of the plant for generating and distributing, the change of population and output, and all the engineering details of the business.

The Commissioners, dealing further with this part of the subject, close their report as follows: Very valuable suggestions may be gathered from the recent history of the Company. During the fifteen years beginning with 1877, the charges against income, for extensions and improvements, have somewhat exceeded \$3,300,000, or an average annual charge of about \$225,000—a little less than 16c. per 1000 cubic feet on the present output of the Company. But the period named was one of extraordinary development; it witnessed the construction of the entire works at Commercial Point, with large expenditure for new mains, and a payment for a part of the land at the Point. No such extraordinary expense seems likely to be called for in the next ten years. If the annual output should be doubled, no additional land purchase would be necessary. Fair provision could be made for extensions and renewals with one-half the sum named above, or 8c. per 1000 cubic feet. The capital of the Company (\$2,500,000) equals \$1.77 per 1000 cubic feet of output; and 8 per cent. on this may be stated at 15c. per 1000 cubic feet. Adding these amounts to the 77c. estimated to cover other items, we have \$1 as a fair price at which gas may be delivered at the consumer's meter upon the conditions described. The detailed figures given are based upon an annual output of about 1414 million cubic feet. If, for any reason, the Boston Company should find it necessary to decline to supply the Roxbury and Dorchester Companies, the cost of distribution would be increased about 6c. because of the reduction in the output. Neither the fact of the purchase of gas from the Bay State Company of Massachusetts nor the price paid to that Company has been considered in these estimates. If the Boston Company were to continue to supply the Roxbury and Dorchester Companies without purchasing from the Bay State Company, it would be necessary to very soon increase the capacity of the Commercial Point station at considerable expense. If a water-gas plant were built (for which the Company now owns the rights), the cost of the mixed gas might be somewhat less than the above estimates.

Electric Lighting for Oldham.—The Oldham Town Council have adopted a scheme, proposed by Professor Kennedy, for the supply of electricity in the borough for lighting purposes.

THE NORTH BIERLEY GAS COMPANY AND THEIR STOKERS.

A case which came before the West Riding Bench at Bradford last Thursday week seems to indicate that the North Bierley Gas Company have recently been having some trouble with their stokers. The action was brought by a stoker named Johnson, who sued the Company under the Employers' and Workmen's Act, for one week's wages in lieu of a week's notice, to which he contended he was entitled. The amount claimed was £1 16s. 9d.; being at the rate of 5s. 3d. per day. From the evidence adduced for the plaintiff, it appeared that he was dismissed on the 10th of February last without any notice being given to him, for alleged misconduct on his part in not doing a full share of work in producing gas, he being employed with others on the night turn. The specific charge alleged against him was that he had only filled into the retort 18 shovelfuls of coal instead of from 28 to 30, which, it was contended, was the proper quantity. Mr. Ward, for the plaintiff, argued that the standard laid down by the Company was impossible; it was more a matter of judgment with the stoker when a retort was properly charged. No complaint had been made to the plaintiff as to any default in his work until he was sent about his business; and not a day's notice was given him, although, under his engagement, he was entitled to seven days' notice, and he now claimed for that term. Witnesses, including several of the plaintiff's fellow-workmen, were called to prove that the work had been properly done. Mr. Theobald, the Branch Secretary of the Gas Workers' Union, also gave evidence, and stated that when he went to see Mr. W. Oldfield, the Company's Manager, as to the cause of the plaintiff's dismissal, he told him that Johnson was one of the best workmen he had. He, however, charged him with only throwing 18 shovelfuls of coal into the retort. Mr. Wright, for the Company, stated that for some days prior to the 10th of February, the quantity of gas produced by the night turn had fallen short by 4000 to 8000 cubic feet. It was in consequence of this that the Manager watched the stokers; and this proceeding led to the dismissal of Johnson. Since his discharge, the full minimum quantity of gas had been made by the night shift. Mr. Oldfield gave confirmatory evidence. In cross-examination, Mr. Ward elicited the fact that during the month of February, after the plaintiff was dismissed, the quantity of gas produced by the night shift had fallen short on several occasions, ranging from 4000 to 9000 cubic feet. Eventually, the Bench dismissed the summons.

ELECTRIC LIGHTING FOR WORCESTER.

A recommendation of the Watch Committee that the tender of the Brush Electrical Engineering Company for lighting the city at a cost of £19,970 should be adopted, and that application should be made to the Local Government Board for their sanction to a loan of £40,000 (repayable in 30 years) for the purpose, gave rise to considerable discussion at the last monthly meeting of the Worcester City Council. At the outset, it was suggested by the Mayor (Mr. W. Holland) that the members should first hear the Engineer of the Brush Company (Mr. Raworth), then the Engineer of the Storage Electrical Power Company (Mr. King), and then Mr. Preece, who had been consulted by the Committee. This suggestion having been adopted, Mr. Raworth commenced his remarks by referring to some of the objections which had been made to the system he advocated. He found that it was assumed that their alternating current system was something like the system worked by Mr. Ferranti at Deptford, which began at 10,000 volts, was transformed to 2400 volts, and went to the premises of the consumers, transformed to 100 volts. The Brush system would commence at 2000 volts, when brought into the heart of the town, and transformed to 100 volts; being kept to a low-tension system or network which was distributed over the whole town. One great advantage of the alternating-current system was that they could stretch out the arms of the main in any direction, to almost any extent, within a radius of two or three miles, without having any serious loss or alteration in the system. Mr. King then addressed the Council on behalf of the Electrical Storage Power Company. He said that the system he advocated was in operation in more than one place; and in Chelsea it had worked for three years without the smallest hitch or trouble, except during the period of abnormal fog, when the power fell so as to afford some of the consumers who were scientific men reason for objecting to the fall of pressure below that specified by the Board of Trade. Their arrangements to prevent high pressure passing through consumers' wires was perfect. In the course of Mr. Preece's remarks, he said he could see no reason against the acceptance of the lowest tender—that of the Brush Company. He thought that very likely he should have said precisely the same if the tender of the Storage Company had been at the bottom of the list. There was a great deal of "tweedledum and tweedledee" about the arguments the two gentlemen had been urging—both systems were admirable, and were equally adapted for working in Worcester. He swept away what he regarded as the silly and childish objection to the introduction of the electric light—the question of danger. Since the Board of Trade had taken in hand the regulation of the electric light, the inspecting officer had only had to inquire into two accidents—at Brighton and Chatham. He showed how both cases occurred; and remarked that it was not likely anything of the kind would happen in Worcester. He found that of 56 central stations, 30 were worked at high pressure and 26 at low pressure; and of the 30, 28 were on the alternate-current system. As to water power, there was at hand a magnificent supply, which was shown by the figures of the Surveyor to be continuous. But supposing they did not use it, the Brush Company gave an alternative tender. Assuming the central station was not placed at the weir, it would be situated in the town. The tender would then be reduced from £21,065 to £15,980; but, on the other hand, the cost of working was raised. In reply to a question, Mr. Preece said he estimated the revenue per lamp at 9s. In answer to a member, Mr. Raworth stated that the cost of working the Brush system without using water power would probably be raised from £3150 to £4200, as against £3690, the cost of the storage system. Among other questions

was one inquiring if the electric light would be an economical method for the streets if they did not get any domestic consumption; and to this Mr. Preece replied that it would cost more than gas. At the close of the discussion, Alderman Hill moved—"That, subject to obtaining the sanction of the Local Government Board to the requisite loan, this Council is in favour of accepting the tender of the Brush Electric Company, Limited, for applying electric light to the city; but delays the actual acceptance of the tender pending the receipt of a report from the Watch Committee as to the portion of the tender which should be accepted, and especially as to: (1) Whether provision should be made for steam power only, or steam and water power combined; and (2) should provision be made for street lighting." Mr. Williamson seconded the motion; and afterwards Mr. Millington proposed, as an amendment, "That the Council be supplied with copies of the tenders of the Brush Company and the Electrical Supply Power Company." This was seconded; and then Mr. Price pointed to the fact that at Barnet and Leamington the electric light had proved a financial failure. On the amendment being put to the vote, 21 members were in favour of it and 16 opposed it. Further discussion ensued; and then Mr. Millington's proposition was amended to read as follows, and in this form was carried—"That copies of the tenders sent in by the Brush Electrical Engineering Company and the Electric Power Storage Company, but excluding the accompanying plans and drawings, be printed and circulated amongst the members of the Council; and that Mr. Preece be requested to submit at the next meeting a report on the comparative cost of production and distribution of electricity on the alternate-current and storage systems, illustrated by particulars of the cost in other towns, including Bradford and Newcastle-on-Tyne." Mr. Matthews subsequently moved that the Town Clerk be instructed to obtain a list of the members of the Corporation who hold shares in the Worcester Gas Company; but the motion was defeated.

The Lighting of Rio de Janeiro.—The cost of lighting the streets of Rio de Janeiro last year was \$1,081,130, against \$856,047 in 1890. The lighting of the public gardens involved an expenditure of \$12,209, as compared with \$7961; and that of the public departments, \$271,594, as against \$179,043.

Arundel Gas Company.—The accounts presented at the recent annual meeting of this Company showed a balance of £714; and a dividend of 10 per cent. on the old capital, and of 7½ per cent. on the new was declared. It was stated that the Directors contemplated making some improvements at the works.

Preston and the Electric Light.—The temporary installation of electric lighting at Preston is giving way to a permanent one, with underground conductors, which are now being laid along some of the principal streets. Messrs. Latimer Clark, Muirhead, and Co. are putting down the plant. The central station will contain ten engines and dynamos and five boilers, providing power for the lighting of 50,000 8-candle lamps. The pressure on the mains will be 200 volts; entering the consumer's premises at 100 volts. The installation will, it is expected, be complete by August.

Anglo-Romano Gas Company.—At the general meeting of this Company, recently held in Rome, a dividend of 12 per cent. was declared for the year 1891; the profits having amounted to £77,185. The quantity of gas sold last year was about 388 million cubic feet to the public, and about 132 million cubic feet to the town. With reference to the electrical branch of the undertaking, in 1891 the Company laid down 775 yards of large primary underground cables, 1383 yards of secondary road cables, 9 transformers, and 31 meters; making a total at the end of the year of about 22,500 yards of primary cables, and 4968 yards of secondary cables, 152 transformers, and 109 meters. Current was supplied to 353 arc lamps and 12,360 incandescent lamps; but the electric plant of the Cerchi could easily supply the current for a further 10,000 lamps without much extra expenditure. There has been a considerable reduction in the cost of producing the current; and the profits have thus amounted to £7800, or about £2000 more than in the previous year. The transmission of the power from Tivoli to Rome has been delayed for several reasons. A number of improvements have been introduced into this work, the outlay on which so far amounts to £50,000.

Monte Video Water-Works Company, Limited.—The report of the Directors of this Company for the past year, which has been issued in view of the general meeting of shareholders next Thursday, states that the gross revenue amounted to £78,876—a decrease of £7655, entirely due to the reduced amount received from the Government for subvention, the receipts from this source being £3888, against £11,730 in 1890. The working expenses show a decrease of £2214; and the net income amounted to £47,687, against £53,128. After providing for interest and other charges, and adding £2046 to the fund for the renewal of buildings and plant, there remains an available balance of £22,257. An interim dividend of 2½ per cent. was paid on Nov. 1 last, absorbing £10,000; and the Directors recommend a further dividend of 2½ per cent. (making 5 per cent., tax free, for the year), and carrying forward £2256. The exclusive character of the Company's concession expired in March, 1891, and with it terminated the Government subvention of \$4600 per month. Negotiations have been entered into with the authorities for a new concession; and a provisional arrangement has been arrived at under which the Company retain all the rights and privileges granted by the original concession, with the exception that the subvention is reduced from \$4600 to \$500 per month. The new subvention, at the rate of \$500 per month, has been duly received in respect of the nine months from April to December, 1891, and has been credited to revenue account. The works in progress at the date of the previous report—viz., further additions to the filtration works at St. Lucia, a new covered storage reservoir with a capacity of 3½ million gallons at Las Piedras, and important additions to the mains—have now been completed; and the results are stated to be most satisfactory. The past year was one of great depression in Monte Video; and there was a considerable falling off in the number of new houses built. This has naturally checked for a time the expansion of the Company's business; but it is gratifying to note that the ordinary revenue does not show any sign of reduction.

METROPOLIS WATER SUPPLY.

The Quality of the Water in March.

The returns furnished to the Registrar-General by the London Water Companies as to the water supply of the Metropolis during the past month, show that the average daily supply was 181,507,050 gallons, as compared with 173,356,318 gallons in the corresponding month of 1891; being at the rate of 29·7 gallons per head of the population. Of the entire bulk of water sent out, 90,642,303 gallons were drawn from the Thames, and 90,864,747 gallons from the Lea and other sources. Reporting upon the quality of the supply, Dr. E. Frankland said: "Taking the average amount of organic impurity contained in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies and by the Tottenham Local Board of Health was: Kent, 0·8; New River, 1·3; Colne Valley, Tottenham, and East London (deep-well), 1·4; East London (river supply), 2·6; Chelsea, 2·7; West Middlesex, 2·8; Grand Junction, 3·0; Southwark and Lambeth, 3·3. The water abstracted from the Thames by the Chelsea, West Middlesex, Southwark, Grand Junction, and Lambeth Companies maintained the improved quality which it attained in February. It was efficiently filtered in all cases. The water taken chiefly from the Lea by the New River Company ranked with the deep-well waters as regards organic purity; while that supplied from the same source, but lower down the stream, by the East London Company, was superior to the best of the Thames waters. Both waters were efficiently filtered. The deep-well waters of the Kent, Colne Valley, and East London Companies, and of the Tottenham Local Board of Health, were of good quality for dietetic use; that of the Kent Company being specially distinguished for its excellence. The Colne Valley Company's water, having been softened before delivery, was rendered suitable for washing. All these waters were clear and bright without filtration. Seen through a stratum 2 feet deep, the Kent, Colne Valley, Tottenham, and East London (deep well) waters were clear and colourless; the New River was clear and nearly colourless; and the remaining waters were clear and very pale yellow. The bacteriological examination by Dr. Koch's process of gelatine plate culture, gave the following results: One cubic centimetre of each water, collected on the same days as the samples for chemical analysis, developed the following numbers of colonies of microbes: West Middlesex, 22; New River, 24; Kent, 30; East London (river supply), 44; Chelsea, 56; Grand Junction, 60; Lambeth, 72; and Southwark, 156.

THE GLAMORGAN COUNTY COUNCIL AND THE BIRMINGHAM WATER BILL.

At a Special Meeting of the Glamorgan County Council at Pontypridd last Thursday week, Sir Hussey Vivian, M.P., who presided, said he should have been very glad indeed had he been able to ask the Council to sanction an opposition to the Birmingham water scheme. He regarded it with real dread; for he considered that the population in that county would hereafter increase enormously, as they had so increased in the past. It should be borne in mind that the population of Glamorganshire at the commencement of this century was 71,000; and now it was 687,000. If it had increased in that enormous ratio, what would it be a hundred years hence, or even fifty years hence, and where would they get their water from? He could only see that they could get it from the high grounds of Breconshire and Radnorshire, and perhaps in Cardiganshire—at any rate from the watershed which belonged by nature to the Bristol Channel, and to the population along the border of the Bristol Channel. If they did not now safeguard their water, then future generations would rightly and properly blame them for allowing great populations like Birmingham and London to come and take it away. He was told by the Clerk that, unless proper notice was given to the Council of their intention to oppose the Bill, they could not spend any money for such a purpose. If the Council passed a resolution that a petition be lodged against the Bill, if not with the Commons, then with the Lords, he could be requested to give evidence; and he would be very happy indeed to do so. The only course for the Council to adopt, if they did resolve to petition, would be to adjourn the meeting, so as to give proper notice to authorize the Council to oppose. Alderman Charles then moved—"That a petition be presented on behalf of this Council against the Birmingham Water Bill, and that a special meeting of the Council be held upon a convenient date to sanction the payment out of the county funds of the costs of opposing the said Bill." Mr. James seconded the motion, and suggested that, by opposing the Bill, they might secure the insertion in it of a clause safeguarding the rights of the inhabitants of the Principality to a supply of water for the area prescribed. The resolution was adopted; and it was further resolved that the Clerk should communicate with other County Councils in Wales with a view of securing united action in the matter.

PLYMOUTH CORPORATION WATER SUPPLY.

The Proposed New Works.

A Special Meeting of the Plymouth Borough Council was lately held to consider the proposed scheme of the Water Committee for the conservation of the borough water supply. Mr. J. T. Bond, Chairman of the Committee, in moving that they be authorized to give effect to the recommendations contained in their report (an abstract of which was given in these columns last week), asked the members to boldly declare themselves in favour of the Burrator site, and loyally sustain the Committee in their determination to carry the scheme through. It was, they were convinced, the best and wisest policy. As to the cost, he had no objection to take it at £150,000; but he had a very strong

opinion that it would be considerably less. There was, for instance, £30,000 put down as cost of easements, land, and parliamentary expenses; and this, he believed, was a most generous estimate. The population of Plymouth was 84,179; its rateable value, £309,000; its capital expenditure on water, £110,000; its total indebtedness on capital account for all purposes, £264,020, or £3 2s. 9d. per head; and rates amounting to 5s. 10d. in the pound. With regard to how they intended to meet the cost of the scheme, the amount they would require at the outside calculation of £150,000, repayable in 60 years, would be £5750 per annum. The repayments on the Guildhall would cease next year, which would give them £1500 a year to deal with. Then there were the old-bonded debts, the repayment of which they had been making to the tune of £3000 a year; and out of this it was thought they could take £2000. Then it was calculated that six years hence the water revenue would have increased by £2000. If they gave the manufacturers a constant supply of water, there would also be an additional consumption, without interfering with the question of rates at all, amounting to £250 a year, which would bring the amount up to the figure he had quoted as a sufficient yearly sum to discharge the cost of the proposed work and interest in 60 years. In times gone by, they had suffered from blizzards in the winter, and from constantly recurring periods of want of water in the summer; and in this scheme they had the remedy for these things. The town demanded that the water problem should be solved, and that no further delay should take place. He contended that before them was a scheme wise in its conception and sound in its conclusions; and he complimented the Engineer (Mr. Sandeman) on the fact that his project had received approval from such high authorities as those whose opinion had been sought. Mr. Alderman John Shelly, in seconding the motion, expressed the hope that the members would approach the Committee's proposals with a very strong feeling in their favour. The Council had for a long time recognized the absolute necessity of having a storage reservoir; and its necessity and urgency had greatly increased, and were still increasing. Considerable discussion followed, in the course of which the Committee were advised to be cautious and not in too great a hurry, but no objection to the scheme was raised. The result of the voting was that the motion was carried *nem. con.*; four members abstaining from voting.

Midland Railway Company and Electric Lighting.—The Midland Railway Company are about to introduce the electric light into all their offices at Derby, and also the Midland Hotel. The installation will cost about £11,000.

The Todmorden Local Board and the Gas-Works.—It is stated that an arrangement has been entered into between the Todmorden Local Board and the Gas Company for the transfer of the gas-works; and the matter will shortly come before the ratepayers for confirmation or otherwise.

The Rowley Regis Local Board and the Gas-Works.—A report was presented at the annual meeting of the Rowley Regis Local Board last week by the Public Works Committee, in which they recommended the Board to take into consideration the acquisition of the gas undertaking. The report was adopted.

Formby Gas Company.—The annual report of the Directors of this Company states that the net profit for the past year, after the payment of all the working expenses and interest, amounted to £542, which, with the balance brought forward, made a total of £619. Out of this the Directors recommended the payment of a dividend (free of income-tax) at the rate of 5 per cent. per annum. The gross receipts for the year from the sales of gas and residual products came to £1788, as against £1571 in the previous year.

The Gateshead Town Council and the Water Company's Bill.—A special meeting of the Gateshead Town Council was held last Friday to consider certain matters relating to the Bill of the Newcastle and Gateshead Water Company to sanction the construction of new works on the Rede to provide the district with a larger supply of water than can be furnished at the present time. It was stated that the Bill had not been brought before Parliament within the time specified in the Standing Orders of the House, and that the opponents of the Bill were taking advantage of this omission and seeking to get it put back. In the interests of the district, it was urged that the oversight should not be allowed to act as a bar to the progress of the Bill; and it was decided that the Council, along with others, should petition the House of Commons to dispense with the Standing Orders in this case.

The Public Lighting of Bideford.—The Bideford Local Board last Thursday week had a discussion on the question of entering into a fresh contract with the Gas Company for the public lighting. On the Company's tender being opened, Mr. Restarick said it would be very unwise to accept a tender for lighting by gas for anything like three years. There was a great desire in the town for the electric light; and the Lighting Committee should get information as to the cost, &c., of providing an installation. Mr. Poland moved that the Gas Company's tender be accepted for one year only. He, however, saw no reason why the Board should not erect gas-works of their own. The Council had made the Company what he considered a splendid offer for their concern; but unfortunately no arrangement had been come to. The Company's Provisional Order was opposed; and the Council, if they thought fit, could carry the matter to a Parliamentary Committee. The Chairman observed that the Lighting Committee had met several times, but were as yet unable to report anything definite. Mr. Clements seconded the motion; remarking that it would be unwise to enter into a contract with the Company for more than a year, having regard to the proposals for lighting the town with electricity. Mr. Squire moved, as an amendment, that no tender be accepted until the negotiations going on between the Company and the Lighting Committee were fully understood. Mr. Braund seconded the amendment. Mr. Restarick remarked that there was great reason for dissatisfaction in the matter of the gas supply. The Council were anxious some time ago to buy the Company's works, and have the lighting of the town in their own hands. The negotiations had fallen through; the Company not giving the Council sufficient time to consider the matter. On being put to the vote, the amendment was carried.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Reverting to the remarks of Mr. J. Hall, of St. Andrews, at the informal meeting of gas managers in Glasgow on the 14th inst., upon the subject of the education of young men, and the granting of bursaries to those who study gas making in a scientific manner, one or two reflections may be stated. Mr. Hall thought it strange there should be no bursary in connection with the North British Association of Gas Managers, which would put it in the power of some young man to acquire an education in chemistry, "so that they might have established at some of their colleges an analyst that they could depend upon, and who could assist small gas companies in having an analysis." The latter part of the proposal would be an excellent thing for the companies. There are many small gas companies who have not the means of having coal analyzed; and if the Association could provide this, much benefit to them might ensue. The difficulty would be in the working out of any such scheme. If such a gentleman were found, he would, on the one hand, either be a permanent official, who would hold office during his lifetime, whether he gave satisfaction or not, or he would be a man of ambitious turn of mind who, as soon as he had the offer of another situation, would accept it, and leave to the Association the trouble of selecting a successor. The work which such an official would do might thus be interrupted; and the benefits to be derived from the appointment would be largely lost. But there are serious drawbacks to the proposal. One of these is that the whole of the pecuniary benefit to be derived from the bursary fund would go to one person, who might or might not be helpful to the gas industry. Another is that the procuring of analyses is the interest of the companies more than of the managers; and any fund which the managers may raise should be applied so as to benefit themselves, and not their employers. "The greatest good to the greatest number" is a safe rule for the managers to follow in such a matter. The suggestion of the Chairman of the meeting (Mr. T. D. Hall), that the bursary might be applied in the education of the sons of gas managers or of young gas managers, was, in the light of the above rule, more to the point; but even it fails in this particular, that the son of a gas manager might not become himself a gas manager, and the outlay upon his education would be lost to the industry. The training of young gas managers is the correct idea, because money expended upon them would bring a return in the improvement of the industry. But the £300 which the Murdoch Memorial Fund Committee have in hand would do but little in this direction; and the suggestion of the Chairman's father (Mr. J. Hall), that coal and iron masters might be asked to subscribe to the fund, is worth taking up. If sufficient funds could be raised, I would say that it would be a good thing if a bursary, or scholarship, were established, which would be held by one person for three years; the holder to be obliged to study gas making scientifically during that time under regulations to be laid down, and to be free afterwards to promote his own interests. But as there is not likely to be sufficient funds for such a purpose, if I might be allowed to make a suggestion, I would say that the Murdoch Memorial Fund might be applied in this way: First of all, let the North British Association agree upon a manual of instruction in the elementary principles of gas making, and require the gentlemen who are already its members to instruct their assistants in the principles laid down in the manual, as well as in the practical work of gas manufacture. Then, at the annual meeting of the Association, the assistants who chose to enter might be examined by either a Committee of the Association, or by an examiner appointed by them; and certificates—prizes, if they could be afforded—would be granted to those who passed. The proceeds of the fund would be awarded to those managers who had been instrumental in obtaining passes for their assistants; or, if the funds permitted it, in remunerating all the managers who had been engaged in the tuition of their assistants. Such a scheme would confer benefit on both parties—on the assistants, who would receive the education, and on the managers, who would be remunerated for their trouble. I am led to make this suggestion because of my experience of another trade—the baking trade—which resembles that of gas manufacture, in being one which combines a little scientific with a large amount of practical knowledge. I know nothing of baking; but I attended last winter a course of lectures upon bread making in one of the Technical Colleges, and I was convinced, night by night, of the utter futility of employing merely scientific lecturers to instruct practical men. Unless for a very few, the severely scientific aspect of his occupation is thrown away upon either the gas manufacturer or the baker. It is the practical that is wanted; and the scientist cannot supply that. He deals in units and in formulæ which are bewildering to the ordinary worker. It is a significant indication of the weakness of the strictly "scientific" method of training that, at the close of the course of lectures alluded to, a master baker had to be asked to give a series of lessons on practical bread making before the class could be submitted for examination. It would be the same with gas making; and therefore I would suggest that instruction in the practical side of the subject should be the chief aim—such instruction as the ordinary gas manager is thoroughly capable of giving—and that assistants should be left to their own resources in furnishing themselves with whatever of science they may think they require. Having had the practical training, the more of the scientific they could command, and carry along with them, the better it would be for themselves. The ordinary man may do without much of the scientific, but without practical knowledge he would be useless; and I therefore submit this suggestion in the confidence that by it, or something like it, would be found the best means for the promotion of the important industry of gas manufacture.

The Corporation of Paisley, as owners of the gas undertaking, are in the position of having, on account of popular clamour, to take up questions connected with the gas supply, and to defend themselves. The town is extending, with the result that Mr. Hislop, having to send his gas farther afield and through mains which were laid to serve only the original smaller area, has had to fall back upon the expedient of putting on extra pressure. This, and the dark weather, led to the gas bills in the centre of the town being larger at the January survey; and the inevitable charge of bad gas or mismanagement was raised. A

crop of complaints alleging overcharge sprang up rapidly; and these were sent to a Committee, whose report was submitted to the Town Council on Tuesday of last week. The Committee recommended the laying of larger mains in several parts of the town, at a cost of about £1000; and that the practice of gratuitously giving out burners suited to the gas should be resumed. In their opinion, the increase had been partly caused by those who had complained having changed their burners, substituting much larger sizes, which had led to a great increase in the consumption. The only cure is to educate consumers as to what is necessary for the particular gas which is supplied. This, the Gas Committee stated, they are prepared to do, provision being made for explaining and illustrating the principles by which consumers should be guided in both lighting and heating their houses by gas. The Committee's report was adopted. It is not difficult to see Mr. Hislop's hand in these arrangements. He is a strong advocate of the gratuitous supply of burners; but hitherto, except for a short period of eight months or so, somewhere about 1883, he has been unable to have his views carried out. On that occasion, some of the Corporation became alarmed at the cost; and the free supply of burners was stopped. Mr. Hislop has now the satisfaction of having been able to convince his employers that his view is the right one. It is an interesting move on the part of a large Corporation. I had almost called it an experiment; but, on second thoughts, I have no doubt that Mr. Hislop has thought out the whole subject so well that before it is begun, the step he is about to take is already beyond the stage of experiment, so far as Paisley is concerned. Mr. Hislop has received much sympathetic, but little practical, support in his proposals—only one or two small places having hitherto adopted the policy he advocates. Now that it has been placed in his own hands to demonstrate the feasibility of his scheme, let us wish him a free hand in the carrying of it into execution; and at the meeting of the North British Association of Gas Managers in 1893, there should be something interesting to listen to.

The Gourock Police Commissioners, as owners of the gas undertaking, have done what appears to be a foolish thing. When the railway was extended from Greenock to the town four years ago, the place suddenly became one of great activity, the larger portion of the coast traffic passing through it, with, as a matter of course, a considerable proportion of the passengers making a more or less extended stay in the burgh. That meant an increased consumption of gas; and the question, following upon it, of how to make provision for the demand. The Commissioners some time ago asked Mr. James M'Gilchrist, of Dumbarton, to report to them on what was necessary. Mr. M'Gilchrist is as practical a man, and as well acquainted with the requirements of Gourock, as anyone they could have employed. His report, submitted to the Commissioners on Monday recommended a re-arrangement of the works and several extensions and renewals, at an estimated cost of £2250, or including a new gasholder of from 100,000 to 130,000 cubic feet capacity, of £5250. The proposals were exceedingly moderate and fair, considering the rapid growth of the place; but the Commissioners appear to be a timid body of men, and "after a long discussion," they adopted in preference what appear to have been cheaper proposals by Mr. M'Ewan, their own Engineer. In a place like Gourock, where the output, though not very large, has increased by 3 million cubic feet in one year, the future is a more important factor than the present, which the Commissioners seemed not to realize. In their case, too, the debt upon the undertaking is small—only the mere trifle of about £8000; and both these considerations should have induced them, when they were in the way, to have made a thorough overhaul of the gas-works. It seemed to them otherwise, however; and they adopted local proposals, appointing Mr. Andrew Gillespie, consulting gas engineer, of Glasgow, to be the advising engineer. These proposals are presumably good enough so far as they go; it is in not going in for a thorough scheme of overhaul, that the Commissioners have adopted the policy which will probably be the most costly in the end.

There is a proposal to expend nearly £5000 upon the gas-works which belong to the Corporation of Wishaw. The town is not a very large one; but the consumption of gas has been advancing at the rate of some 2½ million cubic feet a year. Mr. M'Nair, the Gas Manager, suggests the re-building of the retort-house, and the constructing of the new house on Mr. G. R. Hislop's system of regenerative furnaces. He also proposes a new gasholder of 80,000 cubic feet capacity. The necessity for the proposed works was admitted by the Police Commissioners at a recent meeting; but they were not sufficiently informed on the finance question, and they took a fortnight to consider Mr. M'Nair's proposals before giving their sanction to them.

The lighting of common stairs, which has given so much trouble in Edinburgh, has been engaging the attention of the Police Commissioners of Partick, one of the suburban burghs of Glasgow. The burgh has no gas supply of its own, since the Partick, Hillhead, and Maryhill Gas-Works were taken over by the Corporation of Glasgow; and the situation arose that, whereas in Glasgow the cost of stair lighting is partly defrayed out of the rates, the same system could not be applied in Partick without arrangement with the Police Commissioners. The Commissioners having received a communication from the Gas Committee on the subject, consulted the ratepayers thereon; and the result was reported to be that the owners and occupiers of property in which 964 gas-jets are used gave their consent to the Commissioners lighting and extinguishing the lamps. The Commissioners resolved to undertake these; and the others who have not consented will have to come to terms with the Glasgow Gas Commissioners for a supply of gas, and to light and extinguish the lamps in their own properties.

The Board of Supervision are not satisfied with the report by the Medical Officer regarding the Fraserburgh Gas Company's works. They have written to the Police Commissioners pointing out that he altogether omitted from his report the necessary statement as to whether the works were "so conducted as to be offensive or injurious to health." If the Medical Officer is unable to certify as required by the Board of Supervision, it is not improbable that the Board may yet send down a man to make an examination for them; and it will depend upon his view of the situation whether or not the Gas Company get into trouble over the matter.

The water supply of Aberdeen, introduced so far back as about 1866, has been examined this week by Mr. J. M. Gale, of Glasgow, with a view to his reporting on the questions connected with the pollution

which affects the present supply, and on the sources of a prospective increase. Ever since a general system of water supply was introduced into Aberdeen, it has been derived from the River Dee—a stream which is frequently spoken of with the prefix "silvery," on account of the clearness of its waters. Originally, the supply was taken from the river at the old Bridge of Dee, about three miles from the sea; but the growth of the suburbs, with their attendant discharges of sewage into the river, led to the pumping-station being abandoned, and the present (which is a gravitation system) being substituted for it. The same causes have again operated. Since 1866, owing chiefly to the growth of health resorts upon the higher reaches of the river, pollution is again troubling; and the city also has grown very largely, and a supply of 8 million gallons per day is becoming perilously small. Mr. Gale spent Tuesday and Wednesday examining the river; and on Thursday he had a meeting with the Water Committee, at which he communicated some of the conclusions he had arrived at. On the subject of pollution, he is of opinion that the sewage from the towns and villages, which is at present drained into the river, should be dealt with by irrigation. Extensive pollution does exist; and he advises that the local authorities of the places where it arises should be compelled to either prevent it altogether, or adopt means to render the discharges innocuous. In the course of ten or fifteen years, he considers, it will be necessary to face the question of an increase to the water supply of the city; and he does not think the Town Council should contemplate anything less than the doubling of the present service. The river, he considers, should still be their source of supply; but they should go farther up with the point of abstraction, in order that they might get beyond, if possible, the sources of contamination, and in order to have a better pressure in the higher districts of the area of supply. In the meantime, he is of opinion the water should be filtered and the storage should be increased, so as to be equal to three or four days' supply, in order that they might be able to shut out the river in times of flood. Were more water taken from the river, it would be necessary to provide compensation water; and in that connection, he had examined Loch Callater, in the hills above Braemar, about 70 miles from Aberdeen, and Loch Muick, about nine miles above Ballater and 50 miles from Aberdeen. Loch Callater would be unsuitable, because the drainage area is so small that not more than 7 million gallons per day could be got from it. Loch Muick, on the other hand, would suit admirably, provided its surface were raised 25 or 30 feet. The Committee, having heard Mr. Gale, instructed him to frame a report to them on the subject. They also resolved to seek an interview with the County Council on the subject of pollution, with a view to avoiding litigation. In this they are likely to be successful, as the County Council are as anxious as the City Council are to avoid polluting the river. Loch Muick is partly the property of Her Majesty. She possesses on its banks a small rustic dwelling, called a "shiel," in which she occasionally spends a couple of days and nights in that rural simplicity which she so much enjoys; and if the level of the loch were raised, it is probable that this favourite retreat of hers would have to be removed to another site.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, April 23.

Sulphate of Ammonia.—The market is without alteration; and there is a fair amount of business passing—not sufficient, however, to raise its tone. Hull quotations are at £10 3s. 9d. to £10 5s.; Leith, at £10 3s. 9d.; Liverpool, at £10 2s. 6d.; and the shipments indicate that the position remains perfectly sound. There is rather more continental inquiry; and especially summer and autumn deliveries are eagerly sought after. Makers are not sellers of "futures;" but it is reported that some of the speculators are taking orders. Nitrate is in fair demand; but prices are tending downward.

LONDON, April 23.

Tar Products.—The make of tar is now much reduced; and tar distillers are less anxious to sell than they were before the holidays. There is no improvement to report in any of the products; and with the exception of pitch, which is moving off against old contracts, practically no business is being done. A large quantity of creosote is being burnt as fuel at producers' works; and to this extent stocks are being relieved. Market prices may be taken to be: Tar, 10s. to 12s. Pitch, 28s. to 29s. Benzol, 90's, 1s. 7½d.; 50's, 1s. 4d. Toluol, 1s. 2½d. Solvent naphtha, 1s. 2d. Crude benzol naphtha, 30 per cent., 9½d. Creosote, ½d. Naphthalene salts, 20s.; pressed, 45s. Carbolic acid, crude, 60's, 1s. 1d.; 70's, 1s. 4½d.; crystals, 5d. Cresol, 8d. Anthracene, 30 per cent., "A" quality, 10½d.; "B," 7½d.

Sulphate of Ammonia.—Transactions have been noted at prices varying from £10 to £10 3s. 9d., less 3½ per cent., and according to conditions and terms of delivery. The market is extremely dull, and the prospect not at all encouraging. The improvement which it was hoped would take place with the advent of better weather does not so far appear to have been realized. The season, however, is a late one; and home consumers may yet require considerable quantities. There does not seem to be much hope of the better prices which usually obtain at this season of the year. Gas liquor (10-oz.) is quoted at 5s. to 6s. 6d.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Except that the protracted severe weather has been keeping up a fairly active demand for house-fire qualities, increasing quietness is generally reported throughout the coal trade of this district; and although the pits in most cases have been stopped for a longer period than usual for the Easter holidays, supplies are plentiful in all descriptions of fuel, with stocks accumulating. For the better qualities of round coal, prices are well maintained. Best Wigan Arley still averages 12s. 6d.; Pemberton four-feet and second qualities of Arley, 10s. 6d. to 11s.; and common house-fire coals, 9s. to 9s. 6d. per

ton. Inferior qualities of round coal show, however, a weakening tendency, which is only to be expected, with the gradually decreasing requirements for iron making, and other coal-using industries. Renewals of contracts are already being taken at lower figures; and there seems every probability that there will be a keen competition for the usual contracts which will shortly come upon the market for supplies of gas and locomotive coals. At the pit mouth, steam and forge coals do not average more than 8s. to 8s. 6d. per ton; whilst for shipment, under these figures has been taken, owing to the increasing competition of Welsh coal, which has, during the past week, been considerably reduced in price. Delivered at the ports on the Mersey, good ordinary qualities of Lancashire steam coal are not averaging more than 9s. 6d.; whilst best Welsh steam coal is obtainable at 10s. 6d. per ton. Engine fuel is hanging upon the market, owing to the unsettled condition of the cotton trade; and although the better qualities are still fairly maintaining their price, inferior sorts are offering at low figures, and there is a good deal of competition with surplus supplies from other districts. At the pit mouth, good, ordinary qualities of burgy still average 6s. to 6s. 6d., and the best qualities of slack, 5s. to 5s. 6d.; but common slack can be bought readily at 3s. 6d. to 4s. per ton.

Northern Coal Trade.—The coal trade is still abnormally situated by the continuance of the Durham miners' strike. There is an import of coal from Scotland and from Yorkshire; and with a restriction of the consumption at the great works, there does not seem much scarcity. Northumbrian steam coal is, however, rather higher in price, as the season for exports is drawing near. For best qualities, about 11s. per ton f.o.b. is the current quotation; and the turns for delivery have been rather long. Second-class coals are 1s. per ton lower. Small steam coals are in demand for manufacturing purposes; and about 5s. per ton f.o.b. is the price. Gas coals are rather scarce, at 12s., less 2½ per cent.; but there are offers of supplies from Scotland at rather lower prices. Bunker coals are dull, in consequence of the large number of steamships laid idle both in the Tyne and in the Wear. Household coals are dull; the finer weather having lessened the consumption, whilst the supplies from the Yorkshire collieries are larger. Coke is very scarce, and as high as £1 per ton f.o.b. is asked for best qualities for export; but there are no sales of moment, and the deliveries are chiefly on old contracts at much lower rates. Gas coke is on the whole steady at the reduced rate; but the consumption seems most in the retail way. There are some indications that the long strike of the Durham miners is approaching its end; and its termination would be received with joy by all sections of the trading community in the country.

Scotch Coal Trade.—The demand for most varieties of coal is slackening, and prices have receded from the figure they reached on the outbreak of the miners' strike in Durham. This is, to some extent, accounted for by warmer weather setting in—the snow of the past week having all disappeared; but it is to a greater extent reaction following upon the laying in of stocks which sprang up when the "miners' play" was announced. Very little is being done in forward business—less than might have been expected, considering that the Baltic is being opened up. Owing to the distress in Russia, it is anticipated that money will be difficult to collect there; and there is less eagerness than usual to take up the few orders which have come. Scotch coal continues to be sent in considerable quantities to the North of England. The quotations in Glasgow last week were: Main, 7s. 9d.; ell, 8s. 6d. to 8s. 9d.; splint, 8s. 3d. to 8s. 9d.; and steam, 10s. 3d. to 10s. 6d.—all unchanged from the previous week.

Belgrano Gas Supply.—An arrangement has been come to by which the Belgrano (Buenos Ayres) Municipality will pay its debt to the Gas Company half in bonds and half in cash; and the price of gas will henceforth be increased 50 per cent.

City of St. Petersburg New Water-Works Company, Limited.—The Directors of this Company have received information from the Manager at St. Petersburg, that the Senate has decided in favour of the Company in the long-pending suit with the Municipality as to payment for meters.

Sale of Shares in the West Ham Gas Company.—In accordance with the announcement which has appeared in our advertisement columns during the past few weeks, Mr. Alfred Richards sold last Thursday, at the Auction Mart, Tokenhouse Yard, 1150 original (£10) 7 per cent. shares in the West Ham Gas Company. They were submitted to public competition by order of the Directors, under the provisions of the Company's Act of 1889. They were put up in lots of ten; the prices realized ranging from £11 10s. to £13 10s. per share.

Sulphate Plant for the Newcastle Gas-Works.—Mr. Maurice Schwab, of Manchester, is the successful competitor for the erection of new sulphate of ammonia apparatus for the Newcastle and Gateshead Gas Company. He has received instructions to erect plant to distil 70 tons of liquor per day each for the Elswick and Redheugh works. It will be fitted with the most modern improvements—Wilton's patent saturators and dischargers—and will be completely automatic in action. These appliances are, we learn, giving very satisfactory results; upwards of sixty of them being at work in the United Kingdom.

The New Water-Works for Northallerton.—The ceremony of cutting the first sod in connection with the Northallerton new water-works took place last Friday at Thimbleby, about 1½ miles from Osmotherley. The members and officials of the Local Board drove out in brakes to the site where the sod was cut by Mr. Charles Waistell, Chairman of the Board, who was presented with a silver spade, suitably inscribed. Mr. A. M. Fowler, of Manchester, the Engineer of the scheme supplied the following information relative to the new works: They were started about two years ago; the reservoir being situated some 6 miles from the town; the line of conduit, including the mains in the town, being about 7½ miles in length. The water is collected from several springs on the south side of Oakdale, and is collected into a small reservoir in the upper portions of the town, and from thence is conveyed to a service reservoir at Bullamoor, at an elevation of 218 feet. The capacity of these two reservoirs is 200,000 and 300,000 gallons respectively.

The Castleton (Derbyshire) Water-Works Company, Limited, has been registered with a capital of £2000, in £1 shares, to supply the village of Castleton with water, and generally to carry on the business of a water company.

Collapse of a Gasholder at Gillingham.—Last Thursday week, the side of a small gasholder gave way at the Gillingham (near Chatham) Gas-Works; and the whole of the gas it contained escaped. The holder was an old one, and has only been used occasionally for some time past. Fortunately no one suffered any ill-effects from the gas; and the consumers experienced little or no inconvenience.

Stafford Corporation Gas Supply.—Alderman W. H. Peach, the Chairman of the Gas Committee, presented a report at the last meeting of the Stafford Town Council, which showed that the gas consumed during the past year had been 123,000,000 cubic feet—an increase of 9,294,000 cubic feet over last year, or 9.42 per cent.—while the quality had been 18.15-candle power. The Chairman also stated that the railway siding was now in full working order, and the trucks were shunted into the works by the railway engines; and with this accommodation the Corporation would find considerable advantage and saving in the matter of haulage. It had also been decided to provide additional coal storage, at an estimated cost of £350.

New Water-Works for Plympton.—Mr. S. J. Smith, C.E., one of the Inspectors of the Local Government Board, held an inquiry at Plympton a short time ago, into an application by the Sanitary Authority of the Rural Sanitary District of Plympton St. Mary Union for sanction to borrow the necessary money for works of water supply for the district. The scheme which it is proposed to carry out has been projected by Mr. B. J. Shiers, of Ilminster, who estimates that the cost will be £7242. Among the witnesses called in support of the scheme was Mr. H. Francis, the Manager of the Devonport Water Company, who said he computed the outlay at £7463. There was a large attendance of ratepayers, several of whom opposed the application.

The Reliability of Water-Meters.—An interesting case recently came before His Honour Judge Martineau and a jury at the Dorking County Court in which the Dorking Water Company sued Dr. T. W. King for £17 8s. 6d. for water supplied by meter. The defendant disputed the registration of the meter, and paid £8 5s. into Court. In the quarter ending March 24, 1891, the meter was said to have passed 26,250 gallons; and this he firmly believed to be incorrect, for during seven weeks of the quarter he was entirely without water, owing to frost, and in previous quarters he had not consumed half the amount. In consequence of Dr. King's complaint, the matter, it seems, was inquired into by Mr. Rossiter, the Managing Director of the Company. A new meter was fixed in place of the old one on Sept. 24; and it registered within three or four gallons of the same average daily consumption. On Oct. 31 the new meter had registered in seven days 3860 gallons, or 551 gallons per day. On Oct. 7 it registered 7180 gallons, or 553 gallons per day. On that day the water was turned off from the meter at 10.30 in the morning, and was not touched till 2.45; and it then appeared that the meter, which in the morning had registered 7180 gallons, had gone on to 7250 gallons—a difference of 70 gallons in four hours. The meter was fixed at Dr. King's front gates, and the pipe ran across the lawn. From the fact that the meter showed a consumption while the water was shut off from the house and stables, it was conjectured by the Company's officials that there was a leak between the meter and the house. Evidence was given by Dr. King and his servants; and they all declared that they had not detected signs of leakage. A plumber also stated that he had examined the service-pipe and internal fittings, and had found them all in good order. The jury gave a verdict to the effect that the meter was unreliable, and that the index had moved when no water passed. His Honour on this finding gave a verdict for the defendant, with costs; and refused leave to appeal.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

For Stock Market Intelligence, see ante, p. 744.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon invest-ment.
£			p. c.					£ s. d.
GAS COMPANIES.								
590,000	10	13 Apr.	10½	Alliance & Dublin 10 p. c.	10	15½-16½*	..	6 7 3
100,000	10	"	7½	Do. 7 p. c.	10	11-12*	..	6 5 0
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105-107	..	4 13 5
100,000	20	27 Nov.	8	Bahia, Limited	20	12-14	..	11 8 1
200,000	5	12 Nov.	7½	Bombay, Limited	5	6½-7	+½	5 5 9
40,000	5	"	7½	Do. New	4	4½-5½	..	5 14 1
380,000	Stock.	26 Feb.	12½	Brentford Consolidated . . .	100	210-215	..	5 14 1
150,000	"	"	9½	Do. New	100	158-163	..	5 13 5
220,000	20	11 Mar.	11½	Brighton & Hove Original . .	20	40-42	+1	5 9 6
888,500	Stock.	11 Mar.	5	Bristol	100	95-100	..	5 0 0
320,000	20	13 Apr.	11½	British	20	42-44*	..	5 2 3
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	10	19-20	..	5 15 0
51,510	10	"	8½	Do. 7 p. c.	10	14-15	..	5 13 4
328,750	10	"	—	Buenos Ayres (New) Limited	10	6½-7½	..	—
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	93-96	..	6 5 0
150,000	20	26 Feb.	8	Cagliari, Limited	20	24-26	..	6 3 1
550,000	Stock.	13 Apr.	13	Commercial, Old Stock . . .	100	230-235*	-1½	5 10 8
105,000	"	"	10	Do. New do.	100	185-190*	..	5 5 3
130,000	"	30 Dec.	4½	Do. 4½ p. c. Deb. do.	100	118-123	..	3 13 2
800,000	Stock.	30 Dec.	13	Continental Union, Limited .	100	221-226	..	5 15 1
200,000	"	"	10	Do. 7 p. c. Pref.	100	185-195	..	5 2 7
75,000	Stock.	30 Mar.	10	Crystal Palace District . . .	100	185-195	..	5 2 7
486,090	10	29 Jan.	10	European, Limited	10	19-20	..	5 0 0
354,060	10	"	10	Do. Partly paid	7½	13½-14½	-½	5 3 11
5,470,820	Stock.	12 Feb.	12	Gaslight & Coke, A, Ordinary	100	210-215	..	5 11 8
100,000	"	"	4	Do. B, 4 p. c. max.	100	94-97	..	4 2 5
665,000	"	"	10	Do. C, D, & E, 10 p. c. Pf.	100	245-250	..	4 0 0
30,000	"	"	5	Do. F, 5 p. c. Prf.	100	116-121	..	4 2 9
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	169-174	..	4 6 2
1,300,000	"	"	7	Do. H, 7 p. c. max.	100	153-156	..	4 9 9
463,000	"	"	10	Do. J, 10 p. c. Prf.	100	243-248	+2	4 0 8
476,000	"	"	—	Do. K, 6 p. c. Prf.	100	146-150	..	4 0 0
1,061,150	"	11 Dec.	4	Do. 4 p. c. Deb. Stk.	100	113-116	..	3 9 0
294,850	"	"	4½	Do. 4½ p. c. do.	100	118-123	..	3 13 2
908,000	"	"	6	Do. 6 p. c. do	100	163-168	..	3 11 5
3,800,000	Stock.	12 Nov.	12	Imperial Continental	100	224-228	..	5 5 3
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4-4½	..	6 13 4
560,000	100	1 Apr.	5	Met. of Melbourne, 5 p. c. Deb.	100	106-108	..	4 12 7
541,920	20	27 Nov.	6½	Monte Video, Limited	20	14½-15½	..	8 7 8
150,000	5	27 Nov.	10	Oriental, Limited	5	8-8½	-½	5 17 8
60,000	5	30 Mar.	7	Ottoman, Limited	5	4-5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited	10	2-3	-2	—
420,000	100	3 Nov.	6	People's Gas of Chicago—	100	105-108	..	5 11 1
500,000	100	1 Dec.	6	1st Mtg. Bds.	100	105-108	..	5 11 1
150,000	10	15 Oct.	10	2nd Do.	10	8-9	-½	—
500,000	Stock.	26 Feb.	15½	San Paulo, Limited	100	267-272	..	5 14 0
1,350,000	"	"	12	South Metropolitan, A Stock	100	220-225	..	5 6 8
200,000	"	"	13	Do. B do.	100	235-240	..	5 8 4
725,000	"	30 Dec.	5	Do. C do.	100	140-145	..	3 9 0
60,000	Stock.	11 Mar.	11½	Do. 5 p. c. Deb. Stk. . . .	100	225-230	..	5 0 0
729,331	Stock.	30 Dec.	10	Tottenham & Edm'nton, "A"	100	240-245	..	4 1 7
1,720,252	Stock.	13 Apr.	8	Chelsea, Ordinary	100	193-198*	+1	4 0 10
544,440	"	30 Dec.	4½	East London, Ordinary . . .	100	136-140	..	3 4 3
700,000	50	11 Dec.	8	Do. 4½ p. c. Deb. Stk. . . .	50	96-99	+1	4 0 10
708,000	Stock.	12 Feb.	10½	Grand Junction	100	250-255	+3	4 2 4
1,043,800	100	30 Dec.	9½	Kent	100	217-222	+4	4 5 7
406,200	100	"	7½	Lambeth, 10 p. c. max. . . .	100	183-188	+1	3 19 9
260,000	Stock.	30 Mar.	4	Do. 7½ p. c. max.	100	120-123	..	3 5 0
500,000	100	12 Feb.	12½	Do. 4 p. c. Deb. Stk.	100	320-330	..	3 23 6
1,000,000	Stock.	29 Jan.	4	New River, New Shares . . .	100	126-129	..	3 2 0
902,300	Stock.	30 Dec.	6½	Do. 4 p. c. Deb. Stk.	100	145-150	+5	4 6 8
126,500	100	"	6½	S'thwk & V'hall, 10 p. c. max.	100	130-135	..	4 16 3
1,155,066	Stock.	11 Dec.	10	Do. D 7½ p. c. do.	100	240-245	..	4 1 7
WATER COMPANIES.								
729,331	Stock.	30 Dec.	10	Chelsea, Ordinary	100	248-253	+5	3 19 4
1,720,252	Stock.	13 Apr.	8	East London, Ordinary . . .	100	193-198*	+1	4 0 10
544,440	"	30 Dec.	4½	Do. 4½ p. c. Deb. Stk. . . .	100	136-140	..	3 4 3
700,000	50	11 Dec.	8	Grand Junction	50	96-99	+1	4 0 10
708,000	Stock.	12 Feb.	10½	Kent	100	250-255	+3	4 2 4
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max. . . .	100	217-222	+4	4 5 7
406,200	100	"	7½	Do. 7½ p. c. max.	100	183-188	+1	3 19 9
260,000	Stock.	30 Mar.	4	Do. 4 p. c. Deb. Stk.	100	120-123	..	3 5 0
500,000	100	12 Feb.	12½	New River, New Shares . . .	100	320-330	..	3 23 6
1,000,000	Stock.	29 Jan.	4	Do. 4 p. c. Deb. Stk.	100	126-129	..	3 2 0
902,300	Stock.	30 Dec.	6½	S'thwk & V'hall, 10 p. c. max.	100	145-150	+5	4 6 8
126,500	100	"	6½	Do. D 7½ p. c. do.	100	130-135	..	4 16 3
1,155,066	Stock.	11 Dec.	10	West Mddlesex.	100	240-245	..	4 1 7

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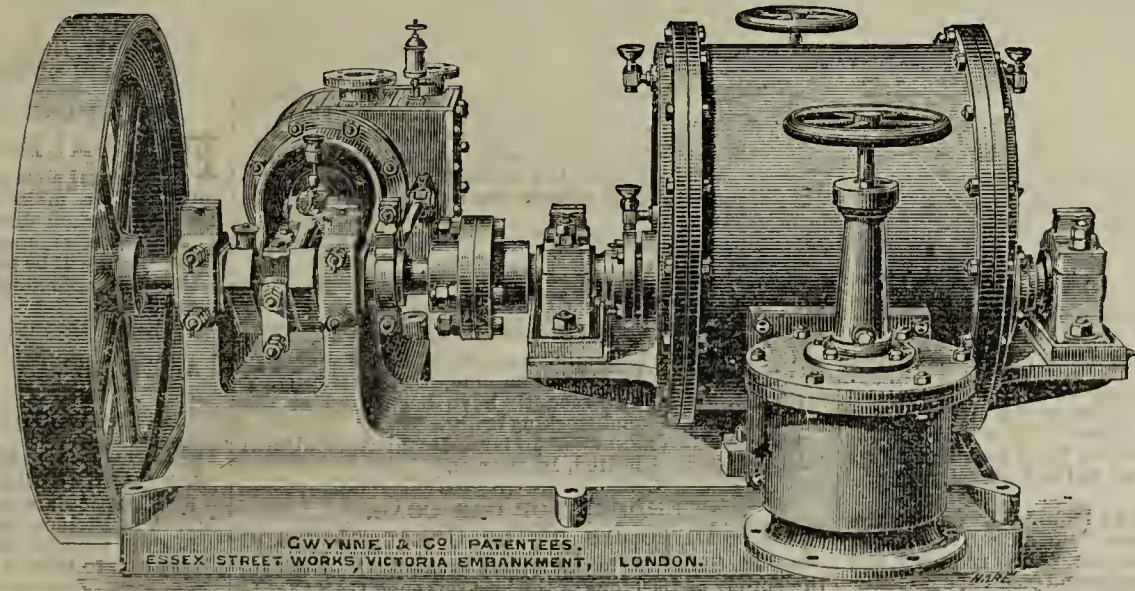
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JOS. TIMMINS,

Engineer.

April 21, 1892.

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GEO. PARKER,

Manager.

April 23, 1892.

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April 1, 1892.

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THOMAS MAY,

Engineer and Manager.

April 20, 1892.

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For particulars apply to **M. LE DIRECTEUR DU SERVICE DU GAZ**, 8a, Rue du Chêne, BRUSSELS.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

THE

JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MAY 3, 1892.

Labour Topics.

THE wretched farces that have been played in the North of England during the past few weeks by Unionist miners and fitters, are among the most distressing incidents of an agitated time. One of these performances—the strike of engineers on the Tyne and Wear—has collapsed, after causing immense suffering and irrecoverable loss, leaving the original matter of dispute exactly where it was. For twelve weeks nearly 20,000 workmen have been absent from their ordinary employment, and it is calculated that they have lost thereby £180,000 in wages alone. “Great loss has also been caused to the employers, many shop-keepers have been reduced to a state of bankruptcy, there

“has been a serious drain upon the funds of various Trade Unions, and hundreds and thousands of people have only been saved from starvation or the workhouse by public charity.” All this has resulted because two Trade Societies—the Amalgamated Society of Engineers and the Plumbers' Society—could not agree as to whether some pipe-fitting on board ship was plumbers' or engineers' work. People who hastily assume that Trade Unions do nothing but protect workmen against the rapacity and tyranny of employers, may be recommended to correct this impression by the facts of the East Coast engineers' strike. In this case, the employers had at first absolutely no interest in the dispute. They did not care what class of men did the work in question, so long as it was done. But the trouble was brought about wholly by the arbitrary action of the engineers, who number thousands to the plumbers' hundreds. When trade was good, the engineers refused to touch pipe work, which they then said was a branch of plumbing. When trade grew slack, however, they wanted to take the same work away from the plumbers; and this was the origin of the strike and lock-out, which began about the end of January, and has only terminated within the last fortnight. As the time passed in enforced idleness, one set of supporters after another fell away from the men's Strike Committee, who showed a strange determination to continue the strike long after its origin and motives were seen to be absurd. As *The Times* Newcastle correspondent puts it, the Committee “succumbed at last to the unanimous denunciations of the press and the public, to the demands of the London Executive of the Amalgamated Society of Engineers, and to the manifest discontent of those on strike.” Unfortunately, however, the consequences of such treasonable folly to the cause of trade and labour as that which has just been suppressed at Newcastle remain for long after the error has been abandoned and repented of. It is not within the power of trade unionists to ensure that the work they lay down when they go out on strike is there to take up again at their own sweet will. Contracts cannot be played with in this way; and so it is not surprising to hear that in very many instances when the strikers of the Tyne and Wear professed themselves willing to resume work on the old terms, there was no job for them on any terms.

In contrast with the Tyne and Wear strikers, who were kept idle by their Executive, the Durham miners have refused to permit their Union leaders to settle terms for a resumption of work with the employers; and the latest news from this afflicted district is that so many works dependent upon coal have been stopped, that the prospects of the coal trade are worse than ever, so that an even greater reduction of wages than the men stood out against at first will have to be submitted to before coal-getting can be resumed. It has been asserted that the effect of this change in the state of the coal market may be to prolong the strike until June. However this may be, the spectacle presented by the strikers, in trying to prevent the pumping out of mines, in resorting to violence against individuals whom they regarded as their opponents, or merely for having put before them unpalatable facts, has been a truly lamentable one. Mr. Burt, M.P., told the delegates composing the annual conference of the Miners' National Union, which recently met at Durham, some home truths, for which he has, of course, been hotly abused by the Anarchist section of self-styled Labour politicians. He has found it necessary to tell the miners, as though they were news, some of the most elementary points of what should be the behaviour of a free man in a free country. Thus, he assures his hearers that they must learn to respect freedom in debate, and must school themselves to listen patiently to remarks which they may for the moment consider as being opposed to their interests. Mr. Burt reproves his class with being impatient of sliding scales of wages and prices, and rejecting arbitrations when awards go against them; just as though they were children who would revenge themselves upon the barometer when the weather turns out less propitious for their purposes than they could wish. It seems strange that men who have votes can need talking to in this style; but it is one of the curious features of the modern Labour Movement that the workman is continually being assured by the demagogues who aspire to live by and upon him, and who climb to notoriety over his shoulders, that the New Unionism is quite independent of such old-fashioned conditions as legality, reliance upon truth, obedience to

obligations willingly incurred, and other restraints to which employers and other inferior animals are subject. Consequently, there is nothing the unionist workman "rightly struggling to be free" from a supposed state of bondage to his employer requires to take more closely to heart than the proper appreciation of the duties of a free, responsible citizen. When one hears the vile trash that is habitually poured forth by some mass-meeting orators—the intemperate appeals to selfish and sordid impulses, the hollow flattery of the "many-headed," the misrepresentation and slandering of honourable men, and the bitter denunciations of workmen who decline to support the speakers—the marvel is, not that strikers are commonly wilful, and occasionally given to violence, but rather that they do no more mischief. True, they are overawed by the rest of the community. But we take leave to suggest to such Labour leaders as are really and truly desirous of seeing workmen succeed to the place in the nation which their numbers would seem to warrant, for the honest purpose of contributing towards the solution of the problem of Poverty, that a little true wisdom in trade councils, a little magnanimity in common things, a little reverence on their part for "the eternal laws of God which know no change," will go farther in establishing the credit of the Labour Party than any number of the gaudiest banners and the brassiest bands that could be convened for a May Day celebration in Hyde Park or anywhere else.

The Meeting of the Incorporated Institution of Gas Engineers.

THE programme for the forthcoming session of the Incorporated Institution of Gas Engineers has reached us; the adjourned general meeting being fixed for Wednesday and Thursday, the 11th and 12th inst., at the Institution of Civil Engineers, under the presidency of Mr. Charles Hunt, of Birmingham. It is notified, in the circular convening the meeting, that advance slips of the papers to be read will be obtainable a few days before, so that members desiring to take part in the discussion of any subject will be able to prepare their remarks with full knowledge of what the writers have to say—a decided step in the right direction. Seven papers are included in the two days' agenda; and, in addition to these, there will, of course, be an address by the President. Mr. George Livesey will contribute a paper on the "Failure of the Wages System of Payment, and the Remedy—Profit Sharing," which ought to arouse an interesting debate; the author's well-known views on the subject being as yet almost peculiar to himself—that is, if belief is to be gauged by practice. Mr. A. F. Browne, of Rotherhithe, is to follow with a memorandum on "Oil Gas Manufacture." Professor V. B. Lewes will also give a paper on the "Use of Oil for Carburetted Gas;" while Mr. T. S. Lacey, of Pimlico, will contribute some "Notes on the Enrichment of Coal Gas with Liquid Hydrocarbons;" and Mr. E. L. Pryce will descant upon the "Comparative Value of Oils for the Purpose of Enriching Coal Gas." The above are to constitute the first day's work. In the evening, the annual dinner is to be held at the Holborn Restaurant. Next morning, the "Technology of Water Gas" will be expounded by Messrs. T. Goulden and A. M. Paddon; and the last paper on the list is a "Description of a Six-Lift Gasholder and Tank at East Greenwich," by Mr. Frank Livesey. The day will be filled up by visits (by steamer) to the Tower Bridge works and the East Greenwich Gas-Works; all the necessary arrangements being made by the President. The South Metropolitan Gas Company will entertain the visitors at East Greenwich. It will be seen that the programme for the two days is a very full one. The questions of the day have been kept in view by the Council in accepting contributions; and there should not be much left to be said about oil gas, carburetted coal gas, or water gas, after the five papers devoted to different aspects of the general subject have been read and discussed. Evidently, the meeting will not be so fruitful in Transactions of an engineering cast as last year's; but obviously chemistry must have an innings occasionally. In the report of the Council, issued with the circular, it is stated that during the past year 45 applications for admission into the Institution have been received. This is an eminently satisfactory sign of the estimation in which the organization is held by the class of professional men for whom it was formed. The financial position of the Institution also is described as satisfactory. Certainly, if there is any taste among British gas engineers for the cultivation of a technical gathering

where professional matters can be discussed without being overshadowed by any other kind of attraction, the Institution should be sufficiently severe and businesslike to meet the want.

The Meeting of the North of England Gas Managers' Association.

THE gas managers of the North of England had a very successful meeting on Saturday; a good assemblage coming together, under the presidency of Mr. R. Wallis, J.P., to hear some decidedly interesting and valuable papers by Mr. V. Wyatt and Mr. W. J. Warner. Mr. Wyatt had two contributions—one being a substantial address upon "Anomalies in Gas Undertakings," composed in the philosophic vein often affected by this talented engineer; and the other a brief but important sequel to the paper of 1889, in which the author suggested a sectional method of constructing gasholder-tanks. This communication proved that Mr. Wyatt's suggestion was no mere "pious opinion," but was intended to be carried out, as opportunity served. The opportunity came at the Redheugh works; and Mr. Wyatt seems perfectly satisfied with the results of his experiment. It may, therefore, be said that the new method is another step forward in concrete tank construction. Besides other considerations, the plan is to be commended for saving the earth in which the excavation is made, from the long exposure to air inevitable with trench work, which is extremely mischievous in the case of most sorts of clay. Whether concrete tanks should be formed at all in tough clay is another matter. Mr. Warner's paper was a very worthy production indeed, and would of itself have redeemed the meeting from the reproach of being common-place. Briefly stated, it was the author's object to show that the sliding scale in gas-works regulation ought to be used very much more freely than is ordinarily done. Mr. Warner is no believer in the generally-accepted policy of spending reserves in order to maintain prices and dividends at a steady point. He would have them fluctuate in closer agreement with the varying conditions of the undertaking; so that the public may feel that there is something in operation to govern the policy of gas directors. He does not lose sight of the value of constant rates of dividend to those who have to go frequently into the Money Market; but he puts the question whether the sliding scale ought to be held so far in the background as it usually is, and whether it would not be better to have more frequent recourse to it. The point is well taken; and we may rest assured that it will not escape the notice of some of the most eminent gas-works administrators.

Discontent in Boston.

THINGS seem to be anything but comfortable in regard to the gas supply of Boston, Massachusetts, where the ingenious Mr. Addicks reigns over the remnant of a Gas Company which once boasted itself as secured in its position more by virtue of the fairness of its dealings than by statute or guarantee. Only those fortresses are invulnerable, however, which have never been seriously besieged. A time came when the eye of the "raider" was attracted by the remarkable spectacle, for the United States, of a large city supplied with gas by one Company, which was selling at a low rate, and doing reasonably well by all parties. Such a state of things was clearly scandalous, and Mr. Addicks felt a call to show the local aldermen and others a more excellent way. After having been repulsed several times, the raid succeeded only too well; and Boston awoke one morning to find itself blessed, or cursed, with two Gas Companies where one had been sufficient for all practical purposes. How the trick was done will never be known. Mr. Addicks is apparently a skilful operator; and his backers were not men to stick at the price of an alderman or two, when it came to the point. The treachery of the aldermanic body was, of course, veiled at the time in the usual specious phrases about the benefits to be expected from competition in gas supply as in other matters; and so the transaction was concluded without, in all probability, the Boston public becoming conscious of the fate prepared for them. Of course, nothing was farther from the mind of the astute Addicks than competition, in the natural sense of the term. He was obliged to start a new Gas Company as a means of introducing himself into the city, and with this Company, which was himself "writ large," he, in another capacity, made a contract, of gorgeous appearance, for the construc-

tion of gas-works. He did buy a piece of land, it seems ; but this bit of real estate, and his parcel of aldermen, were all his gas-making preparations at the commencement of his campaign, which ended in the capture of Boston. A brilliant stock operation, of the nature only too familiar to our Transatlantic friends, whereby the capital of the old Boston Company was "watered" sufficiently to recoup Mr. Addicks for his trouble and outlay, completed the victory of this clever gentleman, who now occupies the dignified and lucrative post of Treasurer of the Boston Gas Company, keeps his yacht, and is universally respected in the super-select society of the "hub of the universe." It is quite an improving tale of the "Good Young Man who 'didn't Die' type ; but, unfortunately, it is not yet finished. Boston is awaking to the consciousness that it is paying \$400,000 a year more for its gas than would have been necessary if the genial Addicks had bestowed his expensive favours elsewhere ; and so a number of the largest consumers are moving the State Legislature to see if they can upset him. We do not for a moment suppose that these proceedings, which are connected with the Boston gas news reported in last week's JOURNAL, will seriously hurt Mr. Addicks, or even cause him very much uneasiness. Capital, however obtained, is too sacred a thing for State Legislation to meddle with for the mere sake of public interest. These things are rather amusing, however, and certainly tend to bear out our old opinion, that the gas managers of the United States have a good deal to think of besides the plain technical matters which employ their British brethren. For what conceivable fraction of responsibility in fixing the price of gas can be ascribed to the gas manager's technical work, in face of the vagaries of such disturbing causes as that which, in the case of Boston, is represented by the modern Aquarius—J. E. Addicks ?

Mr. R. G. Shadbolt, Assistant-Manager at the Fleetwood Gas-Works, has been appointed Engineer and Manager to the North Bierley Gas Company.

Dr. S. Rideal has been appointed Gas Examiner for the area under the control of the Lewisham District Board of Works, in succession to the late Mr. C. Heisch.

The Metropolitan Gas Companies' Accounts for the Past Year were presented to Parliament last Tuesday, in accordance with statutory requirements, and ordered to be printed.

The Recent Re-Assessments and the Cost of Public Lighting.—The South Metropolitan Gas Company have informed the Woolwich Local Board that, in consequence of the Board having increased the Company's assessment, the price for the public lamps will be raised from £3 3s. 9d. to £3 9s. per lamp per annum ; but if the higher assessment is not enforced, there will be no change in the cost of lighting.

The Huddersfield Corporation and Inclined Retorts.—A deputation of the Gas Committee of the Corporation of Huddersfield, accompanied by their Engineer (Mr. W. Ralph Herring), journeyed to Brentford last Wednesday, and, by permission of Mr. Frank Morris, inspected the system of inclined retorts (112 mouthpieces) as worked by the Brentford Gas Company. The Chairman of the Committee himself charged one retort in seven seconds ; and the deputation were thoroughly satisfied with the working of the system.

An Important Discovery of Rich Coal at Launceston (Tasmania).—The prospectors employed by the Mole Creek and Zeehan Mineral Prospecting and Exploration Company, Limited, recently brought in, for the inspection of the shareholders of the Company and for analysis, some heavy samples of cannel coal, or oil shale, which they reported had been discovered in outcrops of scores of tons on the surface. Some of this coal was submitted to the Engineer of the Launceston Gas Company (Mr. T. S. Cleminshaw, Assoc.M.Inst.C.E.), who tested it in regard to its value for gas-making purposes, and reported as follows : Quantity of gas (average of four tests), 11,200 cubic feet per ton ; illuminating power (average of three tests), 50.40 candles. The residue was non-coking, and valueless for fuel purposes ; being similar to the coke produced by the richer sorts of cannel. Its volume was 55.5 per cent. When broken, the sample exhibited signs of being an outcrop specimen ; and water was visible internally. The tarry vapours, from their appearance, indicated the presence of oil. Mr. Montgomery, the Government Geologist, after inspecting the specimens, pronounced the discovery a most interesting one for Tasmania. The quality of the gas produced shows 2 per cent. higher illuminating power than that of the best kerosene shale of New South Wales ; and the quantity will improve as it gets under cover. The value of the coal as a marketable commodity for gas-producing purposes in the colonies is now considered to be in every sense assured ; and it is confidently believed that it will also produce oil in very large quantities.

WATER AND SANITARY AFFAIRS.

As the preliminary statements of the London Water Companies have now been sent in, though some of them not until yesterday, it may be hoped that a commencement will be made in the reception of evidence at the meeting of the Royal Commission on the Metropolitan Water Supply to be held to-day. Other public bodies, including the County Council and the Corporation, have been asked in like manner for documentary statements. The result will be interesting, especially as the proceedings of the Commission will be open to some portion of the Press. The Water Companies have a strong case ; and they have every reason to court publicity. Their opponents have had a long hearing, while the Companies have made no reply, except in the shape of a speech from a Chairman at a half-yearly meeting of shareholders, or a few remarks in the course of a parliamentary debate, with occasionally, but very rarely, a letter from an independent correspondent in *The Times*. The Press, as a rule, has been hostile to the Companies ; and the editorial pen has attacked them without stint. Calm and judicial inquiry may now be expected to dissipate many fallacies, and to abate the force of prejudice. Concerning the New River Company, which, despite the title, is by far the oldest of the eight—some striking facts are likely to be elicited, showing the enormous supply which the Company are able to draw from their deep wells. Such are the resources in this direction, coupled with the volume now taken from the Lea, that there is every prospect the Company will be able to cope with the demand for the next forty years, supposing the population to go on increasing at the same rate as for some years past. If in future the growth of the population is maintained at only the same rate as for the last two years, the supply will hold good for more than half a century. If facts like these are fairly demonstrated before the Royal Commission, there will be little room left for the contention that London is under any necessity to expend millions of money in order to get a supply from Wales or the West of England. Not only the New River Company, but all the Companies supplying London and its suburbs, will be able to show resources far beyond what the County Council have seen fit to allow. At the very utmost, taking the case of the Thames, all that may be needful in the shape of novelty will consist in the provision of compensation water. Unquestionably there is water enough, only some of it comes at the wrong time. Another point is the question of monopoly. We believe we are right in saying that there is a clause in the Charter granted to the New River Company, by which it is provided that no water may be supplied to London or Westminster except with the consent of that Company. It may be presumed that the Company have consented to what has been done in other districts than that which they now serve ; but the mere existence of such a clause is sufficient to show the legal basis on which the water supply of London has been established. Parliament may abrogate the clause ; but it has not yet done so.

The monopoly of the water supply is keenly discussed by correspondents in *The Times* ; and we do not know but what Colonel Makins has conceded rather more to his opponents on this question than was needful. Assuredly, the water supply of London is in the nature of a regulated monopoly, in the exercise of which the Companies possess a statutory guarantee so long as the prescribed conditions are fulfilled. One of the disputants, in reply to Colonel Makins, evidently apprehends this point. He endeavours to show that "the obligation to provide water has already been violated ;" and he expects that this will be proved in evidence before the Royal Commission. We can expect nothing of the kind, seeing that the domestic supply per head in the Metropolis far exceeds that of several large towns in the kingdom, and is really lavish in its abundance. Supposing it could be shown—which we do not at all anticipate—that one Company has experienced some difficulty in keeping up the supply, is that to be a reason for disestablishing all the rest ? If, on the other hand, it is shown that the Companies have fulfilled their obligations, the principle comes into operation which the objector has himself admitted—that Parliament will grant compensation on the profits earned in the case of the Companies loyally fulfilling their duties. The opponent can be successfully met on this ground, and compensation claimed accordingly. Yet there is another barrier raised against justice being awarded to

the Companies. When they have done all that they were required to do, they are to be pronounced unprofitable servants, because it is assumed in certain quarters that they will not be able to fulfil their duties at a future date. It is argued that if a jury are assessing the value of a going concern, with no very heavy outstanding engagements, they fix one price; and if they are valuing a similar business with a heavy bill coming due at the end of a few months or years, they fix a very different price. But the Water Companies have no heavy bill coming due. They are in the position of a tradesman who has to enlarge his premises and to embark additional capital from time to time, in order to conduct his business on a more extensive scale. As for the ability with which the Metropolitan water undertakings are conducted, Colonel Makins offers a weighty consideration when he says there is much more danger of jobbery and extravagance where public money is being expended by elected councillors, than when there exists the personal interest of investors who work for a profit, as a stimulus to economy and careful management. Had the Metropolitan Water Supply been in the hands of a County Council from the beginning, we venture to say that the consumer and the ratepayer would alike have suffered.

Mr. Ralph Fearnley, of Rastrick, has been appointed Manager of the Chorley Corporation Gas-Works.

The Murdoch Memorial.—The Committee in charge of the Murdoch Memorial, through the Secretary (Mr. James M'Gilchrist, of Dumbarton) have commissioned Mr. D. W. Stevenson, R.S.A., Edinburgh, to execute in marble a bust of William Murdoch, the Inventor of Gas Lighting, to be placed in the Wallace Monument, where he will be in the company of his friend and partner James Watt. The model is already prepared, and has been approved of by the Committee; and the bust will be unveiled this year—the Centenary of Gas Lighting.

The First Visible Colour of Incandescence.—Writing to *Nature* on a recent occasion on the subject of the first visible colour of incandescent iron, Mr. T. C. Porter describes how he tried a similar experiment with the carbon filament of an ordinary incandescent electric lamp. For this purpose he employed an 80-volt Edison-Swan 16-candle lamp; and the method of heating it gradually was to pass a current, supplied from a battery of accumulators, through the lamp and a water resistance, which latter was gradually reduced by the addition of sulphuric acid. The room in which the experiment was performed was very carefully darkened; and the observers were kept in darkness some minutes before the current was switched on. As the current was increased by regular stages, the observers (25 in number) carefully inspected the lamp in rotation, and every one of them wrote down his impressions of the colour of the filament in the dark, so that their eyes were not affected by extraneous light. Of the whole body of observers, all agreed that the colour of the filament was at first very pale. Thirteen called it a very pale yellow; three termed it white; seven, a faint pink; two, a bluish white. All agreed, also, that as the temperature rose, the colour grew deeper and redder; passing through orange before arriving at crimson. The words used to designate the final tint reached in the experiment varied from deep reddish orange to copper colour, dark red, blood red, crimson. In diffused daylight this would be called a dull red.

A Remarkable Gas Explosion.—A remarkable gas explosion is reported in the columns of our contemporary *Engineering* by Mr. J. H. Apjohn, Vice-Chairman and Engineer to the Calcutta Port Commissioners, illustrating the way in which light carburetted hydrogen may sometimes occur in unexpected places. It is stated that in July, 1890, a vessel loaded with vegetable produce of various kinds, and ready to go to sea, was sunk at her moorings in Garden Reach by another vessel running into her. For local reasons the wreck was suffered to lie where it sank; being duly marked with buoys. Eighteen months later, another vessel happened to strike the wreck with her bow, as she was being turned preparatory to leaving the port, and within a very short time afterwards, variously estimated by the different witnesses at from 45 seconds to 4 minutes, an explosion occurred in her fore-castle, where the crew were at the time having their breakfast, which killed two of them on the spot and so seriously injured the rest that seven more subsequently died in the hospital. The suggestion was offered that the explosion was due to foul air from the wreck, which at first seemed to Mr. Apjohn to be incredible; but, on looking into the matter, he found that this was undoubtedly the cause of the accident. Bubbles rising from the wreck were found to consist of marsh gas; and it was discovered, upon examination of the second vessel, that in touching the sunken ship she had torn a hole in either bow, through which, during the momentary period of contact of the two vessels, sufficient marsh gas from the decomposing submerged vegetable matter had entered to form an explosive mixture with the air in her forepeak. This ignited at the nearest light, with the result recorded. The incident is perhaps the most extraordinary explosion of inflammable gas to be found in technical annals.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 814.)

THE revival of business on the Stock Exchange still remains postponed *sine die*. The past week was quiet and humdrum; the settlement (which was not heavy) enjoying all attention, and fresh business being but lightly entered into. Purchases for investment progressed; and this class of business received an additional fillip when the Bank rate was, somewhat unexpectedly, reduced to 2 per cent. from the $2\frac{1}{2}$ per cent. rate fixed on the 7th of April. Two per cent. is the Bank minimum rate; and it is just four years since it last obtained—the rate stood at 2 per cent. from the middle of March to the middle of May, 1888. As far as can be foreseen (but that is not much), there is no reason why the minimum rate should not hold good for many weeks. Business in the Gas Market has been rather dull; and movements have been somewhat contradictory and irregular. The chief feature was the flatness of Gaslight "A." The tendency to weakness evinced the week before was confirmed at the opening; and a further fall took place. Prices gave way pretty well every day, until the quotation closed at 202-207, with business marked at 203. Moderate transactions were effected in the debenture, preference, and limited issues, at steady figures; "J" being the strongest at a further rise of 1. South Metropolitan, on the other hand, though not active, were very firm; and the "A" advanced 3. But no business was done in it. A few transactions were marked in Commercials at low figures; but the corner is probably turned by this time, and those who have been shrewd enough to buy in the falling market will reap the benefit. The Suburban and Provincial undertakings remain very quiet and uneventful; the only move being an advance of 1 in Brentford new. The Continental Companies are firm and quiet; the principal issues being unchanged. But Continental Union preference has made an improvement of $2\frac{1}{2}$; and Cagliari rose 1. Of the Indian Companies, Bombay was in fair demand at good prices; but Oriental has been inactive. Among the South Americans, nothing has moved but San Paulo, which recovered $\frac{1}{2}$. Water has settled down; and very little business was done in any of the Companies. The tendency remains favourable; and one or two further advances of slight extent have been effected.

The daily operations were: The Gas Market was extremely quiet on the opening day; and little beyond a few transactions in Gaslight "A" was marked. The latter was weak, and fell $2\frac{1}{2}$. Business continued very restricted on Tuesday. Gaslight "H" and "F" were done at medium prices; but "A" was not touched, and quotations did not move. In Water, Chelsea advanced 2. There was decidedly more activity on Wednesday throughout the Gas list; and an advance of $2\frac{1}{2}$ was effected in Continental Union preference, and of 2 in Brentford new. In Water, both Lambeth issues advanced 1. On Thursday, Gaslight "A" receded afresh, with a fall of $2\frac{1}{2}$; but the "J" rose 1. South Metropolitan "A" also improved 3; and Cagliari, 1. On Friday, a further fall of 1 was marked in Gaslight "A"; but San Paulo recovered $\frac{1}{2}$. Saturday was an especially quiet day, in view of the Exchange being closed on the following Monday; but Gaslight "A" contrived to recede 2 more.

ELECTRIC LIGHTING MEMORANDA.

Local Authorities and Electric Lighting Orders—Choking Coils and Regulator Lamp Sockets—The Illuminating Power of the Bath Arc Lamps—The Metropolitan Electric Supply Company—Mr. Preece on the Union of Electric Lighting and Water Supply.

THE ways of municipal corporations having Electric Lighting Orders to carry out are a grievance to our contemporary the *Engineer*, as they doubtless are to a good many other people with a more immediate interest in the practical working of the Act. It is complained that when corporations are in possession of Electric Lighting Orders which they have finally made up their minds to carry out themselves, instead of calling in an electrical engineer, to make a design for the necessary plant, they often adopt the trick of inviting tenders from competing firms of electrical contractors, with the result that a great deal of money is spent to waste by the latter upon unsuccessful tenders. This money they naturally try to save from somebody; and so it happens that when any firm of contractors do manage to get a corporation contract, with no engineer to look after them, they usually succeed in putting in so many "extras" that the ultimate cost of the plant is found to be unnaturally enhanced thereby. "Thus eventually the ratepayers have to stand the cost of all the muddle and waste engendered by a loose system of tendering and contracting for public works." Our contemporary therefore concludes that it would be much better if, instead of asking for designs and tenders, local authorities contemplating electric lighting would employ competent engineers to plan the installation beforehand, just as is done with most other public works. This contention is reasonable enough; but it appears to us that our contemporary loses sight of the initial difficulty

that besets a local authority embarking upon this kind of enterprise, which is, to find a reliable adviser who can be depended upon to deal with their Order on its merits, and not make it a peg whereon to hang his own preconceived ideas. They really want to know which is the best system of electrical generation and distribution to adopt, before calling in anybody; because when they have once got into the clutches of Professor A., or Mr. B., or Dr. C., he will be certain to recommend his own pet system, whatever it is. This difficulty does not exist in anything like the same degree in other branches of engineering.

There has been some little discussion lately in electrical engineering circles upon the subject of so-called "choking coils"—which have no connection, be it understood, with any device for executing criminals by electricity. They appear to be something like transformers, inasmuch as they take off a portion of the charge from the conducting wire to which they are applied. Practical use is made of these "choking coils" in the construction of certain regulator sockets for incandescent lamps, in which the possibility of lowering the light is the chief recommendation. Our contemporary the *Electrician* has made a calculation of the difference in cost which may be expected between the use of a regulator socket for reducing the light emitted by a lamp, and simply shading it to the same degree by a screen. According to this computation, there should, upon a lighting period of 2500 hours, be a balance of about 6d. in favour of the regulator socket. But as the socket itself may be supposed to cost something extra, there can hardly be much real economy attending its use. It seems scarcely likely any noticeable saving can be secured by turning down electric lamps till the problem of storing electricity is solved; and then a great many other things will happen.

The Electric Lighting Committee of Bath have had the illuminating power of their street arc lamps tested by an independent examiner, with the result that the nominal 1200-candle power lamps are reported to be quite correctly described, but that this quantity of light only applies to the performance of the naked arc, and does not represent the net lighting effect produced after allowance is made for the loss by ground-glass or opal globes. With regard to the absorption of light by the latter, it was ascertained once more that clean ground-glass globes stop from 42 to 46 per cent. of light, and opal glass stops from 54 to 70 per cent. when clean, and more when dirty. Seeing that lamp-glasses generally are dirty, and that ground-glasses especially can hardly be satisfactorily cleaned when it has once become grimy, it would appear that the citizens of Bath may think themselves lucky if they get one-half or even a quarter of the nominal amount of light radiated from their arc lamps. We are, of course, not surprised at this; but when nothing of the kind is mentioned at the time of giving out the electric lighting contracts, but the degree of proposed illumination of the streets is expressed in terms of the brilliancy of the naked arcs, it is only natural that the citizens should feel a little aggrieved at the result.

The Metropolitan Electric Supply Company is the second largest venture of the kind in London—indeed, since the London Electric Supply Corporation have been so hindered by their misfortunes, the Metropolitan may be ranked as the most considerable. This is a concern which has not "all its eggs in one basket;" but maintains several stations supplying current upon the moderate high-pressure system from centres near Lincoln's Inn, Holborn, and Oxford Street. They have another station in hand in Paddington. Altogether, the Company have spent £486,926 upon capital account, and have come to the end of their tether, so they propose to raise £100,000 more by the issue of debentures. Here again, therefore, may be seen the not altogether satisfactory spectacle of an open capital account while the money already sunk is not so productive as could be desired. Still, it is clear enough that, until an electric lighting district is fully wired, it is impossible to say whether it will prove profitable to work, or the reverse. The net revenue of the Metropolitan Company for last year was £9720, out of which the Directors recommended a final dividend of 2s. a share.

Mr. W. H. Preece has been lecturing before the Liverpool people upon the interesting subject of the utilization of the waste forces of Nature—of course, with particular reference to the possibilities of cheapening electric lighting by obtaining this form of energy from other sources than the heat of burning coal. He specially appealed to his audience by referring to the waste of the power which will be represented by the loss of head in the Vyrnwy aqueduct. The total energy continuously expended by the water in its fall from Lake Vyrnwy to Liverpool will be about 7000-horse power. While admitting that much of this will be disposed of as friction, Mr. Preece remarked that "it is well worth the consideration of our water authorities whether some utilization of this wasted energy in water-works generally cannot be effected so as to deliver it in the form of electrical energy in our streets and buildings. The whole of the streets of Liverpool could be brilliantly lighted by the energy wasted in the Vyrnwy aqueduct." It has often been urged that electric lighting ought to be combined with the gas supply of towns; and we have never been able to accept this view of the case as altogether the correct one. To make electric lighting a branch of a gravitation water supply is, however, another and a totally distinct suggestion; and we shall be pleased to help in shifting the responsibility for cheapening electric lighting from the shoulders of gas engineers to those of their water brethren.

A MEMOIR OF MURDOCH.

IN last week's JOURNAL, reference was cursorily made to a little book about Murdoch, the inventor of gas lighting and of a great deal besides, written by his descendent, Alexander Murdoch, of Pollokshields, and now on sale for the benefit of the Murdoch Memorial fund,* which, as is well-known, is under the control of the North British Association of Gas Managers. It is unnecessary to discuss here the claims of the inventor of gas lighting, whoever he might be, to a national memorial. If the recognition by society of its benefactors were always gauged proportionately to the material good done by, and in consequence of, the acts of the latter, it is hard to say what bounds should be set to the commemoration of such names as those of the first man to apply coal gas to the purpose of lighting, or the discoverer of the method of maintaining roadways in a usable state, or any similar practical improver of the conditions of civilized existence. By what is doubtless a wise, as it certainly is a deep-seated discrimination in these matters, however, the world does not care to memorialize these useful persons in the same way as it does its heroes of peace or war, or its prophets and teachers, spiritual and secular, who would scarcely, as a class, rank as merely "useful" in their age and degree. It is idle to deny or to overlook this tendency of mankind—it actually exists, and must be reckoned with; and a most striking illustration of the fact is to be found in the circumstance that it has been left for the North British Association of Gas Managers to petition for a resting-place for the portrait-bust of their ingenious prototype in the interior of the monument which impresses the memory of Wallace Wight upon the perceptions of all visitors to the spot which is so deeply hallowed by the most momentous incidents in the long tragedy of Scottish national history.

When one ponders these things, one can in a little time understand how the deep conscience of mankind works with regard to them. It is impossible to weigh in the same scale, or to reward in the same kind, the deliverer of a nation and the discoverer of a new industrial process. Take it how we may, the latter proceeding is something "in the way of business," the production of which does not necessarily argue any sort of merit in the person whose name happens to be identified with it in industrial chronicles. The world looks at an inventor in this way: He is successful and makes money, in which case he has his reward; or he is unfortunate, and for some reason fails of the recompense on which it is reasonable to suppose he counted. In the latter case, he is to be pitied; but his misfortunes rarely touch the hearts of his fellows differently from those of any other unsuccessful man of business. This may seem a hard saying to ears that have been seduced, by the flattery of such as are interested in patents, to believe that the inventor, *quâ* inventor, is the greatest benefactor of his species. It is a part of the superficiality of much that now-a-days passes current for common sense and worldly wisdom, to exalt the material and the useful at the expense of the real and the true; but, somehow, in Fame's long account with Time, these mistakes of an hour do not affect the final balance.

Now, bearing in mind what has just been said, it will be perfectly clear that the first name to be associated in technical history with the application of coal gas to lighting purposes might very well have been a name, and nothing more, in the estimation of posterity. Yet another reason besides those which arise from the considerations already advanced may be given in explanation of this statement. It is this: The world is growing ever more and more chary of taking at their own valuation, or that of their friends and partizans, the individuals who, personally or by proxy, claim to be able to say of anything under the sun "Alone I did it!" We appreciate the one-man power quite as highly as it deserves; but we no longer accept so readily as did our forefathers the proposition that the one-man power is to be credited with everything that, in the shorthand which we call History, is labelled by the name of a particular individual. Processes are the fruitage of ideas, and ideas come—who knows how or whence? At certain times particular orders of ideas are "in the air," and a man cannot tell how many sleeping partners he has in his own projects.

And so it is that something more than the crude reputation of having been the originator of a particular process, or the discoverer of a special application of a natural force or product, is needed to arouse our interest in a man. Suppose, for example, that the originator of gas lighting had been a mere guesser, like the man who first "struck oil" in Pennsylvania thirty years ago, and recently died in poverty and obscurity. Let it be imagined that the first application of gas to lighting purposes was a "lucky hit." Would there then be any reason to remember the name of the undeserving recipient of Fortune's favours? By no means. Although the first gas engineer had been the happy possessor of a patented specialty as productive of gold as the big oil monopoly of America, this would not warrant us in observing his centenary. Will the Big Panjandrum of the Standard Oil Company be remembered a hundred years hence? Perhaps, if he pays for the luxury; but hardly otherwise.

If Murdoch's name had merely come down to us as that of the man who first thought of putting the light of coal gas to

* "Light without a Wick. A Century of Gas Lighting; 1792-1892. A Sketch of William Murdoch, the Inventor." By Alexander Murdoch, of Pollokshields. Glasgow: R. Maclehose, 153, West Nile Street.

systematic use, it would have been fair to remember it as that of a striker-out of a new path for industry. It is conceivable, however, that there might have been no advantage in knowing any more of the bearer of the name. Just as, for the sake of rounding off the story, the historian of California sets down the name of the first man known to have found gold in the country, without treating the fact as necessitating his narrating the biography of the man, unless the finder happens to be a notable character in other respects. In the case of Murdoch, we are happily able to say that this Ayrshire millwright, who, like so many of his compatriots, "cam' Sooth" at an early age, and whose life-history attracts the sympathetic attention of the followers of the industry which he was the first to practice, well sustains, as a man, the interest which he arouses as an inventor. For this reason, we cordially recommend all those connected with the executive side of gas supply who read these lines, to procure a copy of Mr. Alexander Murdoch's little work, which will tell them what manner of man William Murdoch was, and some of the things he did; and we shall be content to be blamed as a false guide if those who take our advice—when they have gazed upon the strong, homely, kindly lineaments of the first gas maker, as reproduced in photogravure of the portrait by Graham Gilbert which forms the author's frontispiece, and have carefully read the simple story of the man whom James Nasmyth, with generous appreciation, described as "that incomparable mechanic . . . a man of indomitable energy, and Watt's right-hand man in the highest practical sense"—do not lay the book aside with the verdict: "Here was a man of men, whose invention of gas lighting does but serve to illuminate his mechanical genius and sterling character, for which, rather than for any particular fruit of his untiring industry and bold originality, may his name be ever held in honourable remembrance by those of his blood and speech; and may his spirit inspire all who follow in his steps to work as he did—honestly, skilfully, and modestly, with the materials lying readiest to hand—for a worthy end." We are grateful to the kinsman-author for this glimpse which he has given to us of a truly notable man. Such stories as this of Murdoch are good for the world to know. Here we may read how the gifted Scotch mechanic, who gave the world the germs of steam locomotion and gas lighting, not only received nothing for these epoch-making inventions, but was mercilessly snubbed and treated as a hack by his eminent, but apparently selfish employers, Boulton and Watt; how he outlived their indifference, and survived to see, indeed, his grandest productions returning gains and profit to others, but at least to enjoy in easy comfort the placid eventide of a well-spent life "with all that should accompany old age, as honour, love, obedience, troops of friends," and to see (as he must have done) in the growing of the industries which he initiated, the guarantee of his own lasting renown.

Dr. R. Thorne Thorne, F.R.S., has been appointed Principal Medical Officer of the Local Government Board, in succession to Sir G. Buchanan, F.R.S., resigned.

The Gas and Water Companies' Directory, &c.—The Editor of this useful work (Mr. Charles W. Hastings) asks to be allowed, through the medium of the JOURNAL, to request officials of gas and water companies, corporations, and local boards who have not yet returned the forms sent to them by him, to do so at their earliest convenience, in order that there may be as little delay as possible in the completion of the book. It is obvious that the date of its issue must depend upon the promptitude with which the statistics collected therein are supplied; and while thanking the large number of engineers, secretaries, and managers who, during the last fifteen years, have rendered such signal service by furnishing him with information, Mr. Hastings expresses the hope that this reminder to those who have not done so will bring a response from them, and enable him to publish, at an early date, the result of their combined labours.

Waverley Association of Gas Managers.—The 62nd half-yearly meeting of this Association was held on Thursday, the 14th ult., at North Berwick. Before commencing the business, the members and friends (who assembled in good numbers) visited the gas-works, under the guidance of the Manager (Mr. J. Black). They then proceeded to the Royal Hotel, where the meeting was held—Mr. J. Smith, of Rosewell, presiding. The Secretary read the minutes of the previous meeting; and they were approved of. The members then appointed Mr. J. Black, of North Berwick, President for the ensuing year; and Mr. G. Taylor, of Jedburgh, was re-elected Secretary and Treasurer. After a short address from the President, various subjects connected with the manufacture of gas were discussed—viz., leakage from mains, pressure on retorts, and the probable use of paraffin oil as a substitute for first-class cannel. At the close of the meeting, the members and their friends drove along the sea coast to Canty Bay. On their return, they dined in the Royal Hotel—Mr. Black presiding, and the croupier's chair was occupied by Mr. Smith, of Rosewell, the retiring President. The principal toast—"The Waverley Association"—having been duly honoured, it was responded to by Mr. W. Robson, of Selkirk, the oldest member, who afterwards presented the gold medal of the Association to Mr. Smith, by whom it was suitably acknowledged. The next meeting will be in September, at Peebles.

THE INCORPORATED INSTITUTION OF GAS ENGINEERS.

FIRST VOLUME OF TRANSACTIONS.

JUST in time to avoid the reproach of being too late, the first Volume of Transactions of the Incorporated Institution of Gas Engineers has appeared; thus marking the close of the opening year of a young, and, from one point of view, an experimental organization. We cannot go so far as to say that this volume, which has been so long in preparation, is really ill-timed in its appearance at the present juncture, when the gas engineering world is beginning to ask what the second annual meeting of the Institution will be like. Indeed, the book appears very appositely, and will serve as the best of all advertisements of the coming meeting. For it is only doing common justice to state that the volume now before us constitutes in itself the very best justification that could have been found for the creation of the technical organization of which it is the first-fruit. The opening meeting of the Institution, as we remarked at the time, was an eminently good and successful one, and must have amply rewarded the pains and anxieties of the moving spirits in the venture. There was much in connection with the meeting, however, which could hardly be appreciated at its full value even by those who attended the gathering, and would of course wholly escape the appreciation of absentees. We refer to the numerous and elaborate plans and diagrams illustrative of the papers, the sight of which, covering as they did the interior wall-surface of the lecture-theatre in Great George Street, was as bewildering and oppressive as it was tantalizing. We freely acknowledged at the time that Mr. Alfred Colson's paper upon the Leicester Gas-Works extensions, which was the masterpiece of the show, was the most complete, instructive, and altogether admirable production of the kind that had ever been brought before a gas engineering audience. But its very elaborateness and richness of detail militated against its being fully appreciated at the time. There is no practising engineer but would be glad to have such drawings to study whenever called upon to face the same problems as those dealt with by Mr. Colson; but the place to examine these plans, and to criticize with a view to improving upon them, was obviously not the meeting-room of the Institution. Having the responsibility, as well as the privilege, of publishing Mr. Colson's plans, and also the drawings illustrating the labour-saving machinery at the Kensal Green works, the oil and water gas experiments at Beckton, &c., it is not at all to be wondered at that the Council of the young Institution hardly knew what to do. Happily for their own credit and the reputation of the Institution, they decided to do the thing handsomely; and in consequence of this praiseworthy resolve, their first Transactions are enriched with no less than thirty-four folding plates referring to the Leicester extensions—thus making the volume of unique value among technical books. For this splendid set of drawings alone, it deserves to rank high among the textbooks of gas engineering. We shall best do justice to the subject, perhaps, by declaring roundly our conviction, which no one who has seen the work will dispute, that no gas engineer can afford to be without a copy of it.

The question of the publication of Transactions of technical societies is a subject upon which we, in agreement with other journals which have a great deal to do with reporting this kind of literature, entertain very decided opinions. The world moves, even in regard to the performances of scientific and technical societies; and it is necessary for those outside observers who are in a position to feel the movement, to bring a sense of the facts home to the comprehension of the permanent officials of such societies, who are commonly routineers, and to the members of their councils, whose interest in the management is generally spasmodic and often perfunctory. Time was when scientific and technical societies were almost secret bodies. If they kept any record of their discussions and transactions, these were only in manuscript form, and the outside world knew nothing of them. The collection of this information, and the printing of it for publication, was a very long stride in the way of progress; and it immensely increased the usefulness of the societies which adopted this principle. When they did this, however, and when the publication in book form of printed Transactions became a recognized duty of every respectable technical organization, there was no such thing in existence as a technical press, undertaking, in the ordinary way of business, the reporting of the doings of society meetings, and thus converting the Transactions of the latter into news. It cannot be denied that the appearance of the technical journal wrought a great difference in the relations between technical societies meeting in public and the outside world. It does not seem, however, that the policy of those who are responsible for the conduct of such societies has been modified in reasonable accordance with the alteration and improvement of their opportunities for reaching the wider public which cannot, by force of circumstances, attend meetings, and is not always prepared to purchase volumes of Transactions.

We do not propose to enter into a long discussion of this vexed subject now. The way in which technical societies treat the technical press is as various as the number of such organizations is large. Some take no notice of the existence of any other means of publication besides their own, whatever these may be. Others give every facility for the reporting of

their proceedings. Between these extremes, there are to be found examples of every shade of compromise. As we have argued in previous references to this question, it would often be possible for Councils of Societies to save a good deal of money in reporting, while ensuring the better and fuller transcription of their discussions into a technical journal, by co-operating with the best journalistic reporting agency. This remark, of course, applies only to such portion of the proceedings of a Society in public meeting which can be treated as news matter. After this comes the consideration of the Transactions, which must be published by, and on the responsibility of, the Society itself; since, if they are to be worth anything at all, they should comprise matter, drawings, &c., which no technical journal could afford to embark upon.

This is the reason why the present volume of Transactions of the Institution of Gas Engineers is so valuable and noteworthy a production—simply through the inclusion of plans and drawings which are not to be had elsewhere, and which, being published, are indispensable to gas engineers. For the rest, the book is neither better nor worse than others of its class. There is nothing new to be said respecting the matter of the papers and discussions, which were abundantly noticed at the time. It is certain that these Transactions set a standard of quality for the work of the coming meeting, which it will not be easy to live up to, much less surpass. Let us hope that, under Mr. Charles Hunt's presidency, the Institution will provide its members with another dish of technical fare not inferior to last year's production. The time is very near at hand when curiosity upon this head must be satisfied one way or the other, for the present year's meeting is to be opened at the Institution of Civil Engineers to-morrow week.

COMMUNICATED ARTICLE.

THE PRESENT POSITION OF THE GAS-WORKS RATING QUESTION.

By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S.

(Concluded from p. 747.)

The method of arriving at the fair rateable value of a gas undertaking, has lately been described in these columns by one of the best authorities on the subject—Mr. Thos. Newbigging; and therefore I assume that the reader is well acquainted with the same, and that there is no occasion for giving detailed explanations or examples of it. Worked out with a due regard to the precedents established by custom, it affords a satisfactory result as judged by the above considerations. Without accepting or approving every detail of the *modus operandi*, it is capable of effecting a fair and just division of profits between the landlord and tenant. The average rate of dividend paid would be about 7 per cent. on the total paid-up capital, including debentures and premiums; and by means of this method of valuing, about 4 per cent. is awarded to the landlord and about 3 per cent. to the tenant. After taking off floating capital, preliminary and establishment expenses, and other items not rightly chargeable in the capital of the hypothetical landlord, the 4 per cent. would give him an actual 5 or 6 per cent., which is a fair rental; while the tenant's profit of 3 per cent. does not represent a higher figure than that which could be shown, from actual examples of gas-works let on lease, to be usual in practice. It is an old established formula with gas engineers, that a fair rateable value is something more than half the disbursed profits, or 3 to 4 per cent. on the total capital. Taken in connection with the price of gas, the profits represent from 10d. to 1s. 3d. per 1000 cubic feet, of which the rateable value covers 6d. to 8d. Taking the rates at 6s. in the pound, this amounts to a charge of about 2d. per 1000 cubic feet of gas sold.

So long as the rateable value remains at something under two-thirds of the actual profits—4 per cent. of the total capital, or 2d. per 1000 cubic feet of gas sold—gas companies would not complain. But of late they have had to contend, in many cases, with attempts to raise the rateable value considerably above these proportions—sometimes reaching as high as the total profits, and representing an actual payment of 4d. per 1000 cubic feet of gas sold. And this in the face of the fact that both the capital employed and the rates of profits divided, as compared with the output, are lower than they used to be. When the gas company appeals, their case is supported by the production of a valuation prepared on the lines just indicated. Against them professional valuers are put forward, who leave the final issue out of the question, but direct their attention to the details of the present method of valuing. They traverse the items of the revenue account, and throw out several as chargeable to capital; arriving at a sum for so-called net receipts that represents perhaps half as much again as the disbursed profits, and which if earned would be of no additional benefit, seeing that the law limits the amount to be divided. In effect, they propose to base the rateable value on a fictitious case that cannot exist in fact. Continuing to apply a similar process to tenant's capital and the landlord's deductions for wear and tear, they arrive at a result which leaves the tenant little or no profits at all. Sometimes they go so far as to award the whole of the

available profits to the landlord, in which case it would follow that the tenant would not even get any interest on his capital.

At the time when the precedents generally accepted by gas companies and by the majority of assessment committees were established, it was a very usual custom to let gas-works on lease. In case of dispute arising, it was easy for either side to put actual lessees of gas-works into the witness box; and there is not much difference between a lessee and a hypothetical tenant under the Act, where a valuation is to hold good for a term of years. Under these circumstances, disputes could be settled by reference to existing facts. But the practice of letting gas-works on lease has now become almost obsolete; and so the inquiry must follow on theoretical grounds only—a state of things that is unfortunate for gas companies, as the opposition valuers are now in a position to gain credence for arguments that formerly would have been effectually disposed of. When once this method is attacked and subjected to modification, there is no saying where the innovations will stop. It is just as easy to prove on paper that the assessment ought to be doubled, as that it should be increased 10 per cent. Take for an example the 17½ per cent. on tenant's capital, which has lately become a favourite item of attack. There is no agreement as to the extent to which this factor should be reduced. Some say 15 per cent. is enough; and others go down to 10 per cent. Granting, for the sake of argument, that the 17½ per cent. is entirely unsupportable, where are we to get a factor that can be so supported? In these days of capital invested at 4 per cent. or so, it is easy to construct a plausible argument in favour of bringing the interest allowable on tenant's capital down to 5 per cent. So with regard to the remuneration for personal services, which, together with the interest, forms the trade profit. The difficulty is that, when the valuation is conducted on strict *de facto* terms throughout, the final result is absurd, in the light of the definitions which are contained in the Act.

The fact that the corrections are subject to the same objection as the alleged errors that they are supposed to set right, was strikingly exemplified in the recent appeal case of The Gaslight and Coke Company, which has occupied a full bench of magistrates and an army of barristers, counsel, expert valuers, engineers, &c., for some 21 days. The valuations put in on behalf of the Company agreed fairly well together; but a large number were submitted on behalf of the Assessment Committees, which differed so greatly as to excite special comment from the Bench. Speaking roughly, the lowest figure was about £600,000, and the highest close on a million sterling. With so much difference of opinion amongst presumably the best authorities, it is hard to see how it is possible, without accepting existing methods in their entirety, to arrive at a satisfactory valuation according to the terms of the Act. The dividends paid by The Gaslight and Coke Company are about £1,050,000 per annum; so the highest result just instanced assumes that the hypothetical tenant would be satisfied to accept about 1 per cent. of the total capital, or considerably under 10 per cent. on his money actually invested for the purposes of the lease, in full satisfaction of all claims as to profit. No practical man would think of leasing a gas-works for a consideration of 1 per cent. on the capital, or even for 2 per cent. And therefore I say that such valuations are absurd, according to the fair interpretation of the law.

Looking at the matter from the gas consumer's point of view, it is difficult to see the connection between some of the arguments advanced in favour of increasing the rateable value of the gas undertaking, and the actual fact that he is to be mulcted to the extent of another penny or so per 1000 cubic feet by the medium of such increase. Only a year or two ago, a great deal was said about the Coal Dues in the City of London, and the injustice of applying indirect taxation for the relief of the rates. But a large increase in the assessment of gas-works, at a time when profits are less instead of more than the legal percentage, savours very much of the same thing. Gas is in no sense a luxury, but more like a necessity of modern life; and therefore it cannot be classed with superfluities such as champagne, or silver plate, or private broughams. Large quantities of gas are used by comparatively poor persons, as an indispensable auxiliary in gaining a living; and every additional penny per 1000 cubic feet is a real burden, and not a fancied grievance. The smoke nuisance in our large towns has directed attention to the advisability of extending the use of gas as a fuel; and if this is to obtain to any great extent, gas companies must be assisted in their endeavours to supply cheap gas rather than handicapped by the infliction of increased assessments.

The customary methods of preparing a gas-works valuation must stand or fall as a whole. It is for those who are dissatisfied with them to suggest a fairer or more direct plan; but no permanent settlement is likely to result from endeavours to strain them, to suit imaginary altered conditions. I say imaginary, because if the safety of the gas industry is more established than it was twenty years ago, the addition of 6 per cent. capital and new shares issued under the auction clauses, has lowered the average rates of profit; and it can scarcely be contended that the shareholders are better off when they are receiving an average of 6 per cent. on their investments, than they used to be when they were getting 8 or 9 per cent. Gas companies would not object to any more definite or direct method, dealing more closely with actual facts, and leaving less room for difference of professional opinion; but they naturally feel aggrieved at

endeavours to strain the established practice, with the object of raising the assessment. The arrangements for hearing appeals are unfair to them, inasmuch as a value is decided upon and announced, without any details as to the facts upon which such valuation is based. So that if they are raised as much as 20 to 30 per cent., they may be left quite in the dark as to the reasons for such increase. Englishmen have a strong prejudice in favour of knowing what they pay for. If the income-tax were raised a penny in the pound without a reason being given, there would be a great outcry; yet the local tax on gas may be raised to the extent of 6d. or 1s. in the pound, and no one can tell why.

In small towns, the Union represented by the Assessment Committee may cover a large tract of country, of which the district supplied by the gas company is a comparatively limited area. Under such circumstances, the company have to contend with an opposition majority, whose interests are opposed to theirs. The town may be represented by one or two members only, whose views are outvoted by the preponderance of farmers, country gentlemen, and other representatives of the landed interests, who avowedly seek to put as much assessable value on the town as possible, with a view of keeping down the poundage. Every possible excuse is made for an attack on the gas company; and in case of an appeal, the case comes before the Recorder at Quarter Sessions. This gentleman is usually a member of the legal profession practising in the district, or a county magistrate, or otherwise intimately associated with the landed interests. He has a close acquaintance with the troubles of agriculturists on the one hand, and no special knowledge on the subject of gas supply on the other. It follows that considerations, such as the fact that the gas company have a guaranteed rate of profit and freedom from competition, are likely to weigh heavily with him. The case from the gas consumers' point of view is not represented at all. Under such circumstances, is it remarkable that complaints of excessive assessments are by no means infrequent? And there is the more reason why, if the valuation made by the gas company is rejected, the items that are not accepted should be plainly stated in the judgment, so as to give the appellants an opportunity of carrying the matter further. If the gas company consider they can show just cause of complaint, the matter might be settled by an Arbitration Committee, appointed by the Board of Trade. The decisions of such a Committee on, say, half-a-dozen cases, would establish rules of precedent by means of which disputes would frequently be settled both promptly and cheaply.

Iron and Steel Production in the United States.—A census bulletin, relating to the manufacture of iron and steel in the New England States, has lately been published. It shows that, although a decrease (due principally to local causes affecting the supply of raw materials) has taken place in the number of establishments engaged in the manufacture of iron and steel in 1890 as compared with 1880, there has been an increase in the value of finished products. In 1870 there were 48 iron and steel establishments in New England, with an invested capital of \$5,909,000, employing 3815 hands, to whom \$2,168,719 in wages were paid, using materials of the value of \$7,338,150, and producing manufactures valued at \$10,824,603. In 1880 the number of establishments had increased to 61, with an invested capital of \$11,560,408; the workmen numbering 8654, and receiving wages amounting to \$3,357,911. The cost of materials was \$9,518,570, and the value of products amounting to \$14,558,627. In 1890 the figures afford a striking illustration of the tendency—very marked in certain trades—towards concentration in the hands of a few great capitalists. The number of establishments had decreased to 35; but the total capital invested had increased to \$13,415,450. The hands employed, excluding officers and clerks, numbered 6645, receiving wages amounting to \$3,224,318. The cost of materials consumed was \$9,286,050, and the value of the products was \$15,105,441.

Production of Cast-Iron Pipes in the United States.—As illustrating the extreme minuteness with which the industrial statistics of the United States were collected during the last census, attention may, says *The Times*, be called to a bulletin just issued relating to the manufacture of cast-iron pipes in the United States. This is the first publication of the statistics of cast-iron pipe works separate from the operations of the general foundries of the country. The bulletin shows that during the census year 1890, 36 establishments reported the manufacture of cast-iron pipes as a leading speciality of their business. The total capital invested in these works was \$14,300,933, which included \$68,500 reported by two establishments not in operation during the census year. The hands employed, including officers and clerks, numbered 7788, to whom a sum of \$3,794,407 in wages was paid. The total cost of materials consumed was \$9,483,389; and the value of the products was \$15,168,682. The principal material consumed by the pipe foundries was pig iron, the quantity used amounting to 591,258 net tons, costing \$7,860,408; while cast-iron pipe formed the principal product—the output being 513,030 tons of 2000 lbs., valued at \$12,556,315. The pipe foundries in operation in 1880 were tabulated with other foundries of the country; so that no data are available for comparison. There has, however, the report says, been a considerable growth in this industry in the past decade, especially in the south and west. The returns for 1890 show that 20 of the establishments reporting had been built since the census of 1880.

TECHNICAL RECORD.

NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.

The Thirtieth Half-Yearly Meeting of this Association was held last Saturday, at the Offices of the Newcastle and Gateshead Gas Company, under the presidency of Mr. R. WALLIS, J.P., Chairman of the South Shields Gas Company. There was a numerous attendance of members.

INTRODUCTORY REMARKS BY THE PRESIDENT.

The PRESIDENT said his duty on this occasion was much lighter than it was six months ago. It was a most gratifying sight he saw before him—such a body of intelligent gentlemen met in the great interest of coal gas. There was no better sign of the prosperity of an Association like theirs than to see the members take such an interest as to present themselves at the meetings. The gas interest had certainly before it this year the prospect of doing very great things, of being able to pay their dividends, and of having something left over; but the unfortunate strike of the Durham pitmen had cast a gloom over their hopes. Yet he thought that they were strong enough to be able to tide over the difficulty, and that, at the end of the year, they would come out creditably. Every year, when a body of gentlemen like this met, there was always something to rejoice and something to lament about. That day, they would have, he hoped, a large accession of new members. They had also to deeply deplore the death of one who took a great interest in the Association, and who, young as he was, had made his name in the profession. He would not say much on the subject, because he perceived that his father was present, for whom he had the highest respect, and with whom he had been intimate for many years; and he would not like to harrow his feelings by making any further allusion to it. He must, however, ask the members to pass a vote of sympathy with the father of that excellent, honourable, and intelligent young member of the Association who had gone from among them this year. He certainly had given promise of rising to a very high position. They all knew he was alluding to his worthy friend Mr. Cox, of Sunderland. With respect to the strike of the Durham miners, he thought they should not take a gloomy prospect of that matter. Most of the Gas Companies in that part of the kingdom had made their contracts fairly well, and would have come out all right if it had not been for the strike. They would, however, get over the difficulty; but they must remember that the price of coal affected gas much more than anything else he knew of. They were all aware that the gas industry had been one of the most successful in the kingdom. Gas companies had gone on doubling their business every ten years—at all events, he knew one which had trebled itself in that time. Whether or not they would continue to advance with this rapidity, was a question. There was no doubt they had rivals; and those rivals were making their way, and becoming greater favourites with the public. Even, however, if gas companies did not increase in the same proportion as they had done, they would always hold their own. It would be useless for him to go over all the advantages gas companies had in their residuals; and the wonderful alterations that had been made in the chemical side of their profession. He need only look before him to see that the gas industry had called into existence a body equal to any for their scientific and their artistic attainments, as the managers and proprietors of gas-works were.

NEW MEMBERS AND ASSOCIATE.

The following new members were unanimously elected: Mr. C. Dru Drury, Superintendent of the Hendon Gas-Works, Sunderland; Mr. J. Grant, Superintendent of the Ayres' Quay Gas-Works, Sunderland; Mr. G. Airth, Assistant-Manager, Morpeth; Mr. A. B. Walker, Gas Manager, Berwick; Mr. R. Watson, Gas Manager, Newbiggin. Mr. H. J. Davis, of London, was elected as an Associate.

NOTES ON TANK CONSTRUCTION.

Mr. V. WYATT (London) read some notes on tank construction, in which he described the construction of a tank for a 3-million cubic feet gasholder at the Redheugh Gas-Works, Gateshead. The work was done according to the plan advocated by him in a paper which he read before the Association in April, 1889—viz., by building in sections. Mr. Wyatt claimed several advantages for this method of construction, as compared with the customary method of digging a continuous trench, which required to be timbered. He read the paper to show, he said, that when he talked about doing a thing, he could also do it. This method, he further remarked, had been spoken of as an abortion; but if it was one, it had been imitated, though only partially.

ANOMALIES IN GAS UNDERTAKINGS.

Mr. WYATT then read a paper on "Anomalies in Gas Undertakings," of which we are only able this week to give a summary. Beginning with the recommendation given by Confucius to one of his followers to let reciprocity be the rule of his conduct, Mr. Wyatt went on to say that there ought to be a mutual interchange, or reciprocity, of interests between the producer and consumer. Gas undertakings, of course, must pay a reasonable dividend to the shareholders; but the consumer should be respectfully and even tenderly treated, and supplied with the

best article for his money. All monopolies should be merciful, and should be able to do their business cheaper and better than the private trader. The country had a mortal antipathy to perpetual monopolies. It was not quite wise to incense gas consumers too much, as in some recent cases, where gas companies, with ample revenues for paying dividends of 7 to 8 per cent., and with a falling market in coal prices approaching 20 per cent., had suddenly raised their charges for gas 12½ per cent. to keep up high dividends. The power of charging under the sliding scale was delightfully simple; but the system would have to be either "mended or ended," because, in its present form, it was very confusing to the consumer. He suggested, as a standard rate upon which to start the sliding scale, 2d. per 1000 cubic feet for every ton of coal delivered in the retort-house. Corporations, who had no sliding scales, did not irritate their customers by making the price of gas jump up and down. In the near future they would have the pull over companies, in being able to wipe out all their old overcharged accounts. Then would come the tug of war, and a *régime* under which the company undertakings, capitalized up to the hilt, would have their work cut out for them. The capital accounts of the companies should be consolidated (say) into a 5 per cent. stock, and then gradually reduced, half year by half year, by means of a sinking fund, so as to make the capital correspond to the structural value of the works. The nominal capital of an undertaking should be its real capital. It was not desirable to reduce the capital below the structural value of the works and plant, as consumers of gas should pay for its true cost, including interest upon capital. The amalgamation of gas companies into grouped concerns in well-defined districts, would be a rare success, and would conduce to good management and economy of working. He advocated that a gas undertaking should perform the whole work of the distribution of gas up to the point of consumption, and that the finishing touch of gas distribution should not be handed over to plumbers. The present method of assessment of gas-works was denounced by Mr. Wyatt as most objectionable; and he suggested, in its stead, that the structural works could only be dealt with for rating purposes—business profits of an owner of property being specially taxed under the Income-Tax Acts. Perhaps there was no better way of arriving at the structural value of a gas-works than to estimate it from the number of tons of coal carbonized per annum, multiplying that number by £4 for large, and by £5 for small works. The gross rental might be deducted from that sum by taking the amount of interest payable upon it, and deducting one-sixth from it. The standards of light for testing the illuminating power of coal gas were, he said, in an unsettled condition. It might be asked why they should not abolish the candle, and have a lamp which would consume a certain quantity of sperm per hour? He apprehended they could soon devise a just standard of light for photometric purposes, if only the demon of vested interests could be snuffed out.

THE ACTION OF THE SLIDING SCALE.

Mr. W. J. WARNER (South Shields) then read a paper on the above subject; and it appears on p. 799.

Mr. Wyatt's and Mr. Warner's papers were discussed together; and at the close, a vote of thanks was passed to these gentlemen for their instructive contributions.

ELECTION OF OFFICE-BEARERS.

The PRESIDENT intimated that, in terms of the Scrutineers' report, the following gentlemen had been unanimously elected to office:—

President—Mr. J. Whyte, of Seaham Harbour.

Vice-President—Mr. D. Terrace, of Middlesbrough.

Auditor—Mr. J. H. Penney, of South Shields.

Secretary—Mr. W. Hardie, of Newcastle.

Committee—Messrs. William Hardie, jun., of Tynemouth; H. Tobey, of Malton; R. Moodie, of Redheugh, Newcastle; and W. J. Warner, of South Shields.

VOTES OF THANKS.

Mr. WYATT said they had been presided over during the past year with great ability by their respected friend Mr. Wallis. They liked a Chairman who had a certain fund of experience. He was sure that Mr. Wallis had satisfied them all with the way he had performed his duty; and he proposed that they should accord him their very best thanks.

Mr. J. H. COX (Sunderland) seconded the motion.

The PRESIDENT, in returning thanks for Mr. Wyatt's resolution, expressed the pleasure he had had in presiding over such an Association as theirs. The gas interest had always been a pleasure to him. In his younger days, when he professed a little more acquaintance with science than he had now, he always took a warm interest in the manufacture of coal gas. He made it a kind of relaxation from his more arduous and professional duties; and the members had, at a late period of his life, conferred an honour upon him which was exceedingly gratifying. He felt it most deeply; and he thanked them all for the courtesy and kindness he had received from them.

PLACE OF NEXT MEETING.

It was resolved that the next meeting should be held at Seaham Harbour.

Mr. WHYTE thanked the members for the high honour they had conferred upon him in electing him to the office of President.

He said he felt they had made a great mistake; but he would do the best he could.

This concluded the business before the meeting.

The members afterwards dined together in the County Hotel—Mr. Wallis again presiding. The toast of "The North of England Gas Managers' Association" was proposed by Mr. R. Mitchell, Engineer of the Edinburgh Gas-Works, who, on his way home from London, broke his journey in order that he might spend an hour with his friends in the North of England. The Chairman felicitously acknowledged the toast. The proceedings, which had been of the most pleasant nature throughout the day, terminated early.

THE LUMINOSITY OF COAL-GAS FLAMES.

A Paper read by Vivian B. Lewes, F.I.C., F.C.S., before the Chemical Society, and Reprinted from the Society's "Journal."

In the autumn of 1890, I gave a course of Cantor Lectures on "Gaseous Illuminants," and in connection with these made a considerable number of experiments on the causes of luminosity in flames. Since then I have, from time to time, worked at the subject; and in view of the interest created by Professor Smithells' paper, read before this Society in December [*ante*, p. 68], I venture to bring my results before you. I do not propose to enter into the vexed question of how far carbon particles are essential for luminosity, or under what conditions flames containing dense vapours may become luminous, but will restrict myself to the causes of luminosity in the flame of ordinary coal gas and similar mixtures of gaseous hydrocarbons with combustible diluents.

The researches of Heumann, Soret, Burch, and the recent observations by Professor Stokes, place beyond question the presence of solid particles in a luminous gas, oil, or candle flame; and the only point on which any doubt still lingers is the kind of decomposition which leads to the liberation of the solid carbon particles. Many attempts have been made to trace the chemical changes taking place within a flame, by withdrawing the flame gases during combustion, and determining their composition; and analyses made by Landolt (*Ann. Phys. Chem.*, 1856, XCIX., 389-417) give a great deal of information about the actions taking place.

I have also made analyses of flame gases in order to trace the variations in quantity of the hydrogen, hydrocarbons, and carbon monoxide present in the centre of the flame at various heights, with the following results:—

	Hydrogen.	Hydrocarbons.		Carbon Monoxide.
		Unsaturated.	Saturated.	
Gas in tube . . .	57'08	.. 4'38	.. 33'99	.. 2'63
½ inch above burner	52'90	.. 4'00	.. 32'00	.. 3'00
1½ inches "	12'30	.. 1'53	.. 10'20	.. 3'26
Tip of inner cone .	2'35	.. 1'98	.. 7'80	.. 6'52
Centre of outer cone.	0'13	.. 0'45	.. 0'50	.. 1'51
Escaping unburnt from tip of flame .	nil	.. nil	.. 0'39	.. 1'18

These figures, as well as those obtained by Landolt, point to the fact that the hydrogen in the gas burns first, and that the saturated hydrocarbons also undergo a rapid diminution in quantity, while the unsaturated hydrocarbons only diminish very slowly until the top of the inner non-luminous zone has been reached, after which they quickly disappear in the luminous portion of the flame. Carbon monoxide, however, increases largely in quantity up to the top of the inner cone, and then rapidly burns away in the luminous zone. This increase of the carbon monoxide during the first part of the combustion has been shown to take place in the Bunsen flame by Dr. Blochmann (*Annalen*, CLXVIII., 295), and has also been observed by Professor Smithells under the conditions existing in his beautiful experiment of burning a flame in two parts.

The fact that the unsaturated hydrocarbons only slowly decrease in the inner zone, and then rapidly disappear in the luminous part of the flame, has naturally suggested the idea that it is to these compounds that the flame owes its luminosity; but, as far as I know, no one has attempted to ascertain whether the unsaturated hydrocarbons present at the top of the inner non-luminous zone are of the same character as those found in the coal gas. The undoubted presence of acetylene in the products escaping from a cooled flame, and the fact that the incomplete combustion of hydrocarbon gases always gives rise to the formation of this compound, suggested the idea that it might play an important part in the changes taking place in the interior of a flame; and experiments were made to ascertain if any appreciable quantity was formed by the destruction of hydrocarbons in the flame gases. The coal gas used was that supplied by the South Metropolitan Gas Company; and analyses give as its composition:—

Hydrogen	57'08
Unsaturated hydrocarbons (containing acetylene, 0'035)	4'38
Saturated hydrocarbons	33'99
Carbon monoxide	2'63
Carbon dioxide	0'79
Nitrogen	0'96
Oxygen	0'15
Bisulphide of carbon	0'02
	100'00

* See JOURNAL, Vol. LVI., pp. 1140, 1194, 1240, 1288, 1334.

And this gas, when burnt in a standard London Argand at the rate of 5 cubic feet per hour, is of an illuminating value which averages 16·3-candle power.

The gas was burned at the end of an open tube; and the flame gases were aspirated from the centre of the flame by means of a small platinum tube 2 mm. in diameter, and were led into a glass bulb-tube, in which the sample for analysis of the total hydrocarbons was collected, and then through two Vollhard's absorbing bottles, containing 20 c.c. of concentrated ammoniacal silver nitrate solution. This absorbs the acetylene with formation and precipitation of silver acetylide and silver, owing to the reducing action of the carbon monoxide—two absorbing vessels being quite sufficient to prevent any traces of the gas escaping absorption. The contents of the two bottles were filtered, the precipitate of silver acetylide was carefully washed with water, and then treated on the filter very cautiously with dilute hydrochloric acid, until all action ceased. Acetylene is given off, and the precipitate then consists of a mixture of silver chloride and metallic silver. This, after washing, is digested with dilute ammonia; and the ammoniacal solution, after filtration, is then treated with nitric acid to precipitate the chloride, which is weighed in the usual manner—1 gramme of silver chloride corresponding to 0·09 gramme or 87·03 c.c. of acetylene (Winkler).

Acetylene Formed during the Incomplete Combustion taking place in the Interior of a Luminous Flame.

Gas in burner	Total Unsaturated Hydrocarbons. Per Cent.	Acetylene. Per Cent.
Gas in burner	4·38	0·035
½ inch above rim of burner	4·00	0·340
1½ inches "	1·53	0·560
Tip of inner cone	1·98	1·410
Centre of luminous zone	0·45	0·045
Tip of luminous zone	nil	nil

These figures show that, in the interior of the luminous flame, the hydrocarbons at once begin to undergo decomposition, giving rise to acetylene, which, by the time the top of the inner non-luminous zone is reached, constitute over 70 per cent. of the unsaturated hydrocarbons present. A small proportion of the other hydrocarbons, however, remains undecomposed, and penetrates into the luminous zone, where it and the acetylene are both decomposed by the higher temperature attained; a carbon is liberated, and this, being for a moment heated to incandescence, gives luminosity to the flame.

An ordinary flat flame was now experimented with, the gases being withdrawn and analyzed in the same way as before.

Acetylene Formed in the Inner Zone of a Flat Flame from a No. 7 Bray Burner.

Portion of Flame.	Total Un-saturated Hydrocarbons. Per Cent.	Acetylene. Per Cent.	Other Un-saturated Hydrocarbons. Per Cent.
½ inch from top of burner	3·565	0·115	3·450
1½ inches from burner	2·063	1·303	0·760
1½ "	1·393	1·133	0·260
2½ "	trace	trace	—

The results show that, by the time the top of the non-luminous portion of the flame was reached, over 81 per cent. of the hydrocarbons present had been converted into acetylene.

The next step was to determine the thermal conditions existing in the flat flame, in order to see if they would give any definite information as to the actions taking place.

The beautiful platinum and platinum-rhodium thermo-couple devised by Le Chatelier, and introduced to us by Professor Roberts-Austen, gives a means of measuring the temperatures of flames with ease and comparative accuracy. I made a small thermo-couple of platinum and 10 per cent. rhodium-platinum wire, using it as thin as possible to reduce errors from loss of heat by conduction, and keeping the wires of considerable length to prevent any rise of temperature introducing conflicting currents at the connections with the galvanometer wires. A reflecting galvanometer of low resistance was employed, and sufficient resistance introduced into the circuit to keep the spot of light upon the scale at the highest temperature attained in the flame; and the scale was then graduated for temperature by taking water at 0° and 100°, and checking the higher temperatures by the fusing-points of the chlorides of the alkalis and alkaline earths, as determined by Carnelley (*Four. Chem. Soc.*, 1876, I., 489).

On mapping out the temperatures existing in a flat flame from a Bray burner consuming 7 cubic feet of gas per hour, it was found that, in the inner non-luminous portion, the temperature steadily increased from 500° half an inch from the burner, to 1267° at the commencement of luminosity at the apex; while the centre had a temperature of 1014°, rising to 1216° at the luminous edges. In the centre of the luminous portion of the flame, the temperature was 1166°; while the highest temperature was reached at the top of the flame, which gave 1368°.

These results, I think, help to explain the action taking place in the flame. In the inner non-luminous zone, the hydrocarbons heated up by the combustion of the hydrogen and some of the methane undergo certain changes, which result in their conversion into acetylene; and this, being an endothermic compound, readily decomposable by heat or detonation into carbon and hydrogen, breaks up when a sufficient temperature is attained. Owing, however, to the diluting action of the nitrogen and other flame gases, this does not take place until

the top of the non-luminous zone is reached, where, at a temperature of a little over 1000°, the decomposition occurs with an increase of temperature; and the liberated carbon, being heated to incandescence, gives the luminosity to the flame.

Other luminous hydrocarbon flames were then tried; and the percentage of acetylene formed in the inner zone determined.

	Oil Gas of 30-Candle Power.	Paraffin Lamp.	Candle.
Acetylene	3·09 per cent.	2·222 per cent.	2·163 per cent.

I have made attempts to trace the actions which give rise to the acetylene, and to see if the carbon monoxide, which increases so rapidly in quantity in the inner flame, is due to the same actions, or is formed in some other way. If it be heat alone which converts the hydrocarbons present into acetylene, then this result should be obtained by passing them alone, or diluted with hydrogen, through a very narrow tube, heated to the same temperature as that existing near the top of the dark zone of a luminous flame—that is, to a little way over 1000°.

The difficulty at once arises of obtaining a tube sufficiently narrow in bore to ensure the gas being heated to nearly the same temperature as the walls of the tube without using platinum, as all attempts to obtain a nickle or iron tube of the desired dimensions failed; and the use of platinum is open to the objection of the actions induced by its surface at the temperature employed.

In order to see if surface action would in any way affect the amount of acetylene formed, a very fine platinum tube and a pipe-stem glazed with borax were heated in the same furnace to the same temperature, and an equal amount of ethylene was passed slowly through both, and the acetylene formed estimated. The acetylene formed with the platinum tube = 0·494 per cent.; that formed with the glazed pipe-stem = 0·432 per cent. On now heating the pipe-stem to a higher temperature, the acetylene formed from the same quantity of gas was 0·808; so that the smaller amount obtained in the previous experiment with the pipe-stem was evidently due to the thick clay walls.

From this it appeared as if the platinum exercised no influence on the production of acetylene in the experiment; but as I also wanted to determine the action of small quantities of air upon the hydrocarbons, under the influence of the temperature existing in the inner zone of a flame, I made a second experiment, in which methane, free from unsaturated hydrocarbons, was passed with 10 per cent. of air through a pipe-stem, and through the platinum tube, both being heated to the same temperature, which was a little under 1000°:—

Gases after Heating.

	Pipe-Stem.	Platinum Tube.
Unsaturated hydrocarbons	1·92	1·52
Carbon monoxide	2·30	2·10
Carbon dioxide	1·01	0·51
Oxygen	0·54	0·51
Acetylene	trace	trace

With the pipe-stem it was almost impossible to get an even temperature much above that used in this experiment; but on passing the same mixture of methane and 10 per cent. of air through the platinum tube heated to about 1100° to 1200°, acetylene appeared in quantity:—

Unsaturated hydrocarbons	3·10
Acetylene	2·07

These experiments pointed to the platinum tube having so little action on the gases as to render its use admissible in the following experiments; and the difficulties arising from the pipe-stems not being straight, from the thick walls rendering it nearly impossible to attain even heating, and from constant fracture, were so great that I decided to use a platinum tube 2 mm. in diameter and 1 foot long for the following experiments.

Methane was prepared by the action of the copper-zinc couple upon a mixture of methyl iodide and methyl alcohol, with the usual precautions, and was then passed through the tube, 6 inches of which were heated to 1000° in the flat flame of a broad Bunsen. The methane employed contained 99 per cent. of saturated hydrocarbons and was analyzed for other constituents before and after heating:—

	Before Heating.	After Heating.
Unsaturated hydrocarbons	0·50	3·200
Acetylene	—	1·798
Carbon dioxide	—	—
Carbon monoxide	—	—

The effect of heating the methane with other gases present in the inner zone of the flame was then tried.

Methane Heated with

	3 p. c. Oxygen.	15 p. c. Air.	50 p. c. Carb. Mon.	60 p. c. Hydrogen.
Unsaturated hydrocarbons	2·000	2·000	1·000	1·470
Acetylene	1·426	0·656	0·887	0·473
Carbon monoxide	1·100	1·000	—	0·490

These experiments seem to point to acetylene being formed by the action of heat alone upon the methane; but as soon as oxygen is present, carbon monoxide is also produced. The experiment with oxygen and air also shows the retarding effect of dilution upon the formation of the acetylene.

The presence of carbon monoxide in the methane diluted with hydrogen was probably caused by the latter gas containing nearly 2 per cent. of oxygen; while I think the experiment with carbon monoxide shows that interactions between it and methane cannot give rise to acetylene, as the amount formed

is just one-half that produced on heating methane alone—the reduction in quantity being due to dilution. The action taking place is most probably a splitting up of the methane into acetylene and hydrogen—



and some of the acetylene is then polymerized into benzene, as noticed by Berthelot (*Comptes Rendus*, LIV., 515). The methane takes a far higher temperature for the formation of acetylene than any of the other hydrocarbons experimented with.

Ethane was prepared from ethyl iodide by the action of the copper-zinc couple, and contained 93 per cent. of saturated, and no unsaturated hydrocarbons or acetylene. It, however, contained a trace of air, which would render estimation of carbon monoxide, after heating, useless.

Ethane Heated Alone.

Unsaturated hydrocarbons.	19'470
Containing acetylene	8'224

Ethane Diluted with 80 per cent. of Hydrogen.

	Heated with Air to the extent of		
	15 p. c.	20 p. c.	25 p. c.
Unsaturated hydrocarbons	7'69	5'58	5'05
Acetylene.	3'89	3'20	3'11
Carbon dioxide	—	1'01	1'51
Carbon monoxide	1'54	2'53	3'03

Showing that carbon monoxide is being formed in increasing quantities with the increase in the percentage of air, and that the amount of unsaturated hydrocarbons, other than the acetylene, are reduced in quantity more quickly than the acetylene itself; this, however, being probably due to their splitting up, with formation of acetylene, and both slowly being oxidized. These experiments show that, when between 15 and 20 per cent. of air is present, carbon dioxide as well as monoxide begins to form.

Ethylene was prepared by the action of sulphuric acid upon alcohol, and contained 93 per cent. of unsaturated hydrocarbons, and neither carbon monoxide nor acetylene.

	Gas Heated alone.	With 3 per Cent. Oxygen.
Acetylene	8'894	7'165
Carbon monoxide	—	5'74

Ethylene Diluted with Hydrogen:

	Gas Used.	Heated with	
		20 p. c. Air.	25 p. c. Air.
Unsaturated hydrocarbons	14'50	6'81	3'66
Acetylene	—	2'03	1'59
Carbon monoxide	—	5'30	3'73

These experiments, I think, show that dilution has a distinct effect in preventing the "over-cracking" of the hydrocarbons, as the proportion of acetylene to unsaturated hydrocarbons is far higher in the gas diluted with hydrogen than in the rich gas.

In another experiment, hydrogen was charged with 1'02 per cent. of benzene vapour, and heated with varying proportions of air, with the following results:—

	8 p. c. Air.	13 p. c. Air.	18 p. c. Air.
Acetylene formed	0'026	0'032	0'218

It has been suggested that, if acetylene is formed simply by the action of heat, it ought to be present in quantity in coal and oil gas, which it undoubtedly is not. This, I think, is purely a question of temperature. The fire-clay gas-retort is never above an orange red, which means 800° to 900°; and the gas inside the retort probably never approaches this temperature. Again, in oil-gas making, 800° would be the outside temperature employed; while to convert any large proportion of diluted hydrocarbons into acetylene requires at least 1000°. Indeed, if diluted hydrocarbons are passed through a ½-inch tube heated to 1000°, the yield is very small, as only the thin layer in contact with the walls of the tube is raised to the required temperature; and it was for this reason that it was necessary to use so fine a tube in the preceding experiments.

In order to see how temperature affected the amount of acetylene formed during the manufacture of gas, I made separate batches of oil gas from Russian petroleum (Russian "distillate oil," sp. gr. 0'864) in a Patterson retort.

Acetylene Formed in the Manufacture of Oil Gas.

Temperature of retort	500°	700°	800°	900°
Yield of gas per gallon (cubic feet)	12	60	72	84
Illuminating power (candles)	54'800	50'700	57'100	42'000
Unsaturated hydrocarbons (per cent.)	39'130	36'560	36'550	02'402
Acetylene	0'052	0'084	0'380	0'460

Showing that the quantity of acetylene steadily increases with rise of temperature.

The analyses of flame gases made by Landolt (*Ann. Phys. Chem.*, 1856, XCIX., 389-417), Blochmann (*Annalen*, CLXVIII., 295), and myself, all point to the hydrogen present in the gas burning first; and there is no doubt that the water vapour so formed and superheated in its passage up the flame interacts with the hydrocarbons, giving hydrogen and carbon monoxide, while in the luminous zone the action of water vapour and carbon dioxide upon the incandescent carbon particles again gives rise to the same products, so that their production in reality never ceases until the outer non-luminous zone of the flame is reached. In this zone it has always been supposed that the presence of a free supply of oxygen caused complete

combustion, and that, with a properly constructed burner, only carbon dioxide and water vapour escaped into the air.

Delicate analyses made and described by me in the *Journal of the Society of Chemical Industry*,* show that this is not the case. Heumann noticed that, if a luminous flame was made to spread itself out over a cold surface, luminosity was destroyed, but could be restored by heating the substance over which the flame was playing. This reduction of luminosity is produced by withdrawal of heat from the flame—the temperature falling below the point necessary for the decomposition, or in some cases even the production of acetylene. In the outer zone of the flame, the inrush of cold air sucked into the flame so cools it as to render it non-luminous, and finally extinguishes it; and if the air and products of combustion be collected close to the flame, but not in absolute contact with it, anywhere between 2 inches and 4½ inches above the burner, it will be found to contain small traces of carbon monoxide, acetylene, methane, and even hydrogen. At the extreme tip, however, combustion is more perfect; and only carbon monoxide and minute traces of methane are to be found escaping.

It is usual to describe the structure of flame as built up of four zones; but if any such division into parts be necessary, I think it would be better to found them upon the main reactions taking place, due to the heat generated, and to describe them as three, viz.—

- (1) The inner zone, in which the temperature rises from a comparatively low point at the mouth of the burner to between 1000° and 1100° at the apex of the zone. In this portion of the flame, the constituents of the gas undergo various decompositions and interactions, which culminate in the conversion of part of the hydrocarbons into acetylene; carbon monoxide and hydrogen being also produced, and passing into the next sphere of action, together with some methane and the products of combustion.
- (2) The luminous zone, in which the temperature ranges from 1100° to a little over 1300°. Here the acetylene formed in the inner zone becomes decomposed by heat, with liberation of carbon, which at the moment of separation is heated to incandescence by its own combustion, and by the combustion of carbon monoxide and hydrogen, and gives luminosity to the flame.
- (3) The extreme outer zone, in which the cooling and diluting influence of the entering air renders a thin layer non-luminous, and finally extinguishes it. With an ordinary coal-gas flame, this results in the escape of traces of hydrogen, methane, acetylene, and carbon monoxide; while with a very rich gas, unconsumed carbon also escapes.

This description of a luminous flame is of necessity far from complete, as it leaves out of consideration the numerous subsidiary interactions which are taking place; but I think it gives the general outline of the main reactions.

When Knapp and others first showed that a luminous gas-flame could have its luminosity destroyed by mixing the gas before burning with inert diluents, such as nitrogen, carbon dioxide, and steam, it was recognized that the nitrogen in the air was an important factor in rendering such flames as those of the Bunsen burner non-luminous; and most valuable contributions were made to our knowledge of the subject by Landolt, Blochmann, Heumann (*Annalen*, CLXXXI.—II.) and others. But, as far as I know, no quantitative attempt has been made to arrive at an idea of the relative importance of the various factors which influence the combustion of coal gas and the light-giving value of the flame.

In these experiments, I used a Bunsen, fitted with two supply-pipes leading to the chamber at the foot of the upright tube; each pipe being connected with a small meter, which was from time to time checked with a standard meter, so that the flow of gas and air could be accurately regulated and measured. Working with this arrangement, the amount of air necessary to render the flame non-luminous was first determined. Six volumes of gas required 13'5 volumes of air. Now, 13'5 volumes of air contain roughly 2'7 volumes of oxygen, and 10'8 volumes of nitrogen. On now passing coal gas and nitrogen through the burner, at the rate of 6 volumes of coal gas to 10'8 volumes of nitrogen, a flame was obtained which had only a faintly luminous tip; while on passing coal gas as before, at the rate of 6 volumes to 2'7 volumes of oxygen, a luminous flame is produced, which flashes back unless the tube is covered with fine wire gauze. This experiment was then repeated on the photometer.

		Candle Power.
Bunsen burning gas alone (5 c. ft. per hour)	5'6	
" " 5 c. ft. gas and 2'2 c. ft. oxygen	3'1	
" " " 9 c. ft. of nitrogen	Not readable.	

It appears from this experiment that the amount of oxygen in the volume of air necessary to destroy luminosity does less than one-half the work. I then tried the effect of varying the amount of oxygen added, with the following results:—

		Candle Power.
5 c. ft. gas alone	5'6	
5 " gas to 1'1 c. ft. oxygen	5'4	
5 " " 1'5 " "	8'0	
5 " " 2'2 " "	3'1	(a)
5 " " 2'5 " "	0'0	

(a) Gauze used.

* Vol. X., p. 413; see also JOURNAL, Vol. LVII., p. 692.

position to this enormous extent. A second experiment was then made, in which, by means of a blowpipe flame, a higher temperature was obtained; and 1.5 cubic feet of gas, as before, was passed through the tube, when it deposited 0.2780 gramme of carbon.

	Before Heating.	After Heating.
Carbon dioxide	0.2	0.8
Oxygen	0.3	0.2
Unsaturated hydrocarbons	4.2	3.0
Carbon monoxide	2.6	2.8

Under the same conditions, a mixture of 1.5 cubic feet of coal gas and 3.45 cubic feet of nitrogen deposited 0.0640 gramme of carbon; showing that the effect of dilution is decreased by increase of temperature.

These experiments, I think, show that, when coal gas is diluted to the degree necessary to give a non-luminous flame in the Bunsen burner, the liberation of free carbon is reduced by the retarding action of the inert gas; but as the temperature rises, this action gets less and less.

The action of diluents in increasing the temperature necessary to bring about deposition of carbon was, I believe, first noticed by Wartha, and is probably due to two distinct causes. As has already been shown, the formation of acetylene from the hydrocarbons in the gas is retarded by dilution; while if any be formed, the temperature necessary to decompose it into carbon and hydrogen is greatly increased. These two retarding influences give time for the oxygen present in the air introduced with the gas, and in the air sucked into the flame, to burn up the hydrocarbons without previous decomposition, and so prevent luminosity; and it is probable that the prevention of the formation of acetylene is the chief factor, as only the merest trace can be detected in a non-luminous Bunsen flame.

Collecting the results, we can now explain the various actions which lead to loss of luminosity as follows:—

1. The chemical activity of the oxygen introduced in the air, which causes loss of luminosity by burning up the molecules of hydrocarbons before, in their diluted condition, they can form acetylene.
2. The diluting influence of the nitrogen, which increases the temperature necessary for the formation of acetylene from the hydrocarbons; while if any be formed, a higher temperature is necessary for its decomposition. In this way diluents alone will render a flame non-luminous; and in the normal Bunsen flame nitrogen acts in this way until the hydrocarbons have been destroyed by oxidation.
3. The cooling influence of the air introduced, which is able to add to the general result, although the cooling is less than the increase in temperature brought about by more rapid oxidation.
4. In a normal Bunsen flame, the nitrogen and the oxygen are of about equal importance in bringing about non-luminosity; but if the quantity of air be increased, the oxidation becomes the principal factor, and the nitrogen practically ceases to exert any influence.

I should like to have worked out the secondary reactions taking place in a luminous flame, and so have completed this paper; but, as Professor Smithells proposes to undertake this, I leave the question in his hands, and trust that he may be successful in clearing up the many points which remain to be solved.

In conclusion, I wish to express my thanks to my assistants—Messrs. F. B. Grundy and H. S. Marsh—for the help they have given me in the work entailed in this paper.

Mr. H. Kendrick, for upwards of twelve years in the service of the Birmingham Corporation Gas Department, at the Saltley works, has been appointed Outdoor Superintendent of the Salford Corporation Gas Department, under their Engineer, Mr. S. Y. Shoubridge.

A Water-Leak Indicator.—A novel signalling apparatus is to be used in connection with the city water-works of Covington (Ky.), to give warning of leaks in the supply main or any accident along the line needing immediate attention. The water supply for Covington is pumped from the Ohio River to reservoirs, from which it passes by gravity through about eight miles of pipe to the city. As there is only a single pipe-line, it is especially necessary to detect and repair leaks as soon as possible. It is proposed to have parallel with the pipe-line a telegraph wire strung on poles. Connected with the wire will be signal-boxes located in farmhouses, and each having numbers. A card of instructions will be placed beside each box, with, for example, the following code of signals: One ring, a land slide; two rings, a small leak; three rings, a large leak; more than three rings, a serious break requiring immediate attention. The alarms will be sounded both in the city office of the works and at the pumping-station; the number of the signal station being indicated as well as the character of the trouble. In case of a serious break, says *Engineering News*, the men at the pumping-station will at once proceed to the reservoir and shut off the supply from the main; after which, of course, men would proceed to the break to make repairs,

SOME NOTES UPON THE ACTION OF THE SLIDING SCALE.

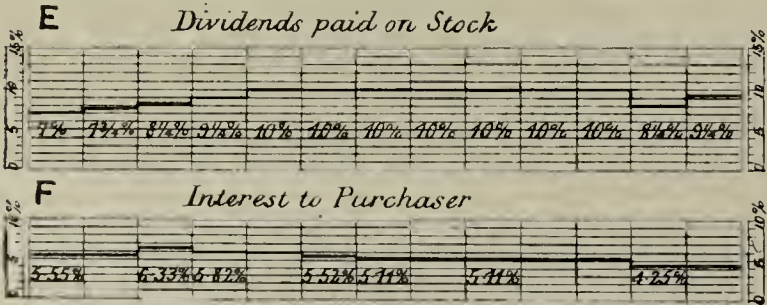
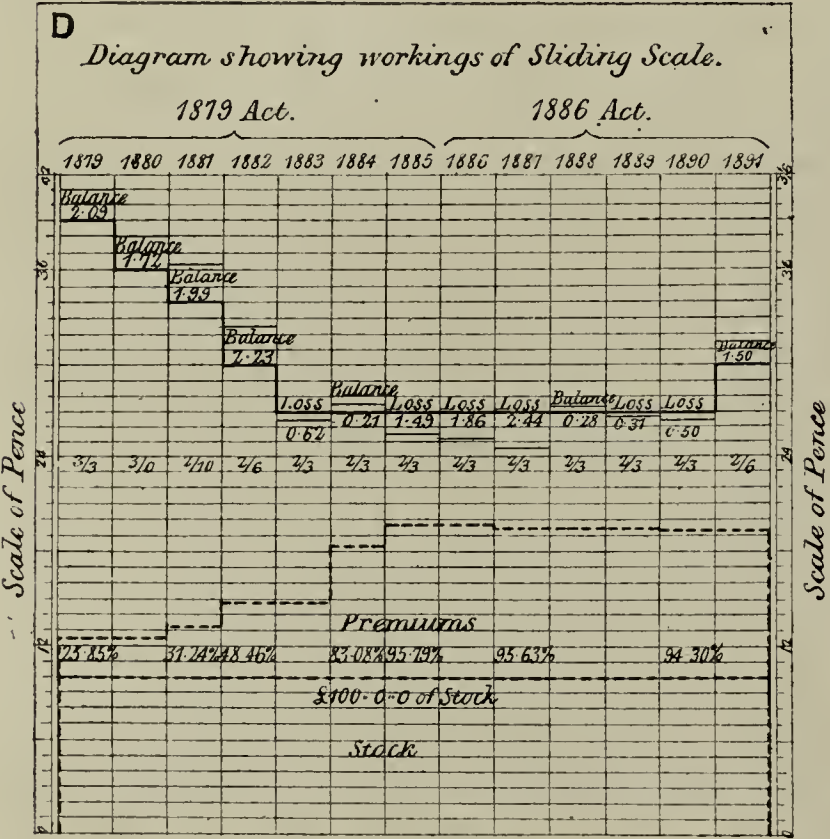
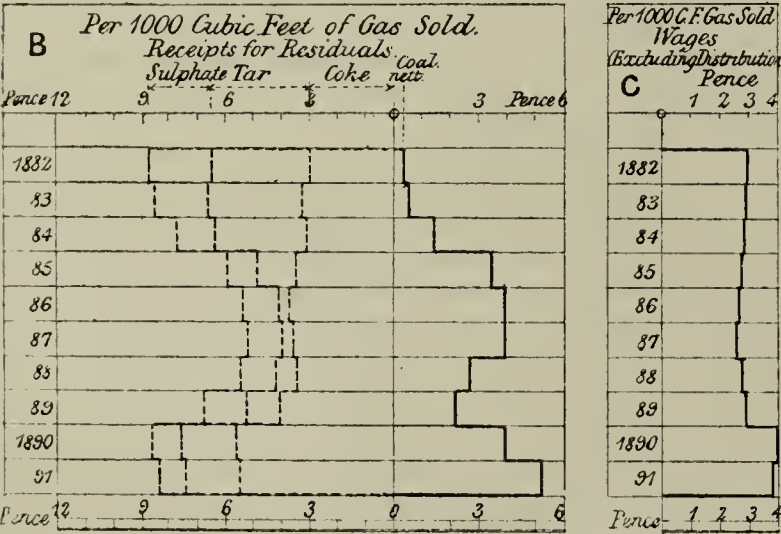
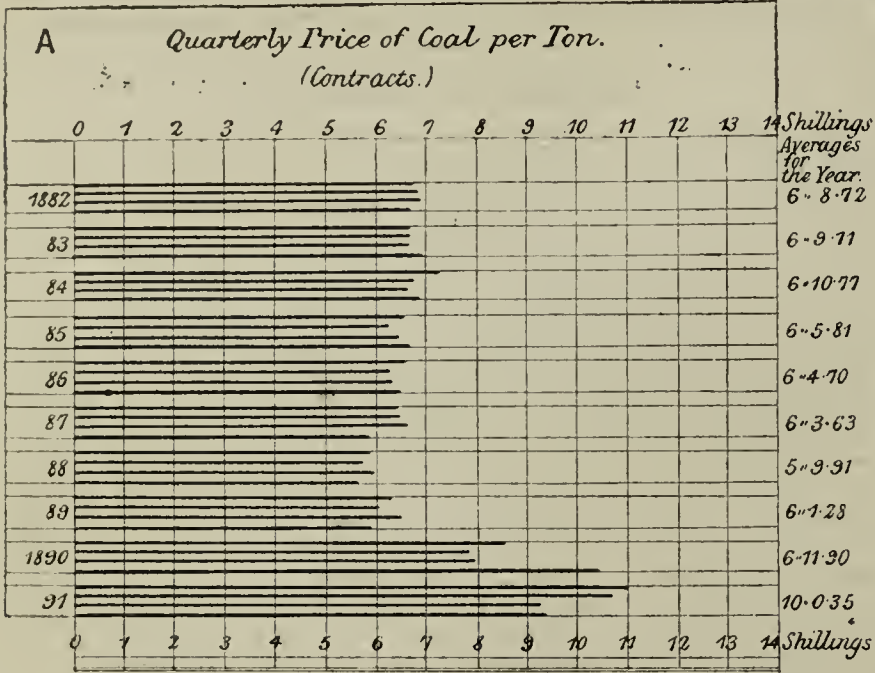
A Paper read by W. J. Warner, of South Shields, before the North of England Association of Gas Managers, April 30.

Mr. President and Gentlemen,—The remarks which I have to offer may be considered as suggested by, and supplementary to, what was said at our Tynemouth meeting. I refer to the able discussion upon the general policy to be recommended under the commercial difficulties which were then rapidly increasing upon us. I need scarcely remind this meeting that, after a very full and interesting discussion, the general opinion was not to advance the price of gas unless absolutely necessary. I did not disagree with this; but I ventured to put in a plea for the shareholders. While fully admitting the grave responsibilities of our position in dealing with our customers, I felt that there are other duties due to the undertakings with which we are identified. There are prescribed rights as well as duties; and these are not, when the sliding scale is in full action, opposed one to the other. There is a reciprocal action by the sliding scale upon price and profit; and by this the consumer and shareholder have a common interest in the prosperity of the undertaking. This, however, is not so fully recognized as it should be (not to use too harsh a term) by those whose self-imposed duties lead them to discuss such questions. Those who would disturb the machinery so well and so wisely arranged for the benefit of the consumer, the capitalist, and the public incur very great responsibilities.

Our commercial prospects have not, unfortunately, improved since the meeting at Tynemouth. Balances to profit have been more or less exhausted, and reserve funds dipped deeply into. The price of gas has had to be advanced, and in some places again advanced. Matters thus prejudicially affecting important interests all round could not have been expected to be of the pleasantest character—could not have been expected to raise the value of stock. Yet the consumer's increase is not proportionate to the increased cost of production; and he may get some consolation from the fact that he is paying very little more for his fuel, if he uses his gas as fuel, than he did before the "holidays" and strikes of the colliers, and the shareholder may feel some satisfaction that his dividends have suffered so slightly in passing through times in which labour has exacted at once an increase of about 50 per cent., and the cost of raw material has been advanced 100 per cent. Why, then, should there be those jarring, disturbing elements occasionally to be found to lessen our influence and weaken our position? The present abnormal condition of things comes entirely from matters outside our sphere of action. The residual markets, as was recently pointed out by the *JOURNAL OF GAS LIGHTING*, are beyond our control; the coal market is the same; and so, it may almost be added, is labour; and it is the abnormal depression of one, and the undue increase of the others, which places us in our present position. This must be known, in a general way, to the consumer, the shareholder, and the corporation; but it should be known accurately and fully by those who attempt to deal with such matters, and draw conclusions from them for themselves, their neighbours, and the general public.

That the disturbing elements may be comparatively and relatively seen, I have prepared some diagrams [see next page]. The several matters dealt with extend over the last ten years. The cost price of coal, quarter by quarter, is shown on the diagram marked A; B gives the amount received for residuals, and shows the net cost of coal per 1000 cubic feet of gas sold; and C is the wages diagram, excluding the cost of distribution. Upon referring to diagram A, it will be seen that the price of coal ranged from 6s. to 7s. per ton during the period from 1882 to 1889, both years included. It then rose to about 10s. per ton in the last quarter of 1890; and reached 11s. in the first quarter of the following year. Now turning to B, it will be seen that while the price of coal may be said to have gradually receded from 1882 to 1889, the net cost very rapidly advanced to an increase of above 3d. per 1000 cubic feet of gas sold. Now, passing over to C, it will be found that we were slightly assisted by a gradual decrease in the cost of labour till 1888. Then, just as we were getting a little relief by the price of coal coming down and the residuals going up, labour advanced; in the following year, it did so again; and then, with a great bound, in 1890 it was increased to above 50 per cent. over 1887. Our present position, therefore, when compared with 1882, may be broadly stated thus: Residuals totally are the same; but, through the increased cost of coal and labour, the cost of gas has increased 6d. per 1000 feet, while our charge is the same.

Now turning to diagram D, we shall see the influence of these three items upon dividends. In 1882 the price was 2s. 6d. per 1000 cubic feet; and a balance having been shown of about 2½d. and the reserve fund being full, the price was reduced 3d. In the following year, there was a slight loss; but that was recovered in the succeeding year. In 1885, the next year, when the first great drop in the values of residuals was so serious, the loss shown was about 1½d. per 1000 cubic feet. This was followed in 1886 by a further decline in the value of residuals, and a further loss upon the year's working—nearly 2d.; and the next year it nearly reached 2½d. Residuals improved in 1888 and 1889. Both coal and labour went up enormously in 1890; and coal again in 1891. These effects are shown by a reduction of dividend of 1¼ per cent. in the former, and ¾ per



cent. in the latter year, accompanied by an increase of 3d. per 1000 cubic feet on the price of gas.

The sliding scale, which we adopted in 1879, has rendered us excellent service through the last few years of adverse influences. The dividend on the first capital was 9 per cent.; on the second, 7 per cent.; and on the third, about 6½ per cent. As to the new capital of 1886, the stock was sold in 1887 to pay 5.11 per cent.; and on the sales of 1890 only 4.25 per cent. was obtained by the purchaser. If the balance of this capital can be sold at about the same price, it can be scarcely correct to say that such a Company has no reserve; though the amount invested may not be so large as it was before we had to struggle with the difficulties of the last few years.

Though the working and policy have been so successful to

the undertaking, and hence to the consumer, it has been satisfactory to the investor as an investment. I will take a few typical cases, extending over the period with which we have been dealing—viz., 1882 to 1892.

No. 1	purchased to pay	£5	os.	1d.	per cent., but received	£5	2s.	6d.
2	"	"	4	18s.	10d.	"	5	os 7d
3	"	"	4	16s.	2d.	"	4	17s 11d.
4	"	"	4	13s.	5d.	"	4	16s. 0d.
5	"	"	4	16s.	2d.	"	4	18s. 4d.

In every case, it will be noted, there has been a gain upon the purchase, though, through the adverse circumstances, not so large as it would otherwise have been. A reference to diagram F will show much the same figures, though the dividends on diagram E are very different. The interest to the purchaser is somewhat constant; the dividends varying with the fluctuations in the price of gas, as shown by the sliding-scale diagram D, only, of course, in the opposite direction—the dividend ascending as the price descends. The action of these upon the capital is shown by the dotted lines in D.

Thus we arrive at the real point of my paper, and its supplementary matter to our discussion at Tynemouth. It was then held—and very properly so, for the reasons given, and with our then somewhat limited experience of strikes and enormously fluctuating markets—that the charge made for gas should not be advanced till it was absolutely necessary. Such an understanding, however, leaves the matter somewhat undefined—leaves the price, as it must be, dependent upon the exigencies of the undertaking, or to some extent upon the individual judgment of those having to make the change. There is in this no standard to which to work. To some, the moment for action would be the exhaustion of the balance in the yearly accounts; to others, it might mean drawing upon the reserve fund; to others, its exhaustion; while to others, the deficiency in the year's working would have to be met at once by the alteration of price. This latter, for those who are not under the sliding scale, would mean an immediate attack upon the undertaking. By the adoption of such a course as this, the consumer, it would be said, alone suffered. With the sliding scale in action, both consumer and shareholder would be affected by change of price. But under both systems—that of a fixed dividend with a varying price, and a varying dividend with a varying price—the position of the undertaking in the Money Market would be affected by the exhaustion of the balance and reserve fund; and so would the revenue too, in cases where the funds had been full.

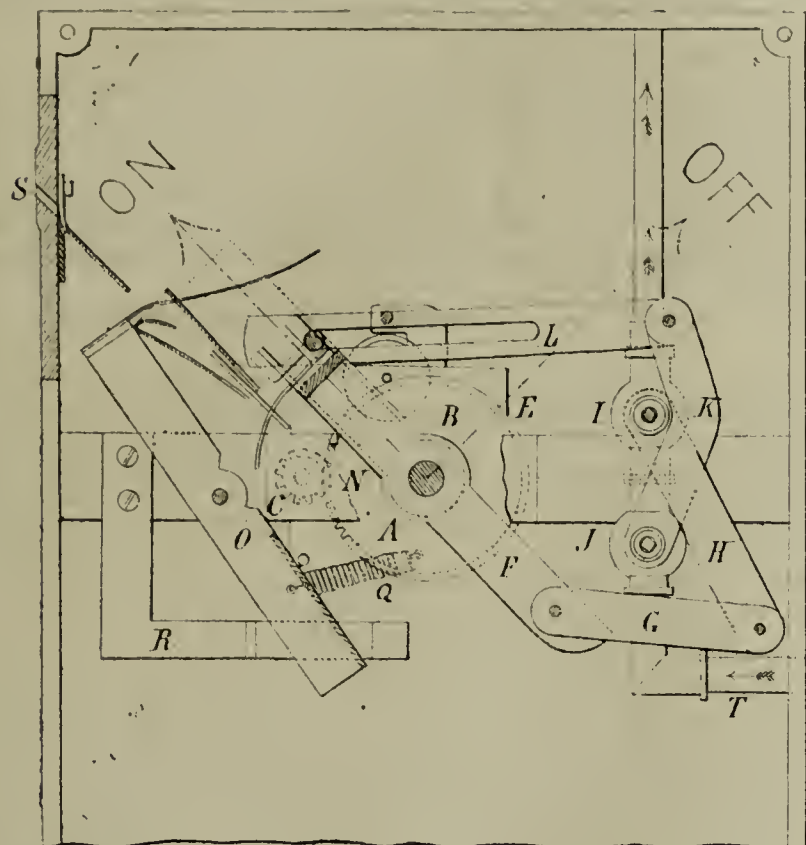
In the action of the sliding scale in its entirety—affecting the threefold interest of consumer, shareholder, and the undertaking—the latter should not, if it is possible to avoid it, be allowed to suffer; its interest should be paramount. The reserves, therefore, should be kept intact; and the chief of these is undoubtedly the premiums upon the sale of stock, which is dependent upon the dividend (and this is regulated by the price of gas), which, in turn, is affected by the premiums paid for stock. By referring to the diagrams, we see the reciprocal action of the price of gas upon dividend, and it again, in its turn, upon the price of stock; while the interest to the shareholder is almost unmoved through all the varying changes, though the value of his stock is marvellously increased through the premiums. That these premiums should be maintained, if possible, there can be no question. The reserve fund, too, when full, being a source of revenue, should also be maintained. I fully admit, however, the value of constant dividends to those who have to go frequently into the Money Market; and also that there is still a considerable amount of elasticity in gas undertakings. But with the experience of the past few years—a succession of adverse circumstances, the introduction of rival systems, strikes, high markets to buy from, and low ones to sell in—would it not be better to let the principle of the sliding scale have full action, and let the price of gas be regulated by its cost year by year? We used it only under flourishing circumstances till we were obliged to put its principle in force. Would it not have been wiser to have conserved our reserves? Had the succession of bad years been foreseen, I do not think the sliding scale would have been allowed to remain so long inoperative. I believe that, in the future, we shall be wiser, and allow full action to the well-devised, equitable, and delicate machinery of the sliding scale, and leave it to adjust to the cost the selling price, and to it the dividend.

North British Association of Gas Managers.—In view of the forthcoming annual meeting of this Association, which is to take place on July 28 and the following day, the Committee are making preparations for the event; and the Secretary (Mr. R. S. Carlow, of Arbroath) has issued to the members the usual preliminary circular, inviting their co-operation in making the gathering profitable as well as pleasurable, by presenting to the meeting, in the form of a paper, their views on any subject to which their attention may have been specially directed, or on any of those which are suggested in a list accompanying the circular. Mr. Carlow reminds his colleagues of the activity which characterizes the present period in the history of gas lighting. He thinks it will be readily admitted that great and important changes are imminent, not only for improving the light-giving properties of coal gas, but also for extending its uses in various ways; and he therefore, in the name of the Committee, presses the matter upon the serious consideration of the members.

REGISTER OF PATENTS.

Automatic Sale and Delivery of Gas.—Brownhill, R. W., of Aston, near Birmingham. No. 5378; March 26, 1891.

The object of this invention is the automatic sale and delivery of gas and liquids, on prepayment by coin or its equivalent, without the use of a meter or meter attachment, as is described in patents No. 7012 of 1887, No. 6537 of 1888, and No. 20,583 of 1889.



The engraving represents in front elevation (partly in section) a prepayment chronometric gas-delivery apparatus constructed and arranged according to this invention. It is intended to deliver gas in given quantities, on prepayment, by starting running-down mechanism at the time of, or subsequent to, the introduction of a coin through the coin slot so that gas can be consumed at the time it is paid for, or at any other time as may be desired. Thus, consumption is admitted by the turning on, first of the master tap, which is only done through the intervention or introduction of a coin, which places certain mechanism in positions which will run down or expend itself on consumption only. The master tap shuts off from, or allows gas to flow through, the gas pipe or inlet; whilst a supplementary or secondary tap turns on and off the gas as may be desired, without interfering with the master one. Hence there is independent action in both, although, unless the master tap is turned on, the turning on of the supplementary one will have no effect. The parts are shown in the positions they assume on the gas being both shut off and turned off.

A is a horizontal axis, working within bearings, and supported by brackets or framings, and carrying at its inner end, upon a loose sleeve, a multiplying toothed-wheel B, which gears with a pinion C, to the axis of which the inner end of a volute spring enclosed within a barrel or casing is fixedly connected. The spring has its outer end connected to a pin carried by the chronometric mechanism-carrying framing E. Made fast to the axis A is a turning-off double-armed lever F, having at its lower end a jointed link G, connected to a swinging arm H, with its upper end attached to a turning on and off tap I, and through which arm the tap is operated. The upper end of the lever F is moved from right to left for turning on, and from left to right for turning off the gas, after the master tap J has been turned on through the intervention of the link K and slotted arm L. Fitted and made fast to the extreme end of the axis A is a handle having a pointer upon the front or upon the axis of it. The upper and top end of the lever F carries a box connection with a slotted lower part, bracket, and mouth having lips or inwardly depending branches. Turning freely upon the axis A is a shutting on and off lever N, having mounted at its back, and upon the sleeve of the same, a multiplying toothed-wheel B, which gears with the pinion C as aforesaid; so that, on an angular movement being made by the lever, the toothed wheel moves with it, and independent of the turning-off lever F, other than when connection is made between the levers by or through the intervention of a coin. The lever or arm N, has forked branches at its upper end, and also a fraud-prevention lever with the inner part formed into a neck or stud, which works within the slot of the quadrant arm L, which has end abutments. O is a jointed wiper lever, having at its lower end a pallet, and with the upper end carrying a wiper (gapped about its middle), consisting of a strip of thin sheet metal made to traverse over the balance-wheel of running down and escape mechanism. Q is a coiled spring for bringing back the lever to its normal position, after being released by the spring-catch R. S is a coin-slot, with a shoot directed to the open top or mouth of a coin-box receiver. T is a pipe with the upper end leading to the gas-jets, and which gas-pipe carries chambered bosses in which the plugs I J, with gas-ways through them, are fitted.

Assuming the parts of the mechanism to be in the positions shown, and with the master tap shut off, and the supplementary tap opened, on a coin being dropped through the coin-slot S, it slides down the shoot and, dropping into the box, rests at the bottom, opposite the gapped parts and upon and between the branched parts. This coin, as introduced, makes the connection of the lever F, with the lever N, which move together as if they were rigidly connected. By now turning the handle, the axis A, levers F, N, and toothed-wheel B, and the whole of the accessory parts carried by these members, are turned from left to right. This lifts the quadrant arm L; and on the stud or neck which traverses in the slot impinging against the end abutment, the link or arm K, and with it the quadrant arm L partakes of the motion, and are hereby

turned back upon the plug of the master tap J, as a centre of motion, and by such rear action of the parts, the master tap is opened. As the movement of the lever F is in the same direction as the lever N, the link G and swinging arm H, are also moved rearwardly, and the supplementary tap I is closed, by the gas-way of the plug being brought at right angles to the gas-way of the pipe T. Immediately the motion of the lever F is reversed, by the turning of the handle in a contrary direction, the lever F leaves behind the lever N, and the penny drops from between the parts into a receiver below; and by fully turning back the lever F, the swinging arm H, and the link G, are turned back, and the supplementary tap I turned on. The former forward movement of the lever F causes its lower heel part to pass over the releaser of the catch R, and impinge against the pallet of the lever O, turning it upon its centre and taking the wiper upon the periphery of the balance-wheel P, until the top of it rests within the gap of the wiper, and at the same time winds up the hair-spring of the wheel. The toothed-wheel B, by being connected with the lever N, is rotated; and through it the pinion C is turned, and the spring enclosed within a barrel is wound up. This barrel has upon its periphery, or has connected with its axis, a toothed-wheel, which gears with a pinion, and so on through the train of wheels and clock mechanism parts as shown.

As the supplementary valve is now closed, and at the same time the chronometric mechanism prevented from running down, and also the wiper lever O, held by the edge of the lower part of it coming against a shoulder, by now turning again from right to left the handle, and the lever F with it, the lower end strikes the releaser, pushes back the catch R, and releases the wiper lever O, which turns on its joint centre, and draws the wiper over and upon the top of the balance-wheel P, so as to set the same and the clock mechanism in motion; and this motion of the lever is given to it by the contraction of the coiled spring Q.

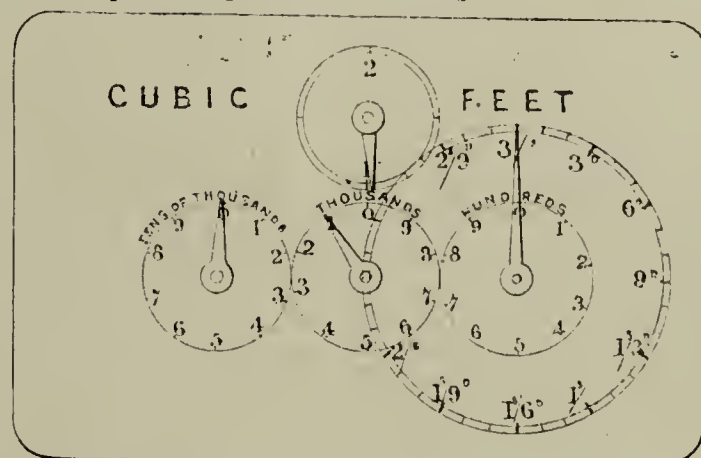
Gas now being consumed by the opening of the supplementary tap, the chronometric mechanism begins to run down; and as this continues, so the lever N, and parts carried by it, go with it, until a nick or stud impinges against the end of the slot, and the slotted arm has imparted to it a forward traverse, which turns the link K, and shuts off the master tap.

Gas or Vapour Engines.—Ridealgh, W. R., and Welford, R., of Sunderland. No. 6598; April 17, 1891.

These improvements in gas or vapour engines consist substantially in utilizing one cam for working the valve gear, having one passage to the working chamber for both the inlet and outlet, and having a momentum governor for regulating the speed—this governor acting by having momentum imparted first, the gear then acting by hitting or missing the gas-valve connection.

Indices for Gas-Meters.—Deighton, W., of Harrogate, and Wright, T., of Leeds. No. 6851; April 21, 1891.

These gas-meter indices are designed to enable both the amount of gas consumed and also the price to be seen at a glance; the registering of the quantity and of the value being effected by the same train of wheels. For this purpose, around the spindle or shaft of the pointer for registering hundreds of cubic feet, there is a large outer circle in addition to, and concentric with it; this outer circle having prices marked on it representing the value of the gas.



The illustration shows a dial for a gas-meter having the circular scales or circles representing the quantities of gas consumed arranged in the ordinary manner. Around the "hundreds" circle is a large outer circle on which, in a radial line with the O on the "hundreds" circle, is marked the price per 1000 cubic feet of the gas—in this case assumed to be 3s. The pointer is made sufficiently long to extend over both circles, which are so graduated that the value indicated by the pointer on the outer circle corresponds with the quantity on the inner circle.

The patentee also describes a form of dial for indicating the value of the gas consumed up to 10,000 cubic feet. In this case, the pointer on the spindle of the "thousands" circle is prolonged sufficiently to extend over a circle which encloses all three circles; and the price of 10,000 cubic feet—in this case supposed to be 30s.—is placed in line with the O on the circle. The outer circle is graduated from 1 up to 30—the division representing shillings, and showing the value of the amount of gas represented on the "thousand" circle. With this arrangement, the hundreds circle as described above may be combined; and thus represent the corresponding values for less than 1000 feet.

Prepayment Gas-Meters.—Cowan, W., of Edinburgh. No. 18,141; Oct. 22, 1891.

This invention, relating to prepayment gas-meters of the coin-freed type, consists of modifications of, as well as of additions to, previous inventions—No. 11,537 of 1890, and Nos. 3575 and 8444 of 1891. The present invention provides: Firstly, an improved substitute for the eccentric arrangement, consisting of a reciprocating rack arrangement; secondly, an improved operating handle, whereby the fraud known as "pumping" is prevented; thirdly, an improved price-changing adjustment, applicable to the eccentric and reciprocating rack arrangements; and fourthly, to an improved double shoot arrangement, whereby small

coins and surplus coins are returned to the consumer without operating any of the interior mechanism.

The improved substitute for the eccentric arrangement described in patent No. 8444 of 1891, consists of a reciprocating rack arrangement, illustrated in figs. 1 and 2. In it, there is mounted a circular or other rack A alongside the slot-piece B; the rack being formed with an extension at right angles to its centre line, and which acts as a pusher within the slot-piece. The rack may, however, if desired, be formed in one with, or lie in line with, the pusher. In either case it is reciprocated backwards and forwards by two spurred pinions C D, mounted one above and the other below the rack, so as to enable them to be operated in their respective directions by means of a revolving disc E, having two segments of spur teeth, operated or revolved by the consumer after the insertion of a coin in the slot through the medium of a suitable handle as heretofore. The whole of the parts are carried by brackets within the index case.

Fig. 1.

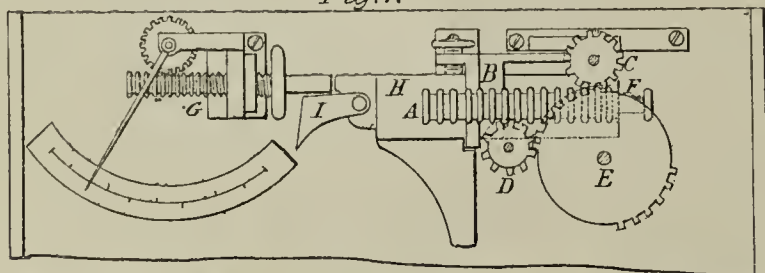


Fig. 2.

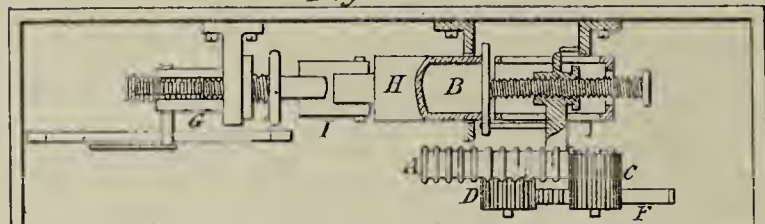
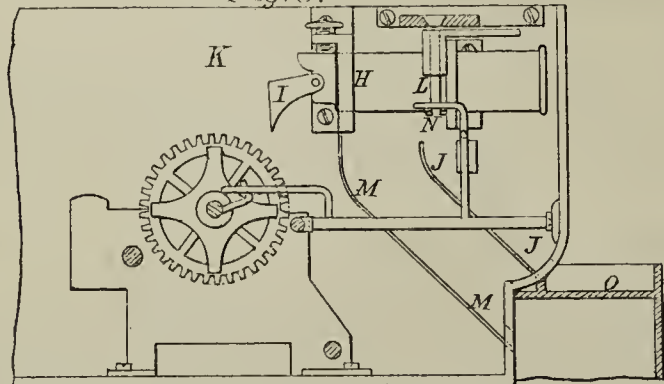


Fig. 3.



The operating handle, whereby "pumping" is prevented, is mounted loosely on the axle of the eccentric, cam-shaped lever, or revolving disc E, and is provided with a pin or projection, which works in a check or recess formed in a collar on the axle. The object of this is to allow the handle a little play, to enable the pawl to act quicker, and so prevent the handle being moved alternately backwards and forwards.

The price-changing adjustment is shown in figs. 1 and 2. The pusher-rod F is formed as a screw; and it is screwed into or out of the eccentric's projection, or the rack's projection, which now forms a carrier for the pusher or screw. The screwing of the pusher in or out of the carrier thus alters the effect it has on the prepayment mechanism, which may be set to any desired distance by means of the adjusting arrangement G or register, as described in patent No. 3575 of 1891. This consists of an adjusting screw having a rack and pinion working a pointer on a scale; the whole being mounted in front of the extension H of the slot-piece. The adjustment is applicable to both the eccentric and reciprocating rack arrangements; whereby, although the movements are in each case uniform, the movement given to the pawl I and prepayment wheel is capable of adjustment.

The double-shoot arrangement is illustrated in fig. 3. The patentee provides an extra shoot J mounted inside the index-case K in such a manner and in such a position that, when the slot of the slot-piece L is in its normal position (as shown), the coin, if present, does not stand directly over the entrance of the money-box shoot M, but over the mouth of this extra shoot, which communicates with an opening in the outside case of the meter in such a way that, on placing a small coin in the slot N, it passes through it down the shoot, and through the opening on to a platform O formed on the outside of the meter-case, and from which it may be easily recovered.

The double shoot J is also applicable for delivering back surplus coins—that is, coins which are inserted after the prepayment pointer has reached a predetermined position on the prepayment dial. The delivery of surplus coins is effected by forming the guard which retains the proper coin in the slot as a moveable guard, and connecting it by means of rods and a spindle, which is preferably centred at each end, to a tail-piece, operated at the proper time so as to remove the guard away from the slot, and so allow the surplus coins to fall down the shoot and on to the platform O by means of a cam or projection formed on, or attached to, the shaft of the gearing-wheel. The parts are retained in their normal positions, as shown, by means of a counterpoise weight until the predetermined quantity of coins has been put in, when, owing to the action of the last coin inserted, the guard has been removed, and no more will act on the mechanism, but will simply pass out on to the platform.

Coal-Conveyors.—Lewis, T., of East Boston, Mass., U.S.A. No. 21,913; Dec. 15, 1891.

This invention relates to apparatus for conveying coal from the hold of a vessel to a suitable receptacle on the shore—particularly to that class of conveyors in which the coal is lifted and removed from the vessel to the shore by buckets operated by endless chains. It is found,

in practice, says the patentee, that the coal-conveyors now in use dig or burrow in the coal in one spot in the hold on a line with the hatchway, but leave large masses of coal untouched at the sides or wings. The principal object of this improvement, therefore, is to provide a conveyor which will take the coal from all parts of the hold, even next the sides, instead of merely digging a hole in a single spot. This object is accomplished by means of a series of three conveyors; one (the main conveyor) being jointed, and the other two auxiliary conveyors being pivotally and otherwise adjustable.

APPLICATIONS FOR LETTERS PATENT.

7368.—LUTHER, W. H., and BAYLEY, E. M., "Burning hydrocarbon or other oils for lighting and heating purposes." April 19.

7379.—BOULT, A. J., "Gas generators." A communication from H. C. Rew. April 19.

7514.—BREYMAN, W., "Regenerative gas-lamps." April 20.

7627.—FREEMAN, W. J. and E., "Preventing the deterioration of the air in an apartment or building in which gas is used for illuminating, heating, and other purposes." April 21.

7708.—CHANDLER, J. C., "Washing, purifying, and scrubbing gas." April 23.

Compensation for Fatal Injury to a Gas Workman.—At the last meeting of the Huddersfield County Council, the Town Clerk was authorized to pay £225 in full settlement of the claim of the widow of Christopher Kenny, who died from injuries received at the gas-works of the Corporation on Dec. 25 last year, as already recorded in the JOURNAL (*ante*, p. 74).

Beverley Water Company.—At the recent general meeting of this Company, the report presented by the Directors showed that the income for the ninth year of working, ending March 31 last, was £952. The working expenses were £536; and the profits £416. After the payment of interest on debentures and other preferential charges, amounting to £307, there was left a surplus of £109, which the Directors proposed to carry forward. The report was adopted, and general satisfaction was expressed at the improved prospects of the Company.

Newcastle and Gateshead Water Bill.—Last Tuesday, the Standing Orders Committee of the House of Commons had under consideration the proposal of the Newcastle and Gateshead Water Company to bring in a Bill dealing with the question of a proposed fish-pass, which they are required, under the previous legislation, to make, and in respect to which the Examiner had held that the Standing Orders had not been complied with. The prayer that these should be dispensed with was supported by the Corporation of Newcastle and Gateshead; but the Committee declined to grant it.

The Proposed Water-Works Extension at Bath.—The Local Government Board have addressed to the Bath Corporation a letter in reply to their application to borrow £18,000 for water-works purposes, in regard to which an inquiry has been held by Mr. S. J. Smith and Mr. E. P. Burd. The Board entertain great doubt as to the scheme at present before them being one in respect of which they will be able to sanction a loan. As, however, it is clear that it will be necessary for the Corporation to carry out additional works of water supply, they will be prepared to issue a Provisional Order extending their borrowing powers under the Local Act.

The Proposed Purchase of the Barnoldswick Gas-Works by the Local Board.—A meeting of ratepayers has just been held at Barnoldswick, to consider the proposed purchase of the gas-works by the Local Board. It was stated that the total income of the Company for the past year was £467, to which sum must be added the next dividend of 6 per cent. (£190), and a probable £60 before the close of the year. This brought the total to £617. It would be necessary to borrow £14,000; and after making the annual payment of interest on this sum, there would be left £94 in relief of the general district rate. At present there were only 310 meters in the town, out of a total of 930 houses and a population of 4131. A motion authorizing the purchase of the works at a price not exceeding £14,000 was carried by a majority of 47.

Charge of Stealing Coke.—The Ramsgate Magistrates have lately been occupied in investigating a charge of a serious character brought against one of the employees at the Corporation Gas-Works. The accused, named Frederick Yates, who had been in the service of the Corporation since 1878, had the issuing of the orders for the delivery of coke. The normal deliveries to a certain firm, regular customers of the Corporation, while Yates was on duty, were booked as 12 cwt.; but, during his absence for a short time on account of illness, it was found that they rose to 18 cwt.—falling again to 12 cwt. on his return. These variations aroused suspicion; and the result was Yates's summary dismissal and the institution of proceedings against him. He was prosecuted on two charges—one of larceny, and the other of falsifying the books; and, after an inquiry extending over several days, he was committed for trial at the Sandwich Quarter Sessions. The firm to whom the deliveries of the coke were made (Messrs. W. and F. Drayson) were also charged with conspiring with Yates to defraud the Corporation; and they were also committed for trial. All were, however, admitted to bail.

The Quality of the Metropolitan Water Supply in March.—The report to the Official Water Examiner for the Metropolis (General A. de Courcy Scott) on the quality of the water supplied by the London Water Companies during the month of March, as shown by samples taken daily for analysis, states that of the 186 samples examined, the whole were found to be clear, bright, and well filtered. The satisfactory character of the supply, which had been commented upon in previous reports, was continued; the quantity of organic matter present in the Thames-derived water being substantially identical with that recorded in February, though just a trifle higher. The report is signed by Professor Crookes and Dr. Odling only—no successor to Dr. Tidy having been appointed. With regard to their late colleague, these gentlemen express their sense of the loss they have sustained by his premature death. He was esteemed, they say, not only by themselves, but by all with whom he was brought into relationship, alike for his great professional knowledge and experience, especially in regard to the analysis of water, and for his bright, kindly disposition and high personal character.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

The Standards of Light Committee.

SIR,—In an article which appeared recently in your JOURNAL, under the heading "Further Work for the Standards of Light Commission," is a sentence which I think must have been written under some misapprehension. It is this: "Gas managers have heard of pentane holders that required to be kept warm by steam-pipes." A statement of the same kind, as to the need of steam-pipes, appeared in your columns some months ago; and thus no doubt gas managers have heard of it. But actually pentane air-gas is unaffected by any fall of temperature down to the freezing point of water. Probably the statement had its origin in an imperfect recollection of an experiment made by the former Committee on Standards of Light, in which the light of the pentane flame, when the holder was heated by a steam-pipe, was compared, and found to be identical, with that of the pentane flame under ordinary conditions. The object of the experiment was presumably to try what effect very hot weather might have.

May I add two questions relating to another paragraph in the same article? Is not "the brightness of the screen when illuminated both sides by two 16-candle flames at either end of a . . . 100-inch photometer bar," the same as when gas is tested in an Evans photometer with a pair of candles? Is not the range of the screen, for a difference of one candle, when two 16-candle lights are compared, greater, and not less, than when the standard gives a light of only two candles?

Christ Church, Oxford, April 29, 1892.

A. VERNON HARCOURT.

Steam-Pipes for Pentane Holders.

SIR,—In an article in last week's JOURNAL, headed "Further Work for the Standards of Light Commission," the writer states that "gas managers have heard of pentane holders that required to be kept warm by steam-pipes." I have had some experience in the use of pentane air gas, and have for the last year daily used it in this College for testing the Manchester coal gas. I have never heard of the necessity of steam-pipes to jacket the holder. I can understand if the temperature of the photometer-room falls below the freezing point, that the water in the pentane-holder will freeze; but so also will the water in the coal-gas meter and governor freeze. The pentane-holder therefore requires a steam-jacket just to the same extent that the coal-gas meter does—neither more nor less.

I imagine the origin of the steam-pipe fable to be this: "In the long investigation carried out by the Board of Trade Committee in 1879-1881, the question was discussed as to what would be the effect of an abnormal rise of temperature on the quality of pentane air gas standing over water. To answer this question, a pentane-holder was surrounded by a coil of pipe through which steam could be blown. Several gas managers saw the apparatus at the Old Kent Road station of the South Metropolitan Company. Is it not possible that the image of the coil remains in their memories, while the object of the experiment has faded away?"

H. B. DIXON.

The Owens College, Manchester, April 29, 1892.

The Present Position of the Gas-Works Rating Question.

SIR,—In his article with the above title in this week's JOURNAL, Mr. Norton H. Humphrys is quite wrong in the definition he gives of "rent" and "rateable value." The assessment question is, in itself, sufficiently intricate, without adding to existing difficulties by a confusion of terms.

Mr. Humphrys states as a "fact" what is not a fact at all—that "the law lays down, as a first principle, the rule that the rateable value should be equal to the rent which a tenant would be willing to give for the property from year to year." And farther on in the same article he asserts that "the rent is the same amount as the rateable value." This is inaccurate and misleading. It is clearly set down in the Parochial Assessment Act, 1836, sec. 1, that the rateable value is the amount remaining after deducting from the rent the probable average annual cost of repairs, insurance, and other expenses. Again, the Union Assessment Committee Act, 1862, sec. 15, expressly states that "the gross estimated rental . . . shall be the rent at which the hereditament might reasonably be expected to let from year to year." Further, the Valuation (Metropolis) Act, sec. 4, substitutes the term "gross value" for "gross estimated rental," and defines it as "the annual rent which a tenant might reasonably be expected, taking one year with another, to pay for the hereditament."

Clearly, then, it is the gross estimated rental, or gross value, which is the rent payable by the tenant; the rateable value is the amount remaining after making the statutable deductions necessary to maintain the hereditament in a state to command such rent.

5, Norfolk Street, Manchester, April 28, 1892.

THOS. NEWBIGGING.

The Cost of Enriching Gas by Carburetting.

SIR,—Perhaps Mr. F. W. Clark will kindly add to the information contained in his paper presented at the recent meeting of the South-West of England Association replies to the following questions:—

- 1st. In how many gas-works is the price for cannel mentioned by him paid?
- 2nd. Why does he not give credit for the value of the residuals and coke from such cannel?
- 3rd. What evidence, of an independent and trustworthy character, exists to prove that the oil which he calls "carburine" will evolve 100 feet of perfect gas of 100 candles per gallon, or add by candle to 10,000 feet of gas?
- 4th. By what photometer was the value of this extraordinary oil gas ascertained?

- 5th. How much of this oil gas is condensed back into the mains?
- 6th. By what means has the amount so condensed been ascertained?

In the absence of a sufficient reply to these obvious queries, I am afraid that Mr. Clark's paper is useless.

Manchester, April 28, 1892.

BLACK COAL.

Reduction in the Price of Gas-Tubes.—The English and Scotch Wrought-Iron Tube Association have lately issued circulars greatly reducing the prices, owing to German competition.

The Mansfield Woodhouse Gaslight and Coke Company, Limited, has been registered with a capital of £2050, in £10 shares. The Company was originally registered in March, 1855. The object is sufficiently indicated in the title.

The Expenditure on the Vyrnwy Water-Works.—The amount of expenditure in connection with these works up to March 31 last was £2,116,867. This includes, for the Vyrnwy embankment works and works in connection with the reservoir, £534,898; the Vyrnwy quarry, £201,262; the aqueduct, £1,062,832; land and easements, £282,413; maintenance of the Vyrnwy estate, £27,041; Vyrnwy Hotel, £8188.

South African Lighting Association, Limited.—The annual general meeting of this Company was held at the London Offices, No. 90, Cannon Street, on Thursday last.—Mr. D. Ford Goddard, J.P., in the chair. In moving the adoption of the report and the payment of a dividend of 5½ per cent. (making, with the interim dividend already paid, 8 per cent. for the year) the Chairman pointed out that it would have been possible for the Company to have paid 10 per cent. out of its earnings for the year; but the Directors considered that, in view of strengthening the position of the Company, and of certain extra risks which a foreign company must necessarily run, it would be better to place the sum of £1000 to reserve, and to pay, as in former years, 8 per cent. The Chairman stated that the present price of gas was 12s. 6d. per 1000 cubic feet; and that a satisfactory result in the yield of gas per ton of coal carbonized was obtained on the works. He also alluded to the possible extension of the undertaking to another town in South Africa; and he stated that prior to this being carried out, the full negotiations would be laid before the shareholders. Mr. Corbet Woodall subsequently gave some further details of the proposed extension. After the re-election of Mr. J. Mansergh, C.E., the retiring Director, and the Auditor, the proceedings terminated with votes of thanks to the Directors and to the staff.

A Secretary Charged with Embezzlement.—On Monday last week, William David Melville Forrester, 39, secretary, was charged, before the Lord Mayor, at the Mansion House Police Court, with embezzling and stealing, on the 16th ult., £600 2s. 6d., the money of the Odessa Water-Works Company, Limited, his employers. Mr. Spokes, who prosecuted, said the defendant had been for some years Secretary to the Company; and on the 13th ult. a cheque for the above-named amount was handed to him to pay the Income-Tax Commissioners. On the 16th, the defendant had the cheque cashed, and on the following Saturday he took the money away with him. He was arrested at his residence the next morning, when the greater part of the money was found upon him, and it had nearly all been accounted for. If his Lordship thought fit to deal with the case summarily, the Directors would leave it entirely to his discretion. Mr. Allen, one of the Directors, stated that the defendant had been in the service of the Company for 21 years; his present salary being £350 per annum. Inspector Mitchell said that on the previous morning he saw the defendant at the police office in Old Jewry, in the custody of Detectives Bacon and Dowse. The defendant said he never intended to embezzle the money. The sum of £546 10s. in notes and gold was found on him; and since he had been in custody his brother-in-law handed witness £25. Detective Bacon said he arrested the defendant at half-past three o'clock on the morning of the 24th ult., at his residence. The defendant said his trouble arose through being a friend to others. He was the worse for drink, and had just arrived home while witness was watching. In reply to the Lord Mayor, Mr. Spokes said there was no other case against defendant. The Lord Mayor said he should not be satisfied to deal with the charge unless he felt sure of it. He should therefore remand it for the purpose of ascertaining for a fact whether it was a solitary case.

Sligo Gas Company.—A special meeting of this Company has lately been held to consider the advisability of obtaining a Provisional Order to increase the capital by £6000, and to acquire power to convert the concern into a limited liability Company. The Chairman (Mr. S. Cullen) explained that, owing to the increased consumption of gas during the winter months of the year, the present storage accommodation was not sufficient; and the Directors had had several complaints of deficient supply. If the shareholders approved of raising the additional capital, it was proposed to erect a gasholder, enlarge the mains from the works to the Market Cross, and pay off the mortgage to the bankers. This would take about £3000. The Directors would require £1000 more for working expenses; so that if they had power to raise £6000, they only intended to issue shares for about £4000. Mr. J. O'Connor then moved—"That the Directors be instructed to take such steps as they consider necessary to have the Sligo Gas Company formed into a limited liability Company;" and the motion was carried unanimously. A proposition having been submitted that the Directors should take what steps they consider necessary for obtaining a Provisional Order, the Manager (Mr. C. B. Tully) made a statement showing the increased consumption of gas during the period from September, 1891, to February, 1892, and also the periods when there was no increase, owing to the works being unable to supply more. He estimated that the new holder and mains would cost about £1500; £1000 of the new capital would be needed for working expenses, and £1850 to pay off a mortgage. This made a total of £4350 of the new capital. He reckoned that after paying 5 per cent. on the proposed new preference shares, they would be able to pay 8 per cent. on the ordinary shares, and carry forward £160. The proposition was agreed to; and it was decided to offer the preference shares at 8 per cent. premium.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

The following progress was made with Bills last week:—

Bill read the first time: Gas Provisional Orders Confirmation Bill (to confirm Provisional Orders relating to the gas supply of Cullingworth, Kempston, Mitcham and Wimbledon District, South Normanton and Blackwell, and Sutton and Hooton District).

Bills read a second time and committed: Bradford Corporation Water Bill; Liverpool United Gas Bill; Oxford Gas Bill; Southborough Local Board (Gas) Bill.

Bill reported: Bournemouth Improvement Bill.

Bill read the third time and passed: Blackburn Corporation Bill.

Petitions against the following Bills were presented:—

Ashton-under-Lyne, Stalybridge, and Dukinfield District Water Bill, from the Guardians of the Poor of the Saddleworth Township.

Rhymney Valley Gas and Water Bill, from the Pontypridd Rural Sanitary Authority.

HOUSE OF COMMONS COMMITTEE.

Friday, April 1.

(Before Mr. CAMPBELL-BANNERMAN, Chairman; Sir W. HOULDSWORTH, Sir H. STAFFORD NORTHCOTE, Mr. R. K. CAUSTON, Mr. S. GEDGE, Mr. P. STANHOPE, Mr. POWELL WILLIAMS, Mr. W. JAMES, and Mr. E. H. LLEWELLYN.)

BIRMINGHAM CORPORATION WATER BILL.

The proceedings on this Bill (see *ante*, p. 758) were continued to-day.

Sir T. Martineau, further examined by Mr. BALFOUR BROWNE, detailed the manner in which the proposals of the Water Committee were submitted to the Council and the general public, and stated that every opportunity had been afforded them for becoming acquainted with the scheme. The Council were unanimously in its favour; and at the ratepayers' meeting, it was agreed to by a large majority. This result was subsequently confirmed by a three days' poll, the outcome of which was a majority of nearly eight to one in support of the Council's proposals. The total estimate of the Engineers for the whole of the works was as follows: For the Elan and Claerwen scheme, £5,654,953; for reservoirs (Northfield and Warley), £86,250; extensions of mains and improvements of present supply during the next 10 years, £195,000; extensions of mains during the following 40 years, £480,000; addition made to cover cost of land, £183,797; amount provided in the Bill, £6,600,000. Of this there would be required during the next 10 years (during which the first instalment of the works with two lines of pipes would be carried out): First instalment, £3,340,700; reservoirs (Northfield and Warley), £86,250; extension of mains and improvements of present supply, £195,000—total, £3,621,950. Some addition might have to be made to this sum, in case of the purchase of additional land, out of the £183,797 provided for that purpose. It was intended that the future instalments of works should be added as required. Mr. Mansergh's expectation was that the second instalment, which would include the third line of pipes, would be wanted by 1908; the third or fourth line, by 1921; and the fourth or fifth line, by 1931. His estimate provided for the expenditure on these instalments running over about four years in each case. As to the local requirements, the reservoirs at Northfield and Warley were needed for the better supply of the high-level districts. Both sites were at a greater elevation above the sea than any of the present reservoirs. With reference to the extension of mains, experience showed that for the development of the works the Committee required about £12,000 each year. The item of £195,000 provided a margin to cover improvements in the present works (such as fresh headings from some of the wells), so as to carry the city on during the construction of the new works. As to all these local requirements, further borrowing powers were needed. The general financial scheme for bearing the annual burden to be occasioned by the proposed outlay for all purposes showed that it could be met by these different factors: (1) The natural growth of the water revenues; (2) an addition to them by an increase in the charges; and (3) the saving to be effected in the annual cost of pumping.

The CHAIRMAN: Are you now charging up to the extent of your powers?

Mr. BALFOUR BROWNE: Oh, no. We are not seeking powers from Parliament to increase our charges.

Witness: As a matter of fact, we shall only reimpose charges which we remitted in 1882-4. We reduced them so boldly, indeed, that for several years we were incurring a deficiency. The amount we have remitted is equal to £33,000 a year; and that which we propose to put on again is £28,000 a year.

In further examination, witness said, with regard to the natural growth of income, he thought that the rate shown in the estimate was reasonable. The estimate was as follows: From 1891 to 1900 inclusive, 3 per cent.; 1901 to 1910, 2½ per cent.; 1911 to 1920, 2½ per cent.; 1921 to 1930, 2½ per cent.; and 1931 to 1940, 2 per cent. The rate of increase from 1876 to the end of 1889 showed nearly 4½ per cent.; but this was hardly fair, as the earlier years were under exceptional circumstances. From 1886 to the end of 1889, it had been 3½ per cent. He believed it was now growing more rapidly. Mr. Mansergh's figures were based on the statistics up to the end of 1889. Calculating at the 3 per cent. rate, he estimated the rental for 1890 to be £132,720. When the Committee made up their accounts for 1890 (*i.e.*, to March 31, 1890), the rental was found to be £135,134; and 3 per cent. would have given an increase of £3866. The actual increase was £6280, or at the rate of 4½ per cent. It was intended that the increase in the annual charges should be made at once. This would give time for a considerable annual surplus to accumulate. The saving in the cost of pumping would be £20,000 a year.

Cross-examined by Mr. PEMBER, witness stated that the Corporation proposed to take the house of Mr. R. L. Lloyd, who had manorial

rights covering upwards of 20,000 acres of the land to be acquired, and also his gardens, together with a village of 180 inhabitants, and 1400 acres of enclosed land. He admitted having heard that Mr. Lloyd had sold of late years a considerable property in another part of Wales for the purpose of spending the money on this estate. Mr. Gray, in his report, did not say that the existing sources of supply could be retained for 20 years. What he said was that, if they could be retained, they would be equal to the growing requirements. There was at present an average daily surplus of 3 million gallons of water.

Mr. PEMBER: But your average daily supply being 3 million gallons in excess of your average daily consumption, there is often a large reserve in store, is there not?

Witness: Yes; but then the store may be exhausted, which it nearly was last year. That was an exceptional case, but one which may occur again this summer or next winter.

Cross-examination continued: Wolverhampton and Worcester had approached the Water Committee as to the possibility of buying some of the supply from Birmingham; and he had had a private inquiry from Bewdley. It was true that, in his speech to the City Council, he said that there was a most imperative reason for not dallying with the matter—namely, what was being done by London. But he was then endeavouring to put before the Council the position in which they would find themselves if, instead of the present scheme, they adopted a temporary expedient.

Mr. PEMBER: Quite so. If you did not jump in and take the water at once, London might acquire it?

Witness: I desired to show that it would be bad policy to adopt a temporary measure.

Did you not put it as an important factor that London was considering the advisability of obtaining a supply from Wales?—Yes; but I wish you to understand that I never said we were moving because of what was being done in London.

In reply to Mr. A. T. LAWRENCE, witness said the Elan and Claerwen were among the most important tributaries of the Wye. The water compensation proposed to be given would leave to Hereford a better river than the city had at present. It was compensation to the riparian owners for the "flow." He knew that Hereford had water-works on the Wye supplied from that river; but he did not know what the proprietary rights of Hereford in the river were.

Mr. LAWRENCE: But, apart from that, can you tell me of any single case in which a stream appropriated for one community has been taken away for the benefit of another?

Witness: Until I know what the rights of Hereford are, I cannot answer that question.

Cross-examined by Mr. C. J. EDWARDS, witness said it was alleged that the scheme had been hurriedly pushed through at Birmingham. He emphatically answered that there was no foundation for this allegation. It was quite true that, in a speech he delivered in April, 1891, he mentioned 4 millions as being the amount which it might cost to carry the scheme through. This sum, however, was given as an illustration, in order that they might work out a financial plan. It was true that between April and October neither the public nor the Council had any materials before them as to the cost of the scheme—nothing except a sort of speculation that had been put in. Witness thought that there were from 300 to 400 people at the ratepayers' meeting. Questioned as to the increased demand for water, witness did not think this had been caused lately by the closing of wells, because many of them were closed shortly after the Corporation took over the undertaking. As to the suggestion about utilizing the Severn and the Trent, witness believed there could hardly be a more substantial reason against this course than the fact that the rivers ran through a contaminated district. The system of double mains had not been considered in the reports, because it was altogether too feeble a scheme.

By the CHAIRMAN: The ratepayers' meeting was held in the Town Hall, which was capable of holding 3000 people; but only 300 attended. But he took that as implying acquiescence on the part of the community, as the voting was eight or ten to one in favour.

Mr. GEDGE: If there had been strong opposition, people would have attended?

Witness: Yes.

Mr. Lawley Parker, the Mayor of Birmingham, gave corroborative evidence. He said the two previous polls of the ratepayers—in April, 1874, and December, 1883—brought together only 1902 and 5713 voters respectively, though the latter was marked by an organized opposition, and the former had relation to the expenditure of £2,000,000 in the purchase of the gas-works. Birmingham manufacturers were not large users of water; so that even if it were possible that they should suffer from a general depression of trade, the demand for water would hardly be diminished.

Cross-examined by Mr. LAWRENCE, witness said he would be surprised to learn that the water proposed to be taken had already been given by Parliament to the city of Hereford.

By Mr. POWELL WILLIAMS: The scheme was promoted not only because it was thought that the population of Birmingham would continue to increase, but because the present sources of supply might become unsuitable. The actual cost of the scheme, according to the last estimate, had been made known before the poll was taken.

Monday, April 4.

Mr. J. Mansergh, M.Inst.C.E., examined by Mr. POPE, said he had been acquainted with Birmingham for 20 years; and he assisted Sir Robert Rawlinson in the report presented by that gentleman in 1871. It occurred to him then that the Elan district, being at a considerable elevation, might not be unsuitable for the highest of large towns in the country; but the distance from Birmingham was so great that he first of all critically examined such available streams as were nearer—viz., the Severn, the Teme (above Knighton), the Ithon (above Llandrindod), and the Wye (above Rhayader). To each there were certain practical objections. The Severn was too low, and not sufficiently pure; the Teme collecting area was insufficient; and the Ithon, above the necessary height, was likewise inadequate. He therefore reverted to the Elan, with its tributary the Claerwen, which he had first observed while engaged on railway work in Wales; and Sir Robert Rawlinson agreed with him. When the report was presented, the water-works were not under

the control of the municipal authority; and since acquiring them the Corporation had for a while been content. But in 1890 he received instructions to advise, on his own part, as to the provision of water—first for the needs of 25 years, and secondly, for 50 years. The distribution area was 83,221 acres, and its population was 647,972, of whom at the end of last year 604,036 were supplied. Witness went on to describe the water-works by which this area and population are served. In reply to a question interpolated by the Chairman, he said that the surface water at present collected came from highly-cultivated ground. He estimated the minimum available supply at 19½ million gallons per day. This was the only safe figure which could be taken, though Mr. Gray had named 20½ millions. He had been sanguine enough to promise the Water Committee that, if the Act was obtained this session, water might be had in Birmingham by Christmas, 1900; but they could not safely calculate upon an earlier date than the spring of 1902. If his first promise were fulfilled, more would be done in the time than ever had been accomplished in this country. Before then the Water Committee (drought and frost apart) would be in grave difficulties; and not a single day ought to be lost before making a start. By the time the new works were expected to be finished, the minimum daily quantity of water required would be rather over 21 million gallons; and the maximum, 26 or 27 million gallons. In other words, there would be a deficiency of 2,154,000 gallons a day at the best, and of over 7 millions at the worst. He was convinced that every care had been taken to avoid waste of the present supply. The domestic consumption in London was 24½ gallons per head per day, though the Companies were very careful; whereas in Birmingham it was only 17 gallons. It would, however, certainly increase from the extending use of water-closets and baths in low-rented houses. As to the possibility of augmenting the supply from present sources, the Bourne could not yield more than a net quantity of 1 or 1½ million gallons a day additional; while the Blythe and Plant's Brook would give no more. He had satisfied himself that no considerable increase of underground water could be obtained; and that some of the existing wells were getting foul, and might soon have to be abandoned. Pumping from such wells caused the water to become harder, and otherwise to deteriorate in quality. The outside additional yield would be 3 million gallons a day, even if the quality were good, and could be kept so. As to the dual system of supply which had been suggested, it was utterly unworthy of a place like Birmingham. It meant duplicate reservoirs, mains in all the streets, and services in every house. Moreover, it would be impossible to prevent the indiscriminate use of the two waters. There was such a system in Paris; and when the spring water failed, the dirty water of the Seine was turned into the pipes conveying the spring water. As to temporary provisions in general, he was of opinion that, in order to justify the expenditure of capital, provision should be made for 50 years at least. As Birmingham was on the average 300 feet higher than Liverpool or Manchester, her case was much more difficult than theirs, and her choice of gathering-grounds more limited. London, for example, could command a much larger choice, with equal advantage. All the schemes hitherto devised for London had been arranged for the delivery of water at elevations varying between only 220 and 300 feet above Ordnance datum. If London was to be preferred in this matter, she would take an area which she did not necessarily need, and which was practically the only one open to Birmingham. With reference to the engineering features of the scheme, the covering of Mr. Lloyd's house with water was an inevitable necessity. Mr. Lloyd was bound to be drowned, or the scheme to be thrown over; for it would be the height of folly to go to an enormous expense for the construction of works without utilizing all the water that the drainage area would yield. In the course of his description of the scheme, witness put in blocks of marble and other rock taken from the strata of the gathering-ground, and said that, with the exception that it was slightly stained with peat, the water was absolutely pure, as well as soft. He had at first estimated that the watershed area extended over 45,562 acres; but he found that a deduction must be made, because a right of user had been acquired to divert the water from 800 acres into Cardiganshire for certain mines. He reckoned the net extent of area available for collection at 44,000 acres. The rainfall, taken for 21 years by Mr. Lewis Lloyd and his father at Nantgwilt, at a height of 768 feet above Ordnance datum, was 63 inches. Observations were also taken by Mr. Symons and himself at three other places during twelve months. At 1040 feet, the rainfall was 70·9 inches; at 1281 feet, 68·2 inches; and at 1197 feet, 69·55 inches. His opinion was that it would not be safe, however, to calculate on getting more than the average rainfall of three consecutive dry years—viz., 56 inches; and as it was impossible to construct reservoirs of sufficient capacity to equalize the rainfall of more than three such years, and almost certain that during this period some water would be wasted by overflow in times of flood, he dared not estimate for collecting more than 36 inches. This would produce a daily average yield of 99 million gallons. Yet at extreme times the yield from the Elan to the Wye was as low as 2½ millions.

Mr. POPE: You are going to give water when the river needs it, and to impound water when, in times of flood, its free escape would do damage?

Witness: Yes; we shall send down an equal flow of 22 million gallons a day; and, in my opinion, that is an adequate compensation. All the way down to Chepstow there are only six little towns, and their population has fallen from 36,587 in 1881 to 35,903 now. As to Hereford, where the population is only 20,267, the quantity of water pumped for drinking purposes would not exceed 600,000 gallons a day, which is 100 times less than the dry-weather flow.

Whatever right they have to the water, you do not propose to take that right from them?—Oh, no. We had the same fight in the case of the Bradford Water-Works last year but one. York was similarly situated to Hereford; but got nothing. York was content, as all other places have to be content, with compensation water. We are going to spend on this water about £300,000, and to supply the water in a better and far more useful form.

In further examination, witness proceeded to describe the reservoirs proposed to be constructed, the gradual progress of installing them, and the proposal made to complete the cut-and-cover work, but to lay pipes only as necessity demanded. Thus the capital would be expended as

occasion required. He put in a table upon which this was worked out year by year, and which showed the reimposition of the remitted charges. There would, he added, be a saving of £60,000 a year in soap alone, owing to the reduced hardness of the water; and if the saving in fuel which would be effected by reason of boilers being kept free of incrustation were taken into the computation, it would be apparent that by these economies the community, as a whole, would be able the earlier to pay instalments of interest and sinking fund. As to the likelihood of towns on the line of route requiring some of the surplus water, he thought it would be fairly assumed, after what had been heard from Wolverhampton and Worcester, to amount at no very remote period to 9 million gallons a day.

Mr. POPE: Reverting to the dual system, is there, irrespective of difficulty, any guarantee that the underground water to be reserved for a dietetic supply under that system would remain unimpeachable?

Witness: No; the chemists who have examined it say that one of the wells has nearly arrived at such a state that it should be abandoned.

Supposing you could continue them for a dozen years, would it be prudent to defer taking other steps till then?—Oh, no. Supposing Birmingham muddled on until then, she would probably find that the only really suitable ground would have been taken away from her.

Cross-examined by Mr. MOON (for the Wye Fishery Board), witness said that, assuming the rainfall had been wrongly computed, there might be a minimum supply of more than 99 million gallons a day; but the reservoirs would be constructed on the lower supposition. To raise the walls of the reservoirs 3 feet would mean an increase of the storage capacity by 800,000 gallons an acre. If the Bill passed, Birmingham could utilize in this way a larger quantity of water than he had hitherto spoken of, and could do so without increasing the compensation to the Wye. But this would mean an increase in the cost.

Mr. MOON: You spoke of 50 years as a reasonable time to provide for, and yet I see, from the table you have put in, that even in 1942 you will have more water than you can estimate that you need?

Witness: But the end of the world is not to come in 1942.

At all events, the increase of the Birmingham demand may have ceased by that time, may it not?—I think that is not at all likely.

Cross-examination continued: It was all nonsense to say the Wye fisheries would be damaged by the scheme proposed in the Bill. The Wye was not so important a river as the Severn, and therefore should not be compensated. Why Birmingham should be mulcted of £150,000 for the sake of a few rod fishers, he could not conceive.

Mr. MOON: Let me put it the other way about, and ask why the owners of property on the Wye should be mulcted for the sake of letting Birmingham have more water than she wants?

Witness: I do not believe they will be hurt a penny's worth.

By the Hon. A. LYTTELTON (for Mr. R. L. Lloyd): He had, of course, looked about to see whether it would be possible to place the reservoir anywhere else than at such a point as to drown Mr. Lloyd's church and house. In Birmingham, out of 25½ gallons of water per head used every day, 17 gallons were for domestic purposes. The question of hardness was therefore very important.

By the CHAIRMAN: The Elan water alone, plus the Caban Loch reservoir, would only last until 1906.

The Committee adjourned till the next day.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Wednesday, April 27.

(Before Justices DAY and CHARLES.)

The Surbiton Improvement Commissioners v. The Governor and Company of the Chelsea Water-Works.

This action came before the Divisional Court by way of a special case, from which it appeared that the plaintiffs sought to recover £63 12s. 11d.; being the amount at which they alleged the defendants were liable to be rated in respect of the general sewer rate made by the plaintiffs as the Local Authority on April 29, 1889. The sum was made up of the following items: General sewer rate, at 3d. in the pound—works, &c., £59 3s. 6d.; 15 cottages, £2 11s. 9d. General sewer rate, at ¾d. in the pound—on mains, £1 14s. 8d.; on land, 3s. It appeared that prior to 1855 the defendants, in connection with the Lambeth Water Company, had, in order to prevent sewage being discharged into the River Thames above their intakes, constructed and maintained, at their own cost, two sewers for draining the works and property of the two Companies, and also for intercepting the drainage of the adjoining houses. The defendants also put down a sand-washing drain for the purpose of draining their filter-beds. In the years 1859 and 1860, the plaintiffs constructed the main sewers in their district. Prior to April, 1889, plaintiffs did not seek to impose any general sewer rate on the defendants. Subsequently to 1855 various Acts of Parliament were passed for the better purification of the Thames; and by section 63 of the Thames Navigation Act, 1886, the discharge of sewage into the river was absolutely prohibited. Prior to the passing of this Act, the plaintiffs and defendants had discharged sewage direct into the Thames by means of the sewer constructed by them. Pursuant to the provisions of the Act of 1866, the Thames Conservancy in the year 1867 served notice on the plaintiffs and defendants and the Lambeth Water Company, calling upon them to discontinue the discharge of sewage into the river, and further notices to a similar effect were given in the years 1869 and 1884. The plaintiffs, in order to prevent the sewage flowing from their district into the Thames, did in 1889, at a cost of about £11,200, cause a new outfall sewer to be made, for conveying the sewage of Surbiton to the purification works at Kingston; and in order to drain the premises of the defendant Company, situate on the Portsmouth Road, the main sewer made by the Improvement Commissioners had to be continued along the road. Prior to the construction of the sewer, a portion of the defendants' property consisted of four cottages on the north side of the Portsmouth Road; and the Engineer's residence and the Company's office, on the south side of that road, as well as two cottages belonging to the Lambeth

Water Company, and situate to the west of the defendants' houses, drained into the sewer of the Lambeth Company (since disused), which ran at a lower level than the new sewer constructed by the plaintiffs. But for the existence of the above-mentioned property, there would have been no necessity to carry the new sewer beyond the houses situate to the east of the defendants' property. The plaintiffs were of opinion that, in consequence of the prohibition against the discharge of sewage into the Thames, the sewers of the defendants did not sufficiently drain their works and property situated within the plaintiffs' district. In 1888 and 1889, new branch sewers were constructed in the Fleece Road by the plaintiffs, by agreement with, and at the expense of the defendants and the Lambeth Company, in order that the defendants' works and property, and a considerable number of houses situate in the Brighton Road, might be drained into the plaintiffs' main outfall sewer, and thence to the new outfall works. If the defendants had not been allowed to discharge the sewage from their works and property into the main outfall sewer of the plaintiffs, the defendants would have had to find some other means of disposing of their sewage than allowing it to drain into the Thames. As to the sum of £1 17s. 8d. in respect of mains and lands within the limits of the Act, the defendants admitted their liability, and also that the four cottages situate north of the Portsmouth Road were liable for sewer rate; and they accordingly paid 13s. 4d. The £61 1s. 7d., being the residue of the amount claimed, was demanded in respect of the filter-beds and other buildings situate north of the Portsmouth Road, in respect of the works, buildings, and land situate between the Portsmouth and Fleece Roads, and also in respect of the buildings and land situate between the Fleece Road and Balaclava Road. The plaintiffs contended that the defendants were liable to pay sewer-rate in respect of all their property within the plaintiffs' district, irrespective of such property within the boundary of the defendants' works; and that the property being enclosed within walls or fences belonging to the defendants did not exempt it from being rated. The defendants contended that they were not liable to pay sewer-rate for any of their property comprised within the present boundary walls or fences, which were alleged to be "fence walls" within the meaning of section 24 of the Act, which provided that the Commissioners could not levy any sewer-rate on "property of the defendants and the Lambeth Company which for the time being should be comprised within the fence walls of the works of the Company, and in respect of any other property of the Companies which, in the opinion of the Commissioners, may be sufficiently drained into such sewers or drains of the Companies or either of them." It was agreed that, if the Court should be of opinion that the defendants were liable to be rated in respect of all their property within the limits of the Act, judgment should be entered for the plaintiffs for £61 1s. 7d., with costs.

Mr. MEADOWS WHITE, Q.C., and Mr. M. SMITH appeared for the plaintiffs; Mr. LUMLEY SMITH, Q.C., and Mr. C. MATHEWS for the defendants.

Their Lordships decided in favour of the plaintiffs; but granted a stay of execution with a view to an appeal.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Guildhall, Wednesday, April 27.

(Before Mr. Justice WRIGHT and a Special Jury.)

Pope and Pearson v. Buenos Ayres (New) Gas Company, Limited.

This case involved a point of special interest to foreign gas companies; it being an action brought to recover £3226, the price of two cargoes of coal, or, in the alternative, £3500 damages for their non-acceptance—the contract for the coal having been cancelled by the defendants on the ground that a mistake had been made in a cablegram transmitted from their Manager at Buenos Ayres (Mr. Lewis T. Wright) to the Secretary in London (Mr. E. W. Layton).

Mr. BIGHAM, Q.C., and Mr. LECK appeared for the plaintiffs; Mr. FINLAY, Q.C., and Mr. BOWYER for the defendants.

Mr. BIGHAM, in opening the case, said the action was brought by Messrs. Pope and Pearson, of Normanton, and also by Messrs. Walford and Co., of Antwerp, against the Buenos Ayres Gas Company, who had offices in London, to recover the price of two cargoes of coal. It appeared that the two firms mentioned were jointly interested in these cargoes, which were shipped by them to Buenos Ayres on speculation, in vessels known as the *Superbo* and the *Nadeshda*. The coal was consigned to an agent named Arabehty; and, as it was not sold on its arrival, he put it into store. The first-named vessel reached Buenos Ayres in March, 1891; its cargo consisting of 695 tons of Silkstone coal. The second vessel arrived in the following May; and had 564 tons of coal on board. The cost of the coal free on board at Swansea was 12s. 6d. per ton; and the freight was 20s. per ton. This was a very material point. Then there were the landing and storing charges to be taken into consideration. The coal not having been sold, the plaintiffs were, of course, anxious to dispose of it. This led to Messrs. Walford and Co. suggesting to Messrs. Pope and Pearson that it should be sold at cost price, leaving Mr. Arabehty to fix the sum with the contractor. Accordingly Mr. Jones, a representative of the latter firm, wrote to Mr. Layton, the Secretary of the defendant Company, asking him whether they would, as a favour, instruct their Manager to take the cargoes. Mr. Layton replied, requesting that certain particulars regarding the coal should be sent to him; and the plaintiffs answered to the effect that it was Silkstone coal, exactly similar to what had been sold to the Company in former years. On the 7th of July, Mr. Jones had an interview with Mr. Heseltine (the Managing Director of the Company), Mr. Easton (the book-keeper), and Mr. Layton. In the course of the conversation, the last-named gentleman said he could not make an offer off-hand, as he did not know the condition of the coal, nor where it was stored; but he said he would cable out to their Manager (Mr. Wright), and, if the reply was favourable, they would make one. Mr. Easton suggested that, as the inquiry was being made at the plaintiffs' request, they ought to pay the cost of the telegram (which would be £4 or £5); and this Mr. Jones agreed to do. The cablegram sent was as follows: "Will you take a consignment of 1250 tons of Silkstone Arabehty report value."

On July 14, the answer came, "Silkstone yes light dollars fifty delivered." It now appeared that the answer which the Manager forwarded was written by him in this way: "Silkstone yes eight dollars fifty delivered." He (the learned Counsel) supposed the word "eight" was altered into "light" by the telegraph clerk. A letter was sent to the plaintiffs by defendants in which they purported to give a copy of the cablegram, with their own punctuation, as follows: "Will take Silkstone. Cargoes light, price 50 dollars delivered." Now at that time the value of the paper dollar was very low; and \$50 would not have been an excessive price in paper. The \$50 paper would work out to about \$12½ gold, instead of the \$8½ which there was no doubt Mr. Wright intended to wire. The dollar was worth about 4s.; while the paper dollar, after the misfortunes in Brazil, he was informed was only worth 1s. It did not at that time appear to the defendants that the \$50 was excessive, because they wrote "kindly inform us if you will accept this price." The plaintiffs' reply was that they would have to submit the offer to Messrs. Walford and Co. Counsel then read a number of letters which had passed between Messrs. Walford and Co. and Messrs. Pope and Pearson; and he incidentally remarked that he read them because the jury would find that the defendants positively pleaded that the plaintiffs were guilty of some sort of fraud in the contract which was ultimately entered into. On July 18, it appeared that defendants wrote a letter to their Manager at Buenos Ayres, in which they stated that they had passed on to Pope and Pearson his suggested offer for the coal of \$50 paper delivered on the works, and were waiting their reply. In answer to telegrams sent by Messrs. Walford and Co. to Arabehty, he advised them only to accept \$50 at the depôt, or \$53 delivered at the defendants' works. Messrs. Pope and Pearson, on Aug. 7, wired to the defendants offering the coal at the latter price; and Mr. Layton replied that the matter should be laid before his Board at their next meeting. Plaintiffs again wrote on Aug. 13 inquiring what decision had been arrived at by the Board. On the same day a letter was received from Mr. Layton, asking whether the plaintiffs could not take the \$50; and two days later Messrs. Pope and Pearson wired offering to settle the matter at \$51½. On the following Monday, Mr. Layton wired that his Company would take the coal delivered at their works at \$51½ paper, at that day's exchange. This was the whole story; and the defence was that the contract was brought about by a mutual mistake, and that therefore the defendants were not bound by it. But the plaintiffs had made no mistake at all about it, because they received what purported to be a copy of the telegram from Mr. Wright; and in Mr. Layton's letter they had a clear offer of \$50. The contract was made between the principals of the Company in London and Messrs. Pope and Pearson at Normanton.

Mr. BOWYER, in reply to his Lordship, said that \$51½ paper would be roughly £2 11s. 6d.; and \$8 50c. in gold, £1 14s. The defence was this: That there was a common mistaken belief in the existence of a fact material to the contract which did not exist.

Mr. BIGHAM (continuing) said it would be remembered that on the 18th of July the defendants sent a letter to their Manager, in which they gave a copy of the telegram which had been received from him. This would take about a month to reach him; and on Aug. 18, when the letter was delivered, there came a cable from him as follows: "Market remains the same. Price of Silkstone eight dollars fifty gold. Do not pay more. Did not require unless great bargain." Defendants then wrote to Messrs. Pope and Pearson cancelling the contract, as it had been made under a misapprehension. It was suggested by the other side that the first telegram was sent at the plaintiffs' "risk." He agreed that it was forwarded at their expense, but no allusion was made at the interview on July 7 as to risk.

Evidence was then called for the plaintiffs.

Mr. J. A. Jones, the agent of Messrs. Pope and Pearson who had the interview with Mr. Heseltine, Mr. Layton, and Mr. Easton on July 7, related what then took place. It was true that he agreed to pay the expense of the cablegram; but he denied that the word "risk" was used in the course of the conversation. Mr. Layton asked him if he was in a hurry for the reply, because if not, their Manager would be telegraphing about other business in a few days, and he could then include his answer. He (witness) told him that they were in no immediate hurry.

Cross-examined: He was certain nothing was said about the payment for the reply. His firm applied to the defendants, asking them to take the coal off their hands, as a favour.

Thursday, April 28.

On the resumption of the proceedings this morning,

Mr. Jones was further cross-examined. At the interview he said he mentioned that the price of the coal delivered at Hull would be 11s. 3d., and the freight £1 0s. 9d. He gave that as the price they would be willing to take; and the difference between £1 12s. and \$50 paper would be 18s. The £1 12s. was for the coal delivered c.i.f.; the \$50 paper was for the coal delivered into the works. Asked whether the defendants after Aug. 17 did not express their willingness to pay the \$8 50c., witness said they distinctly withdrew the offer. Mr. Layton, at an interview on (he believed) Aug. 26, said if he could not accept \$8 50c. on the spot, he must withdraw the offer.

Mr. Walford was next examined. He stated that his firm was jointly interested in these cargoes of coal with Messrs. Pope and Pearson. The coal had now been sold under an order of the Court at \$7 10c.; and it had realized a total of £1812. An order was made that, if they obtained an offer for the coal, it was to be submitted to the defendants first, in order that they might be allowed to make a bid. They received an offer of \$7; and the defendants thereupon said they would give \$7 10c., so that they were obliged to let them have the coal. There was another action pending with regard to the payment under this contract. If they had been paid at the price of the first contract, they would have realized £3226, instead of £1812.

In cross-examination, witness was asked whether the £1812 had not been paid less 10 per cent.; and he replied that he was not sure. The defendants alleged that the coal was damaged, and was useless for gas making.

This ended the plaintiffs' case.

Mr. BOWYER having called his Lordship's attention to various

extracts from the correspondence, submitted, first, that no case was shown by Messrs. Walford and Co.—they did not allege now that they were contractors; and, secondly, that there was nothing to go to the jury on the statements of his learned friend's own witnesses.

His LORDSHIP pointed out that Mr. Walford had stated that his firm were jointly interested in the coal in question; and it was not admitted that both parties were at all times acting under a common mistake.

Mr. FINLAY then opened the case on behalf of the defendants. He contended that it was very clear the whole of this transaction had proceeded upon a mistake; and the question was whether or not the defendants were to be bound to a contract which was entered into beyond all question under a misapprehension. The negotiations were initiated by Messrs. Pope and Pearson, who asked the defendants, as a favour, to take the two cargoes of coal off their hands. He should produce evidence to show that the telegram to the defendants' Manager and the reply from him were to be sent at the expense and risk, or responsibility, of the plaintiffs. Having referred to the wording of the telegram received from Mr. Wright, and the construction put upon it by Mr. Layton, learned Counsel said the result was that a contract was entered into at \$51½ paper money, which was nearly equal to \$13 in gold. They had conclusive evidence that the total outside value of the coal at Buenos Ayres was £1 14s. per ton; while, roughly speaking, \$51½ paper was equal to £2 11s., or a difference of 17s. It was not therefore altogether surprising that on Aug. 22 Mr. Arabehty should write: "I congratulate you on the price obtained, as, on many occasions, I have offered coal to that Company at the price of \$12 gold coin. . . and the only offer they made was \$9 to \$9½ gold coin, as against \$13 gold," which was, the learned Counsel added, the price on which the plaintiffs were seeking to make defendants liable. Under these circumstances, he asked, were the plaintiffs entitled to hold the defendants to this contract? He submitted that they were not. Supposing that, owing to a mistake, the price had been 17s. below the value at Buenos Ayres, could the defendants have held the plaintiffs to that bargain? Here there was a common mistake as to what was fundamental to the whole transaction; and as soon as it was discovered that the message from Buenos Ayres had not been correctly delivered, of course everything that had taken place upon it would have to be considered as rescinded.

Witnesses were then called on behalf of the defendants.

Mr. Heseltine, the Managing-Director of the Company, gave an account of what he remembered took place at the interview on July 7 last. He told Mr. Jones that the Company had sufficient stock at Buenos Ayres and afloat, and they had no need of the cargoes his firm had offered them; but, if they could be of assistance in helping them out of their difficulty, as old friends he was inclined to do so. In speaking of the cablegrams, witness said he pointed out to Mr. Jones that it was a very unsatisfactory thing to carry on negotiations in that manner. Mr. Jones wished to pay for the message then; but it was explained to him that they did not know what the cost of the answer would be, and so the matter was deferred.

In cross-examination, witness said he had been Managing-Director of the Company since 1875. It was scarcely necessary for him to know the market price of coal from day to day, as they entered into contracts for large quantities. At the time they made the offer for the coal, it did not occur to him that for what had cost the coal-owners £1 12s. at Buenos Ayres, they were giving £2 10s. It was distinctly understood at the interview that Mr. Jones was to pay for the words relating to the coal in the Manager's next cablegram. He agreed that there was nothing in the interpretation of the cablegram sent to Messrs. Pope and Pearson which would mislead them. The question as to the price to be paid for the coal was not submitted at a Board meeting, although Mr. Layton had stated in a letter that it would be.

By the JURY: The Company had not bought Silkstone coal since 1885 or 1886; and he did not remember the price they then paid.

Mr. Layton also gave a narrative of what took place at the interview in July 7; and it agreed with the statement of the previous witness. He understood by the cablegram from Mr. Wright that he would take the two cargoes of coal; that the word "light" meant that the cargoes did not weigh out to 1259 tons; and "dollars fifty," that the price was to be at \$50 paper delivered. He communicated the cablegram to Messrs. Pope and Pearson in a way which he thought would be most intelligible to them.

Cross-examined: He understood the cablegram to mean what he had already stated. He admitted that it did not read; and that it might have been much plainer. It did not occur to him to send an exact copy to Pope and Pearson, in order that they might put their own interpretation upon it. They were now paying for their coal 9s. f.o.b. Newcastle; but it was a different class to Silkstone.

Mr. Easton stated that he had taken some particulars from the Company's books, showing their transactions in coal just before and after Aug. 17. He believed the average price was 9s. 3d. per ton; and the freight might range from 18s. to 20s. With regard to cannel coal shipped on the west coast, they paid from £2 2s. 6d. to £2 5s.; and then there would be the average freight to add. The cost of conveying their coal from the ships to the works would be about 2s. per ton; and, of course, they had no charges to pay for storage.

Cross-examined: He made a memorandum as to what took place at the interview on July 7; but it was not made until after the dispute arose. In it he stated that it was arranged with Mr. Jones that the cablegrams were to be sent at the expense and risk of Messrs. Pope and Pearson.

The deposition which Mr. Wright had made in regard to the matter was then read by learned Counsel. It stated that the original copy of the cablegram had been produced before the British Consul at Buenos Ayres; and a copy of it was made in his (Mr. Wright's) press-book. The value of the coal on July 14, delivered into the works, would have been \$8 50c. Directly he received the letter from Mr. Layton on Aug. 18, he sent a cablegram correcting the mistake. He could not recollect whether he forwarded a letter confirming his first cablegram.

Mr. Layton (re-called) stated that he did not receive a confirmatory letter from Mr. Wright.

Mr. FINLAY and Mr. BIGHAM having addressed the jury on the evidence,

His LORDSHIP summed up. He said that in this case a contract was made which was as plain and explicit as a contract could well be; and it

would take a good deal to upset a contract of this sort. On Aug. 15, 1891, plaintiffs wired, asking defendants whether they would take the Silkstone coal in question at \$51½; and on the 17th, the Company telegraphed, and afterwards they confirmed it in writing: "Will take Silkstone, \$51½ paper, at to-day's exchange." Twenty years ago it would have been practically impossible to have got out of that contract; but now they had to look at these things as matters of what was called equity as well as in the strict law. The difference between the price at which the plaintiffs were offering the coal (£1 12s. 6d., plus charges) and the \$51½, which the contract price gave, if regarded fairly, was not so extraordinary as to suggest anything disadvantageous to the plaintiffs. It was clear they were quite ignorant as to what the charges would be at Buenos Ayres. They might well have thought that the Company's Manager would not telegraph a price of that kind without some good reason; and they might also have thought that the expenses out there were large. The plaintiffs, they saw, did not accept the \$50 at once; and they, rather unwillingly, at last agreed to an additional \$1½. Then, on the other hand, the defendants, the instant they learned what their Manager really meant, corrected the error. Therefore they had nothing to do but to consider the substance of the case, and that depended upon what was agreed upon at the interview on July 7; and really there was very little conflict as to what happened on that day. He should think, and probably the jury would be of opinion, that it was arranged between Mr. Jones, and Mr. Heseltine, Mr. Layton, and Mr. Easton, that the defendants should buy the coal at a price fixed by their Manager in Brazil. There was no doubt a great deal to be said for the defendants' view, that the parties merely meant to act on the Manager's valuation. If the jury considered this was really the view, then they ought to say the contract of \$50 was not binding; but if they thought there was a real intention on the part of both parties to contract for \$50, then they ought to find for the plaintiffs. The learned Judge then read the following list of questions which he proposed to leave to the jury: (1) Was it verbally agreed, on the 7th of July, that the defendants should buy at their Manager's valuation? (2) Was the written contract intended by both parties to express and give effect to the verbal agreement (with 3 per cent. increase on the Manager's valuation)? (3) Did both parties at the date of the contract act in the belief that the Manager's valuation was \$50? (4) Was the written contract intended to take effect only upon the supposition that the Manager's valuation was \$50? (5) Or was the written contract intended to be absolute, without regard to the verbal agreement or the Manager's real valuation? (6) Would there have been any contract made on or about the 15th or 17th of August, if the defendants had offered only \$8 50c. in gold, or thereabouts?

The jury retired; and, after an absence of about an hour, they returned into Court with the following replies: To the first question, "No;" second, "No, by eleven jurors, and yes by one;" third, "Yes;" fourth, "No, not by both parties;" fifth, "On the part of the plaintiffs, yes, but on the part of the defendants, no doubt they had their agent's valuation prominently in their minds, but in our opinion they neglected to take the most ordinary and obvious means of protecting themselves;" sixth, "Cannot agree to an answer."

Friday, April 29.

At the commencement of to-day's sitting,

Mr. FINLAY submitted that the answer of the jury to his Lordship's third question gave his clients what was necessary to get rid of the contract. Being answered in the affirmative, they had the finding of the jury that both parties at the date of the written contract acted in the belief that the Manager's valuation was \$50; and it came to this, that the basis of the written contract was the belief that the Manager had valued the coal at \$50 paper per ton, and this agreed with the evidence of Mr. Jones and defendants' witnesses. The answers to the fourth and fifth questions did not modify in any way, to his clients' prejudice, the one given to the third.

His LORDSHIP, in giving judgment, said there was no doubt the parties acted in the belief that the Manager's valuation was \$50 paper; but the jury had found that one of the parties was not determined by that consideration at all, and as to the other party—the defendants—they neglected to take the "most ordinary and obvious means of protecting themselves." By which he understood the jury to infer that the defendants, instead of transmitting the original telegram to the plaintiffs, sent a copy made by themselves, which was wrong, and which amounted to a representation by the defendants to the plaintiffs that the Manager's valuation was \$50 paper. If the original telegram had been sent, he could not help thinking that the plaintiffs would have been so puzzled that they would have wanted a correct representation of it. He therefore could not say the jury were wrong. There was not enough to enable him to relieve the defendants from the contract they had entered into in writing; and his judgment was for the amount claimed.

Mr. FINLAY remarked that the coal had been sold pending a settlement.

Mr. LECK said the amount which it had realized was given by Mr. Walford on the previous day. All they asked for now was £1453.

Mr. FINLAY applied for a stay of execution for a week; and, if there was an appeal, for a stay of execution until after it was heard.

His LORDSHIP agreed to a stay of execution for a week; the plaintiffs' solicitor undertaking to repay the money if so ordered.

Johannesburg Lighting Company, Limited.—In the JOURNAL a fortnight ago, reference was made to the extension of the concession of the above-named Company for supplying gas and electric lighting in Johannesburg. By the terms of this concession, no street lighting by either of these systems can be carried out by any public authority, except through the Company. Their position having been thus strengthened, they are now taking steps to meet the existing demands upon them and obtain fresh business. To do this, more capital is required; and they purpose raising it by the issue of 7 per cent. mortgage debentures of £50 each, convertible, at the option of the holders, into ordinary shares of the Company, and repayable at par on Dec. 31, 1901.

MISCELLANEOUS NEWS.

ASSOCIATION OF SULPHATE OF AMMONIA MANUFACTURERS.

Quarterly Meeting in London.

The Quarterly Meeting of this Association was held last Thursday, at the Offices of the Incorporated Gas Institute, 3, Victoria Street, Westminster—Mr. J. HEPWORTH, M.Inst.C.E., the President, in the chair.

The HONORARY SECRETARY (Mr. G. E. Davis) read the report of the Council, which included a statement of the quantity of sulphate of ammonia exported during each of the last six years, with the price for each year; and the same information, in more detail, for the past three months. It was pointed out that the greatest difficulty encountered in keeping up a fair standard of price was the considerable number of manufacturers, principally the smaller ones, who still hold aloof from the Association. Speculators, it was marked, seemed to be more united, and to support each other better than manufacturers; and whilst this continued, the efforts of the Association were necessarily much hampered. It was intended to approach the Royal Agricultural Society with the view of offering a prize for the best crop grown with sulphate of ammonia; and the members were invited to make other suggestions, with the object of developing the home trade.

The CHAIRMAN, in moving the adoption of the report, said the meeting had been called in the Metropolis with the idea of increasing the interest in the Association in the district; and he was glad to see many gentlemen present from works round London, as well as from other parts of the country.

The report having been adopted, a general discussion ensued, in which Mr. Ness, Mr. Jones (Chesterfield), Mr. Chester, Mr. Valon, Mr. Morton (Ashford), Mr. May, Mr. Parkinson, and other gentlemen took part.

The proceedings closed with a vote of thanks to the President.

In the evening the members dined together.

SAN PAULO GAS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Wednesday, at Winchester House, Old Broad Street, E.C.—Mr. FREDERICK DELMAR, F.S.A., in the chair.

The MANAGING DIRECTOR and SECRETARY (Mr. J. Heath) read the notice convening the meeting; and the Directors' report and the accounts for the half year ending Dec. 31 last were taken as read (see *ante*, p. 716).

The CHAIRMAN, in moving the adoption of the report, said the Directors met the shareholders on this occasion under very painful circumstances, having lost during the half year their respected and esteemed colleague, Mr. H. A. Cowper. He then proceeded to refer to the state of affairs at the Port of Santos; and, in doing so, quoted from an official list obtained from the German Consul. This showed that there were 69 ships at the port on Aug. 11 last waiting for a berth, as the discharging arrangements were inadequate for the increasing trade. This caused vessels to be detained for more than six months, resulting in heavy demurrage—from £1200 to £1500 per vessel carrying 1000 tons of coal, or more than double the cost of the coal. Besides this there was the epidemic of yellow fever, and the increase of wages and salaries owing to the expenses of living being much enhanced; and, in consequence, the owners of vessels refused to call at Santos with the Company's coal. The Directors were therefore driven to seek their coal supplies from various sources; and, after great efforts, they succeeded in obtaining them from Kentucky. They then had to scheme to escape the great cost of demurrage, which equalled the value of the ships; and, in the end, they purchased two ships on their arrival in port. By this means, they hoped they had released themselves from future demurrage; and so would gradually pay for the vessels out of the savings effected. As the cargoes now arrived in port, they were discharged into their own vessels when they became empty. There were other causes for increased expenditure. They had a loss of £11,682 (which, however, might not occur again) through having to write down the currency balances, &c., to 1s. 1d. per milreis on Dec. 31. The profits, he was sorry to say, had been reduced by more than one-half; being only 1s. 8½d. per 1000 cubic feet, as against 3s. 8d. in December, 1890. Yet the business exhibited an increase of 33½ per cent. over the second half of 1890, or a consumption of 62,211,000 cubic feet of gas, as compared with 46,454,000 feet. The rate of exchange had affected the Company by all the payments being made to them in depreciated paper currency—50 per cent. discount—while the gas supplied had cost more than double the usual sum to produce. The Board had also been greatly troubled by being restricted in the contingency, equalization, and reserve funds, from the fact that the shareholders had insisted on having at par the 5000 £10 shares issued in October, 1889, when they were offered at £5 premium; the old shares being at that time at £7½ premium. The net revenue on the half-year's working was only £5516; and deducting this from the large loss in exchange, they had a net deficit of £5081, which the Directors considered it was equitable to write off the contingent account, so as to start the current half year on a fair and level basis. Referring next to the election of two new Directors (Mr. D. M. Fox and Mr. G. A. Hillier), the Chairman said that, under the complications before them, the Board felt it would be unwise to select any but those practically experienced; and fortunately they met with two gentlemen suited in every way to their purpose, and who were connected with the San Paulo Railway. One of those gentlemen had given the Directors a report on the Company's works; and therefore there could only be one opinion as to the wisdom of their choice. There were some shareholders who had expressed their disappointment, and implied that they had been ill-used, as they considered they had a prior claim to election. But he contended that they had no claim whatever beyond that of being shareholders; and, besides, they had not the least experience. Having reminded the shareholders that they had been paid an interim dividend of 5 per cent., the Chairman referred to the indications they had as to better prospects. In the first place, they were now working at a profit, which would be increased if they escaped the cost of demurrage. The price of gas had been raised 50 per cent.; and the

charge for coke nearly doubled. These were, of course, immediate advantages; but there was also the prospect of something being done to improve the Port of Santos. On the 16th inst., a meeting was held in reference to that question, and a Committee was appointed, and sent to the Federal Government. They were received by the Minister of Agriculture; and the Financial Minister had expressed the hope that he would assist him in his endeavours to improve the condition of the port.

Dr. E. BATT seconded the motion.

A long and animated discussion followed; and the following summary will indicate its character.

An inquiry was made as to whether there had been any diminution in the consumption of gas since the price had been raised; and the Secretary replied that they had only the figures up to the end of February, which gave them two months' working, and the increase had been about 30 per cent. Interrogated as to the object of the reserve of £21,527, he said it was not a reserve "fund," but a reserve "account;" and it was used in the business as working capital. With regard to the demurrage suspense account (£3494), that was an amount which was in dispute, and had been paid into Court, pending an arbitration.

Mr. J. E. JONES said he had expressed the view on previous occasions that the amount standing to reserve account ought to have been invested; and, when the new shares were issued, he ventured to urge that it should be at a premium, in order that the shareholders might have a tangible sum with which to form a reserve fund. Now they saw that they had made a mistake. It must have been very saddening to the Directors to have had to appear before the shareholders with such a report as the present; but it was the first time they had had to come before them under such circumstances. The Board, in his opinion, had done the best they could in the interests of the Company in selecting Mr. Fox and Mr. Hillier as Directors. He hoped that the Directors would not on this occasion be unnecessarily harassed; but that the shareholders would do all they could to strengthen their hands.

Mr. ROBINS remarked that the Chairman had alluded to the interim dividend of 5 per cent. At the time they paid that dividend, the various adverse facts to which reference had been made were perfectly well known to them; and he thought it was a very unwise thing to do, looking at the position in which they now stood. He believed the shares were selling last July at £16; but to-day their market value was only about £8. In the past two years, the Directors had been authorized to raise £50,000 of fresh capital for new works; and yet the shareholders were now told that the reserve fund (which they supposed to be in cash) had also been spent on the works. While he did not want to do anything which would affect the prosperity of the Company, he thought some step should be taken, having regard to their present circumstances, to stop this large expenditure as far as possible.

Mr. FOWLER said that until recently he had regarded the Company's shares as a sound investment; and, as late as June last, he had increased his holding. He had thought they had able Directors to manage their affairs; but he had discovered that they were "utterly unreliable and incompetent." ("No, no.") On inquiring of his broker only the previous week as to why the shares had decreased to such a large extent, he received the reply that there was "an utter want of confidence in the management." In consequence of this, he wrote to the Secretary asking to be allowed to inspect the books. He called at the office, and was shown some of them, but others were withheld. He particularly wished to see the minute-book showing the attendance at the Board meetings, but he was not permitted to inspect it. [Mr. J. B. BATTEN, the Solicitor: Quite right, too.] He found from the cash-book that the Directors received £1000 per annum for their services. [Dr. BATT: It was voted by the shareholders.] Now in 1886, the Directors only held between them 175 shares; in 1890, 202; and at the present time, 258. It took 50 shares to qualify as a Director; so that in 1886, they only held 25 shares above the number specified. And these gentlemen, who only held this number of shares, and received £1000 a year for their services, issued on the present occasion a balance-sheet which was disastrous to the Company. The dividend ought not to have been withheld; for the very object of the reserve fund was to meet such contingencies as this. He concluded by moving, as an amendment, that a Committee of Investigation be appointed, on the ground that he believed there was "something rotten in the state of Denmark."

Mr. ROBINS seconded the amendment.

Mr. BATTEN, referring to the new issue of shares, said he was a lawyer, and did not know much about figures; but he should like each shareholder to work out this little sum—"How much better off should I have been now, if I had had to pay £17 apiece for these shares?" He also spoke of Mr. Fox's long experience at San Paulo.

Mr. W. CASH, the Auditor, in alluding to the reserve account, remarked that it was a matter of opinion whether it was worth while locking it up in (say) English railway stock at 3½ per cent., while it could be employed more profitably in their own business.

Mr. J. R. TYNDALE inquired whether the Chairman would have any objection to a Committee of Inquiry.

The CHAIRMAN replied that he should take it as a personal reflection, after his 20 years' service to the Company. Only at the last meeting the shareholders passed a resolution acknowledging the faithful way in which he had discharged his duties; and now to talk about an investigation reflected upon his honesty.

Mr. R. FROST-SMITH considered the Directors were entitled to the sympathy of the shareholders, for the circumstances which had brought about the present position were entirely beyond their control.

After further discussion,

Mr. BATTEN, and two or three of the shareholders, appealed to Mr. Fowler to withdraw his amendment, which he did after his seconder had stated that he could no longer support it.

The original motion was then unanimously carried.

The retiring Directors (Messrs. Fox and Hillier) and the Auditor (Mr. Cash) were re-elected.

On the motion of Mr. TYNDALE, seconded by Colonel ROBINSON, a vote of thanks was passed to the Chairman and Directors.

The proceedings then terminated.

SINGAPORE GAS COMPANY, LIMITED.

The Annual General Meeting of this Company was held last Thursday, at the Cannon Street Hotel—Mr. R. S. FOREMAN in the chair.

The SECRETARY (Mr. R. M. Christie) having read the notice convening the meeting, the report of the Directors was taken as read.

The CHAIRMAN, in moving the adoption of the report and accounts, stated that the position of the Company's affairs during the past year had caused the Directors very considerable anxiety, and also, as he was fully aware, the shareholders great disappointment, inasmuch as they had been asked to forego their customary dividends, and consent to have the profit made from the Company's working during that period applied in reduction (within reasonable trade compass), of the outstanding indebtedness of the Company, caused by the large expenditure which had been required from want of working capital for extension of mains, the construction of an additional gasholder and tank, and for other expenditure, by far the greater portion of which was really properly chargeable to capital, but which of late was not available from that source. The Directors had taken the present opportunity of writing off several items (which he proceeded to specify) that had hitherto appeared on the credit side of the balance-sheet. The various writings-off amounted together to upwards of £1800. They had also placed to depreciation account £750. This and other charges left an available balance of £685 to the credit of the profit and loss account; and this the Directors proposed to carry forward. With regard to their Managers, Mr. Batten, as the shareholders were probably aware, had been eight years in the service of the Company. When he took over the charge of the works, he found them in a very disorganized state. The buildings were much out of order; and the mains had also been greatly neglected. From the time, therefore, of his taking office almost up to the present, he had had to spend considerable sums in order to put the works, plant, and machinery into a thoroughly efficient condition. During his tenure of office, the sum of £5446 had been expended on repairs to buildings, plant, and machinery. In the ten years previously, when Mr. Wells had the management, the expenditure was *nil*. There was not a single item during these ten years charged to the debit of profit and loss account; and therefore Mr. Batten had, in this respect, been very much handicapped. The expenditure for the extension of mains and the new gasholder and tank in the eight years had been £22,800; and as the increase of capital in the same time had been only about £10,000, the revenue had been very heavily charged. The principal works undertaken by Mr. Batten were the erection of a new river wall, which involved considerable cost, to enable him to cope with the periodical recurrence of floods; he had also put up an extensive range of buildings for coal-stores, and had further superintended the erection of a new gasholder and tank, besides carrying out various other improvements, which it was not necessary for him (the Chairman) to further particularize. During his residence at Singapore, Mr. Batten had, as their Manager, proved himself a *persona grata* to the authorities; and he left the Company's service with the goodwill and respect of all with whom he had come into contact. With regard to his successor, Mr. H. W. Smith (late Secretary and Manager of the Caterham and Kenley Gas Company) was known to most of the shareholders, from his constant attendance for many years at their meetings. For the past two years he had been a Director of the Company, and now came to them with very good credentials from his late employers. They believed that Mr. Smith knew the affairs of the Company thoroughly, and that he would prove a most efficient and economical Manager. They received last Monday a letter from him, which he would ask the Secretary to read.

The SECRETARY read the letter, in which reference was made to Mr. Batten's good relations with the authorities; the writer adding that he would endeavour to maintain those relations. He had only made a cursory examination of the works and plant; but, so far, he was satisfied with their condition, and they more than fulfilled his expectations—nothing appearing to be wanting in the way of substantial repairs. He had gone over some portion of the district, which was extensive, and the business part of Singapore had agreeably surprised him. Taken as a whole, he was satisfied with the position of the Company there. The public lighting was done very well, and was equal to that of the City of London.

The CHAIRMAN (resuming) said he had only again to express the Directors' regret that they had no dividend to recommend for the past year. The next account would, however, show a clean balance-sheet. There would be no more writings-off, and whatever balance there was for appropriation would all be divisible among the shareholders. The Directors hoped and confidently expected that they could conduct the business of the Company without any further application to the shareholders for an extension of working capital; and he honestly believed that the Company was now in a better position than it ever had been previously.

The DEPUTY-CHAIRMAN (Mr. S. Spencer), in seconding the motion, observed that the new departure, as he might call it, which had been brought about by the Directors was a very good thing to have established. The Company had been in existence about 30 years; and he believed that this was only the third time that the shareholders had gone without a dividend. He thought this was a wonderful record.

Mr. DEAN criticized the position of the Company, and said he did not see how they had much to congratulate themselves upon, seeing that the shareholders were to get no dividend; and he maintained that the reserve fund—£867—was no reserve at all, being invested in the business of the Company.

The CHAIRMAN having replied, the motion was put and adopted.

Mr. A. E. Stephenson and Mr. B. Green were then re-elected as Directors; and Mr. Magnus Ohren as Auditor, in the place of Mr. C. Newton, deceased. Mr. T. Guyatt was also appointed Auditor in the place of Mr. B. Green, resigned.

The CHAIRMAN next moved a vote of thanks to the former Manager, Mr. W. T. Batten. He remarked that he had already expressed his opinion of the valuable services performed by that officer, and therefore need not make any further comment thereon.

The motion having been carried unanimously,

The CHAIRMAN proposed a vote of thanks to the Secretary, who, he

said, had undertaken the duties at a very arduous time, in consequence of the sudden death of Mr. Robert King; and he must say had fulfilled those duties to the entire satisfaction of the Directors.

A unanimous vote of thanks was then passed to the Chairman and Directors for their services; and the proceedings closed.

MONTE VIDEO WATER-WORKS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Thursday, at Winchester House, Old Broad Street, E.C.—Mr. F. S. ISAAC in the chair.

The SECRETARY (Mr. J. Anderson) read the notice calling the meeting, and the report of the Directors, to which reference has already been made in the JOURNAL, was taken as read.

The CHAIRMAN, in moving the adoption of the report, observed that the Company had encountered very bad times in the River Plate during the past year; and it was therefore with great satisfaction that he could meet the proprietors without having any bad news to report. The accounts showed a result far from unsatisfactory—a similar dividend to that which was paid last year had been earned. He might safely assert that no other company connected with the River Plate had been able to exhibit such a healthy report as the Directors had done. There had been a decrease of £7654 in the revenue; but this was owing entirely to the reduced subvention-money of which they had been in receipt from the Government. The ordinary income, therefore, had been entirely maintained. The expenditure had decreased by £2213, principally due to the saving they had been able to make in coal, and also to economies effected in labour employed in the working of the filters. Since the introduction of the purifying machinery, the expenses had increased; but the results from the process had been highly successful, and had, he believed, tended to an augmentation of the business, and also to a decrease—he might say to almost a cessation—of complaints from the consumers about the water. The special reserve fund, which now amounted to £60,000, had been accumulated out of the Government subvention in past years; and this fund as well as the reserve for the renewal of buildings and plant, amounting to £12,258, was sunk in the business; and the investment in the extension of mains and other large works had proved remunerative. The present time was not favourable for raising new capital; but if, in the future, an opportunity presented itself, the attention of the Board would be called to the advisability of making a fresh issue—at all events, of a sum sufficient to pay off the loans and, in addition, to have an amount of available cash to meet any emergency. The business was in a sound condition. The term of the original concession expired in March of last year; and the subvention-money died with it. They were now working under an arrangement with the Government, the terms of which, with the exception of the reduced subvention, were similar to those of the original concession. At a convenient moment, the agreement would be brought before Congress for approval. The authorities had punctually paid the Company the subvention agreed upon; and they met them in a friendly spirit when matters arose in which their interests were concerned. He thought they owed this position to the determination of the Directors to leave no effort untried for perfecting the quality and condition of the water supplied. To attain this object, they had spent a vast amount of money, which the shareholders might have received in dividends; and he believed it was the liberal policy adopted by the Company which had won the confidence of the people. The works were now pretty well complete; and no material amount of capital expenditure would be necessary for a considerable time. In regard to the current year, the letters received went to the end of March; and up to that date the working was in all respects satisfactory. He concluded by warmly acknowledging the services of Mr. Galwey, the Manager, and those of the Secretary.

Mr. W. A. JONES seconded the motion, which was unanimously adopted.

On the motion of the CHAIRMAN, seconded by Mr. J. H. DUNCAN, a resolution was passed, declaring a further dividend of 2½ per cent.; making 5 per cent. for the year, tax free; leaving £2256 to be carried forward.

Votes of thanks were passed to the Manager and staff, and also to the Chairman and Directors, and the proceedings then closed.

The Gas Question at Eccles.—At the annual meeting of the members of the Barton, Eccles, Winton, and Monton Local Board on Monday evening last week, the Clerk reported that he had received from Sir C. L. Peel, Secretary to the Privy Council, the draft scheme for the incorporation of the district; and as no notice of opposition had been given, he took it that in the course of next month the Charter would be received. Mr. Parr moved that a Committee be appointed to approach the Salford Corporation, with the view of ascertaining what terms they were prepared to offer Eccles in the future in the matter of gas supply. He pointed out that if the new Town Council intended to proceed with a Bill in November next to make their own gas, the preliminary steps would have to be taken by the Local Board, who were, now they had dropped Swinton, in a much better position to demand terms from Salford than previously. Mr. Barlow seconded the motion. Mr. Hill said he was satisfied that Salford, if it did not totally abolish the differential rate, would reduce the present charge by 2d. per 1000 cubic feet. Mr. Heath said he would not only ask for the abolition of the differential rate, but a share of the profits made out of the consumption of gas in the out-districts. Mr. Stocks said the Board had no official evidence that Salford would now abolish the differential rate. As the Board had obtained the right to proceed with a Bill, he objected to going to Salford to ask for further concessions. Mr. Spary held that not only had Salford refused to abolish the differential rate, but it would refuse to allow Eccles to participate in the profits made out of the consumption of gas in its district. After further discussion, the motion was carried; and a Committee was appointed to wait upon the Corporation.

THE PUBLIC LIGHTING OF THE CITY OF LONDON.

Report by Mr. W. Haywood, M.Inst.C.E.

The Engineer and Surveyor to the Commissioners of Sewers of the City of London (Mr. W. Haywood, M.Inst.C.E.) has presented a report on the works executed by that body during the past year. Referring to street lighting, he states that tenders were received from The Gaslight and Coke Company for lighting the public lamps with gas for twelve months from Jan. 1, 1891; the price charged being 2s. 2d. per 1000 cubic feet of gas consumed. The following are details of the tender: Square lanterns, furnished with burners consuming 5 cubic feet of gas per hour, and in use for 4300 hours per annum, £3 4s. 7d. per lamp; being £2 6s. 7d. for gas, 15s. for lighting, and 3s. for repairing. Circular lanterns (similar conditions), £3 8s. 10d.; being an additional charge of 4s. 3d. for extra trouble in cleaning and repairing. Square lanterns, furnished with burners consuming 10 cubic feet of gas per hour (number of hours as with other lamps), £5 11s. 2d. each; being £4 13s. 2d. for gas, and the remainder for lighting and repairing. Circular lanterns, £5 15s. 5d. each; the additional charge being for cleaning and maintenance. The number of defective lights observed during the year was 665, as compared with 685 in 1890. These returns are made to the Commissioners daily by the City Police, and include only those lamps in which defective lighting is very noticeable. Although the number is less than last year, Mr. Haywood says it is above the average of former years, and may be accounted for by the severe weather prevailing during the early months. The 36 meters attached to the public lamps in various parts of the City show that the full contract quantity of gas is given at those lamps. The Inspector of Gas Lighting, as well as the Inspectors of Pavements, are of opinion that the regulators of the lamps generally are kept in proper condition, and that the full quantity of gas contracted for is furnished by the Company at all the public lamps. Owing to the inconvenience to the traffic caused by the fogs, the Company, acting upon the instructions they have had for many years past to light the public lamps when fog or darkness ensues, lighted the gas-lamps during the daytime on 20 different occasions. The experimental lighting by gas of Cheapside, the Poultry, and other important thoroughfares, comprising 112 lamps in all, with burners varying in consumption from 8 to 17 cubic feet of gas per hour, was continued throughout the year, at the expense of the Company; and the results in lighting the streets sufficiently are acknowledged by Mr. Haywood to be very satisfactory. The lamps in Queen Victoria Street were, for the most part, discontinued in the month of September, when the City of London Electric Lighting Company undertook to light that thoroughfare by electricity; and the same may be said of the lamps of Cornhill and King William Street, which were lighted by the same means on Jan. 6 of the present year.

With regard to electric lighting, the report states that, in the year 1890, contracts had been assigned to the Brush Electrical Engineering Company, for lighting the central and western districts of the City; and to the Laing, Wharton, and Down Construction Syndicate, for lighting the eastern district. In January, 1891, the Commissioners were asked to give their sanction to the placing of an electric main junction box beneath the public way on the west side of the Mansion House, so that the inauguration of the work for the electric lighting in the City might take place at the end of the following month. This application was agreed to; and, on the day named, the inauguration ceremony took place. The Lord Mayor, together with the Directors and officials of the two Electric Lighting Companies, laid the memorial or foundation stone of the first junction box for the electric lighting works of the City. On the 13th of January, the Brush Electrical Engineering Company gave notice of their intention to commence their works in Queen Victoria Street; and up to the end of the year, they had laid their conductors in Queen Victoria Street (subways), Cannon Street, St. Paul's Churchyard, Queen Street, Walbrook, and Mansion House Place. They also fixed 25 lamp columns and lamps in Queen Victoria Street, which were experimentally lighted on and after the 17th of June last; but the ordinary gas-lamps were kept alight nightly until the 21st of September, when the largest portion of them were discontinued. Since then the street has been lighted mainly by electricity. On the 17th of January, the Laing, Wharton, and Down Construction Syndicate gave the statutory notice to commence their work in the first section of the east district, under their Provisional Order. Up to the end of the year, this Company had laid their conductors in Lower Thames Street, Arthur Street East (subways), King William Street, Cornhill, Gracechurch Street, and Lombard Street. They also erected 25 lamps and columns, and temporarily lighted King William Street, Gracechurch Street, and part of Cornhill. On Jan. 6 of this year, they lighted permanently the thoroughfares named; the largest portion of the public gas-lamps have not been used since that date. On May 26, letters from the two Companies, with copies of communications addressed to the Board of Trade, were laid before the Commissioners, relative to the transfer of their undertakings to a new Company about to be formed, under the title of the City of London Electric Lighting Company, and asking the approval of the Commission thereto. These communications were referred to the Streets Committee, who, on the 23rd of June, reported relative to the proposed transfer, and recommended that it should be signified to the Board of Trade that the Commissioners saw no objection thereto, provided the due constitution of the new Company and the subscription of the capital should be evidenced to the satisfaction of the Board of Trade and the Commission; also, that a similar reply be given to the undertakers, with the addition that the rights of the Commission under the respective contracts were to be maintained intact. Amendments were moved to this report, to the effect that the Commissioners were unable to approve of the proposed transfer; and that, in the interest of consumers in reference to the operation of the sliding-scale clause, they should strongly object to any amount being paid to the contractors as purchase-money for their agreements with the Commission. These amendments were not carried, and the report of the Streets Committee was agreed to by the Commissioners on the 23rd of June; and the undertakings were transferred on the 21st of August. On the 17th of November, a letter was laid before the Commission, in which the new Company applied for an extension of the period named in the contracts between the Commission and the two original Companies for carrying out the

public lighting of the City. This letter referred to all the work that had been previously done by the Companies; and after reciting the time which had been lost in assigning and taking over the contracts, and the fact that they had already expended large sums of money on the freehold and leasehold sites for generating stations in Southwark and Lower Thames Street, it stated that they trusted the Commission would see that no time had been lost, and would grant an extension of at least one year. At a subsequent meeting of the Commissioners on the 1st of December, this letter was fully considered, together with another explanatory of the exact position of the Company at that date; and the Commission then resolved that the terms of the existing contracts must be adhered to. The Company thereupon vigorously pushed on the work during the month of December; and during the present year, and up to the date of the report (April 5), Mr. Haywood says they have been actively engaged in carrying it forward in both the central and the east districts of the City, but mainly in the former.

GAS AND GAS-METER TESTING IN MASSACHUSETTS.

We have been favoured by Mr. C. W. Hinman, the Inspector of Gas and Gas-Meters for Massachusetts, with a copy of the report presented by him to the State Legislature on the work of his Department in the past year. The following particulars are extracted therefrom.

Dealing first with the testing of gas (although this comes last in the report), we find that the law requires that at least two inspections a year should be made of the gas of every company supplying more than 50 consumers. One additional inspection is to be made for every 6 million cubic feet of gas sold; but the gas of no company is to be inspected oftener than once a week. There are 68 companies in the State whose gas requires inspection; the number of inspections varying from two per annum for the smallest, to 52 per annum for the largest company. Each inspection usually comprises a determination of the illuminating value, the presence or absence of sulphuretted hydrogen, and the amount of sulphur and ammonia in the gas. Additional determinations are sometimes made—such as the specific gravity of the gas and the eudiometric analysis. The law requires the larger companies to maintain stationary photometers at some distance from their works; and they were used for testing the gas supplied by these companies. The gas of the smaller companies was tested by means of a portable photometer. The tests of the gas of the former companies were usually made at the companies' offices. The gas of the latter companies was tested at hotels and town halls, as well as at the offices. The inspections were made at rather irregular intervals; and no notice was ever given when they were to take place. More inspections were made in the winter than during the summer, so as to follow the production of gas to a certain extent. The average illuminating power of the gas supplied by the larger companies (24 in number) was 18.41 candles; that of the gas sent out by the 34 smaller companies being 17.99 candles. There are ten companies making petroleum gas; the average light-giving power being 33.61 candles. With regard to impurity, the percentage of sulphur and ammonia in the gas of the larger companies was 9.85 and 3.88 grains respectively; in that of the smaller companies, 9.31 and 3.09 grains. The companies may be divided into two classes—viz., those who use water gas, and those who do not. Of the larger companies, those at Boston, Charlestown, Dorchester, Fall River, Haverhill, Lawrence, Lynn, New Bedford, Roxbury, and Worcester sell more or less water gas. Leaving out of account Charlestown, Haverhill, and New Bedford, who made only a comparatively small quantity of water gas, the other seven companies show an average increase in the illuminating value of their gas of 1.5 candles over the results of the previous year. The remainder of the larger companies manufactured coal gas, which in some cases was enriched with oil gas. The gas of these companies showed, on the average, the same candle power as the previous year. The gas of the smaller companies averaged one-third of a candle higher than the average of the same gases for the preceding year. The gas at Charlestown was on one inspection found to be below the legal minimum of 15 candles. Those small companies who manufacture a rich petroleum gas, to which they usually add some air to prevent smoky flames, have, on the average, decidedly decreased their candle power, as compared with the gas furnished by the same companies during the year 1890. If, however, the comparison is made with the gas supplied previous to 1890, there is no decrease in candle power shown. On an average, the gas contained a little less sulphur last year than in 1890. The legal maximum is 20 grains per 100 cubic feet. Sulphuretted hydrogen was found on twelve occasions. The average amount of ammonia was greater in 1891 than in several previous years. The Inspector thinks there is no good reason for this excess, as an increasing quantity of water gas, which does not contain this impurity, is manufactured.

After having given the results of his eudiometric analyses of the gas of certain companies, Mr. Hinman proceeds to refer to an apparatus he has devised for quickly and accurately testing gas. His remarks on this matter are as follows: There has been for some years a demand by gas superintendents for an apparatus for gas analysis that could be worked quickly, and still give results accurate enough for practical purposes. The apparatus used for the scientific analysis of gas, and which demand only a moderate amount of time for their use, are fragile, expensive, and are only fit to be used by professional chemists. They all use mercury as a seal. There have been several appliances devised which, by using water as a seal, and neglecting corrections for changes of pressure and temperature, have enabled results to be obtained with ease and rapidity. There has been some question as to the accuracy of the results obtained by this quick-working apparatus; some claiming that they were practically as accurate as any other style of apparatus. I have endeavoured to throw some light on this question by making some comparative analyses of the same gas with both styles of apparatus. The mercurial apparatus used resembles, in some respects, that of Williamson and Russell, and in others that of Doyere. For the apparatus using water as a seal, I have used that of Hempel, as I considered it one of the best of its class, and it is considerably employed by gas engineers. Two different gases were analyzed with each apparatus. The first was a mixture of coal gas and water gas,

with the addition of some carbonic acid and air. This was analyzed repeatedly with Hempel's apparatus, and according to his latest directions. The results were comparatively easy to obtain, and required not much more than an hour's time, if the absorptions and drainings were not too prolonged. The following is an outline of the operations: Carbonic acid was absorbed by caustic potash; the illuminants, by fuming sulphuric acid followed by caustic potash; the oxygen, by phosphorus; and the carbonic oxide, by cuprous chloride dissolved in muriatic acid. A part of the residual gas was mixed with an excess of air and exploded over mercury, and the carbonic acid formed absorbed by caustic potash. The data obtained allow of the calculation of the amounts of marsh gas, hydrogen, and nitrogen. The gas was contained in a glass sealed with mercury, and was analyzed as opportunity offered on four different days. The following results were obtained:—

Carbonic Acid.	Illuminants.	Oxygen.	Carbonic Oxide.	Marsh Gas.	Hydrogen.	Nitrogen.	—
6'33	11'74	1'11	22'70	19'03	32'16	6'93	3rd day.
6'00	11'00	..	21'60	20'50	29'20	11'70	
—	—	—	—	21'30	28'40	11'70	
—	—	—	—	20'50	31'20	9'70	
6'00	11'40	..	21'70	20'20	32'40	8'30	1st day.
—	—	—	—	20'60	31'60	8'70	
—	—	—	—	19'80	31'90	9'20	
5'80	11'20	..	21'60	19'60	33'40	8'40	
5'90	11'60	1'20	20'70	20'50	30'10	10'00	
—	—	—	—	20'10	30'90	9'60	
—	—	—	—	19'80	31'10	9'70	
—	—	—	—	20'30	30'30	10'00	2nd day.
5'70	11'80	1'30	20'70	20'20	30'30	10'00	
—	—	—	—	20'20	30'60	9'70	
6'30	11'60	1'90	21'20	20'00	28'20	10'80	
—	—	—	—	20'30	27'90	10'80	4th day.
—	—	—	—	17'80	37'30	5'40	

The first result was obtained by the use of the mercurial apparatus; the others with Hempel's. The results obtained by direct absorption show a satisfactory agreement between those given by the two styles of apparatus. In three of the analyses, the failure to find oxygen was due to the use of phosphors which had been too long exposed to the light. The smaller amount of carbonic oxide found with Hempel's apparatus was probably due to the use of only one pipette of cuprous chloride, as Hempel recommends two. In the results obtained by explosion in Hempel's apparatus, the hydrogen was usually from 1 to 4 per cent. too low, and the nitrogen from 3 to 4 per cent. too high; the results of the mercurial apparatus being taken as the standard. The last explosion in the table was made over water; and the results are seen to be still less reliable than those over mercury. The coal gas next selected was still more difficult of analysis by the Hempel apparatus, as much less of the work depended on absorption, and much more on explosion, than with the first gas. Two analyses of this gas by the use of the mercurial apparatus are given—Nos. 7 and 8. They are independent analyses, except that a reading was accidentally omitted in one, and was supplied from the other. This substitution only affects the marsh gas and the carbonic oxide. Three other analyses—Nos. 9, 10, and 11—of a similar gas, made some years ago, are given to show the accuracy of the apparatus. These are the only strictly duplicate analyses I have ever made with the apparatus in its present state. This gas was analyzed by Hempel's apparatus, and by the same methods as was the first gas. In this case only one-sixth of the residual gas from the absorptions could be exploded at once, as it contained so much marsh gas. In consequence of this, any error in this part of the analysis was multiplied by six in converting the results into percentages.

—	Carbonic Acid.	Illuminants.	Oxygen.	Carbonic Oxide.	Marsh Gas.	Hydrogen.	Nitrogen.
1 . . .	40	4'70	..	5'60	39'90	40'70	8'70
2 . . .	00	4'50	10	5'30	39'10	42'40	8'60
3 . . .	10	4'90	20	5'80	37'80	42'80	8'40
4 . . .	20	5'10	20	5'50	38'90	48'70	1'40
5 . . .	—	—	—	—	—	47'80	2'30
6 . . .	—	—	—	—	—	49'00	1'10
7 . . .	09	4'89	06	8'47	37'59	48'10	0'80
8 . . .	10	4'89	07	8'33	37'66	48'29	0'66
9 . . .	10	5'59	..	6'91	36'84	49'90	0'66
10 . . .	10	5'65	..	6'97	36'74	49'93	0'61
11 . . .	10	5'70	..	6'75	36'85	49'89	0'71

These results show, as did the previous ones, that the apparatus is reliable for absorptions; but they emphasize the need for a second pipette for absorbing carbonic oxide. Each portion of residual gas left from the absorptions was exploded in four or five separate portions, and the average results are given in the first three analyses. The variations in the results of the separate explosions of the same residual were from 2 to 10 per cent. on the whole amount of gas taken. The average results for hydrogen were 6 per cent. too low; and the nitrogen was as much too high. Variations were made in the pressure at the time of explosion, and also in the amount of air used; but no increase of accuracy was obtained. Of course, such results are of no use to anyone. As the results obtained by this method were found to be so absolutely useless, another method of Hempel's was tried. It consisted in mixing a part of the residue from the absorptions with a sufficient quantity of air, and passing the mixture over palladium sponge. Only the hydrogen burned; and its amount was calculated from the contraction. Another portion of the residue was then mixed with air, then exploded over mercury, and the carbonic acid formed absorbed by caustic potash—its amount giving the quantity of marsh gas. The nitrogen was found by subtracting the volume of all the gases determined from the quantity of gas taken. Analyses Nos. 4, 5, and 6 were made by this method. The quantity of marsh gas given is the average result of all the explosions. If due care is taken, and not less than three explosions are made (the

results being averaged), this last method gives results within about 2 per cent. of the truth. Unfortunately, this method of using the apparatus takes as much time as would be occupied in making an analysis with the mercurial apparatus.

In Mr. Hinman's report for 1890, a full abstract of which appeared in the JOURNAL for April 7, 1891 (p. 655), reasons were given, at some length, for the exclusive use of open burners for testing gas. During the past year, the Company with whose gas the greatest difference between the results of testing with open and Argand burners respectively was found, ceased to supply illuminating gas. The gas of none of the other companies showed nearly as great differences when tested with the two kinds of burners as did that of this Company. These facts, the Inspector thinks, make the need of an alteration in the law less necessary than it was in previous years, although the reasons for a change still remain. He is of opinion that, if the existing conditions are retained, the present minimum for illuminating power should be raised from 15 to 16 candles.

Turning now to the first part of the report, which furnishes particulars as to the testing of meters, we find that during the past year 16,585 meters were inspected, of which number 16,354 were either new or repaired. There were 231 meters which had previously been in use brought to the Inspector's office and complained of as incorrect; the complaints coming mostly from gas consumers. On reinspection, 54 of these meters were found to be too fast—11 being more than 5 per cent., and one as much as 14 per cent. too fast; the average error being 4'74 per cent. There were 144 meters found within the legal limits—viz., 2 per cent. either way; 34 were found to be too slow—9 being more than 10 per cent., and one as much as 50 per cent. slow. The average error was 10'03 per cent. One meter did not register. The average error of the meters complained of that registered was 0'41 per cent. slow. Nearly all these were dry meters. Taking the results of the tests of meters complained of during the past 20 years, a gradual improvement in accuracy is shown—not so much by the average error from year to year, as by the increased proportion of correct meters. During the first five years of the period under consideration, only 44 per cent. of the meters complained of were correct; in the middle ten years, about 50 per cent. of them were correct; and in the last five years, 64 per cent. The Inspector remarks that these meters can scarcely be taken as a fair average of those in use throughout the State, as they were suspected and complained of as incorrect either by the consumers or the gas company. Comparatively few meters are complained of and taken to the office for inspection by the companies; for when they suppose a meter to be incorrect, they generally remove it, and test it for themselves. As consumers are not apt to intentionally complain of slow meters, it follows that those taken to the Inspector on account of complaints, are faster than the average of the meters in use.

EXHIBITIONS OF GAS APPLIANCES.

Last Tuesday, an exhibition of gas cooking and heating appliances, promoted by the Smethwick Local Board, and effectively carried out by the Gas Committee, was opened in the Public Hall in that town by Mr. Jabez Lones, and continued during the week. The exhibits were manufactured by Messrs. W. Parkinson and Co.; and their qualities were well displayed by Miss Woods in a series of cookery lectures and demonstrations, which were well attended. The same firm have a stand at the Trade and Industrial Exhibition now being held at the Bingley Hall, Birmingham; and this week they are holding an exhibition in the Drill Hall, Nuneaton—lectures on cookery being delivered in the afternoon and evening by Miss Woods. The Davis Gas-Stove Company, Limited, were busily engaged all last week in holding in various towns exhibitions of their well-known appliances. At Bedford they were assisted by Mrs. Wilkinson; at Bristol, by Miss E. Johnston; at Felixstowe, by Miss M. A. Rotherham; at High Wycombe, by Miss J. Cameron; at Stoke-upon-Trent, by Mr. W. J. Young, M.P.S. The whole series of exhibitions and lectures was held under the auspices of the Gas Companies in the respective towns. The Alliance and Dublin Consumers' Gas Company held an exhibition of gas appliances last week in the annex adjoining the Leinster Hall, Dublin. The premises, we learn, were most admirably laid out; and nothing could possibly have been better than the way in which the appliances were displayed. Lectures were delivered each day, except Saturday, in a specially erected theatre. During the past week an exhibition of gas appliances was held at the Town Hall, Wells, under the auspices of the Wells Gaslight Company; able lectures being delivered twice daily by Miss E. Golding, of London. The gas ranges, fires, and other contrivances for cooking and heating, supplied solely by Messrs. Richmond and Co., Limited, of Warrington, made a large and most effective display. The matter was energetically taken up by the Company, through their Secretary and Manager (Mr. C. V. Bennett), and on behalf of Messrs. Richmond and Co. by Mr. Arthur Mead, their representative for the district; and there were large attendances. Mr. E. W. T. Richmond gave an interesting extempore lecture on "Gas as a Domestic Servant." In the enforced absence of the Mayor, Mr. E. Hippisley, the Chairman of the Gas Company, opened the exhibition. At Crewkerne, last Tuesday, under the auspices of the Gas Company, Messrs. Darwin and Co., of Glasgow and London, made a successful display of their cooking and heating appliances. The exhibition was opened by the Chairman of the Company (Mr. G. F. Wills); and lectures were delivered by Miss Phillips twice daily during its continuance till Friday. A gas exhibition, held under the auspices of the Rossendale Union Gas Company, was opened at Bacup by the Mayor (Mr. H. Salmon) on Monday last week. The chief exhibitors were Messrs. Richmond and Co., Limited, of Warrington and London (who showed a special cooker suitable for mill hands), Messrs. C. Wilson and Sons, of Leeds; and Messrs. J. Wright and Company, Limited, of Birmingham. Lectures were given by Miss Haxworth, of Liverpool. At Ramsay (Isle of Man), the same firm held an exhibition from the 19th to the 22nd ult., to inaugurate the adoption, by the Ramsay Gas Company, of the system of letting out gas-stoves on hire. The arrangements were carried out by Mr. J. Cannell, the Company's Secretary; and the exhibition was opened by the High Bailiff. Lectures were given by Miss Owen, of London.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Mr. J. M'Gilchrist's Committee of the North British Association of Gas Managers have commissioned Mr. D. W. Stevenson, R.S.A., Edinburgh, a rising Scottish sculptor, to execute the bust of William Murdoch, which is to be placed in the Wallace Monument at Stirling on the occasion of the annual meeting of the North British Association. At the Edinburgh meeting last July, it was agreed that the meeting this year should be held in Dundee; and that on the second day the members should journey to Stirling to conduct the ceremony in the Wallace Monument. The unfitness of the arrangement was observed by some at the time. The Committee of the Association are fully convinced of its awkwardness; and they have issued a circular to the members asking if they will consent to the holding of the meeting this year in Stirling. It will require an almost unanimous vote of the members to upset the resolution of the last meeting; but there should be little difficulty in securing this for a proposal which has so much to recommend it.

The Edinburgh and Leith Gas Commissioners held a short and uninteresting meeting last week—not, I presume, because there was nothing for them to do, or to speak about, but because it did not suit them to make much ado in the meantime. Their most important business was the Engineers' reports for March, which are a puzzle to me. The total output of gas from both works was 106,598,000 cubic feet, which was a decrease of 5,958,000 cubic feet over the output in March of last year. There was an increase of 1,387,000 cubic feet from the Edinburgh works, but a decrease of 7,345,000 cubic feet from the Leith works; though during the month of February there was a decrease in the output from Edinburgh, and an increase in the output from Leith. How the two districts should play fast and loose in this manner, I cannot understand; and I am led to believe it is a puzzle to others as well as to myself. The yield of gas from the Edinburgh works was 10,005 cubic feet of 26·01-candle gas per ton of coal; and from Leith, 10,159 cubic feet of 26·49-candle gas per ton. The Commissioners have set their face against giving assistance to makers of gas-stoves to exhibit their appliances. Within the past two months four firms have applied for permission to get up gas exhibitions; but all have been declined. At the present high price of gas, it is more than probable that an exhibition of gas appliances would do neither the Commissioners nor the exhibitors much good. One effect which it would really have would be to give rise to comparisons with other places, to the disadvantage of the Commissioners. They are probably, therefore, wise, so long as there is no great demand for gas-stoves, to keep as quiet on the subject as possible. An ominous instruction was given for an enquiry into "the increased amount of unaccounted-for gas during the current year," which was probably the occasion of the remark by Mr. Wells that he should point out, later on, that "very little reliance could be put upon the Engineers' reports." He did not enter further into the subject; and therefore the revelation of what Mr. Wells has got under his thumb must be looked for another time. That is a plum in store. A matter which was before the Commissioners—small in amount, but perhaps important in principle—was the rate of pay to the collectors of gas-rental. This was brought up upon a motion proposing a return to the system of pay which prevailed before the transfer; and the notion underlying the proposal was that the Commissioners were too liberal to their collectors during sickness, which encouraged malingering among them. Mr. Cockburn, the collector, had a memorandum prepared, which showed that the cost of collection by these men was at the rate of 1·98d. under the Edinburgh Company, and 2·07d. under the Commissioners—representing an increase of about £70 a year to the Commissioners. Considering the enlargement of the business since the transfer in 1888, this was not out of the way; and the Commissioners refused to take any action in the matter. The Commissioners had also before them the common stair-lighting question; but nothing new transpired upon it, except the hope, expressed by a Special Committee which had considered it, that "by next winter the town will have made proper arrangements for the lighting of these stairs." What they meant by "proper arrangements," I take to be that the town shall have arranged to do the work.

The latest attempted sensation in connection with the gas supply of Edinburgh, is contained in a paragraph to which the *Scotsman* to-day gives the premier place, the statement in which is to the effect that the Gas Commissioners, who have been in the habit of employing a staff of bricklayers for the repairing of retort benches, paying them 8d. per hour, have begun to give the work to a master builder, who will probably charge the Commissioners 1s. to 1s. 3d. per man per hour. It is also added that one of the old bricklayers, a man who has been employed in the works for over ten years, on applying to have his wages raised to 9d. per hour, was refused, and was afterwards turned out of the works without a moment's notice. The story is published, the *Scotsman* says, in order that the authorities may have an opportunity of contradicting or explaining it; but that this is not the only object, is shown by the concluding sentence, which is as follows: "If this be a sample of how affairs are conducted in the gas-works, there is little wonder the price of gas is increasing." The story has every appearance of being a very one-sided one. I have a suspicion that it is directed, not against the management of the works, but against the builder; but to write more about the matter would be an anticipation of whatever explanation may be made by the Commissioners or the officials in the works.

A cheering piece of news comes from Dundee, to the effect that the Gas Commission have received about seventy offers to supply coal during the next financial year, which is double the number received when the Commission was in the market a year ago. In reporting the circumstance to the Works Committee on Monday, ex-Provost Brownlee said he believed the prices would be found to be much lower than are at present being paid. The Finance Committee, on the same day, were informed that for the eleven months ending on March 31, the gas-rental had amounted to £68,324, which is £4687 above the sum at the corresponding date last year; and this increase has taken place notwithstanding that several large installations of

electric lighting have been in existence. Already the members of the Finance Committee are beginning to forecast their schemes for next year. It seems they were prepared to face an increase in the price of gas, to make up for the loss of revenue arising from the fall in the prices obtained for residual products. The lower prices at which coal is being offered, however, they anticipate, will enable them to go on at least at the same rate as at present—3s. 8d. per 1000 cubic feet—and probably they will be able to make a reduction.

Another item of information which was communicated to the Finance Committee, was that four of the annuities of the Commission, amounting to £76 ros., had been purchased for £2315 5s. 2d., which is at the rate of about 30 years' purchase. It is slow work redeeming annuities; but the Dundee Gas Commission keep pegging away at the task, and in course of time, though it is probably a long way off, the undertaking will get rid of them altogether.

There was a slight ruffle on the bosom of the usually placid surface of the big ocean of Glasgow on Tuesday, when the Finance Committee of the Police Board met to consider 106 appeals by owners of property in private streets in the recently amalgamated burghs, against the imposition of a special tax upon them in respect of the cleaning and lighting of their thoroughfares. The cases from Hillhead were the only ones which were argued. It seems that the former Police Commissioners of the burgh were in the habit of requiring the owners of property to provide the street lamps; and that then they undertook the lighting. The Glasgow Police Act does not allow this. The owners of property where the thoroughfares have not been put on the burgh register, are required to maintain and clean them, and to pay also for the lighting. On behalf of the proprietors, it was argued that in taking over the whole burgh, the city of Glasgow also took over the obligations of the former Police Commissioners. Mr. Colquhoun, the Chairman of the Committee, however, pointed out that there was no obligation on the part of the former Police Commissioners to light the thoroughfares, but that they did it *ex gratia*; and that the proprietors not having sought to get an arrangement on the subject while the negotiations for amalgamation were proceeding, the Committee could now only deal with the appellants as they would with any ordinary ratepayer of the city of Glasgow. The Committee were of opinion that the proposed assessments were legally imposed; and further that no objection could be taken to the form in which they had been imposed. As, however, it was asserted that some of the thoroughfares had been virtually taken over by the Police Commissioners before the amalgamation, the Committee adjourned till May 10 so as to enable the proprietors in such thoroughfares to make good their assertion. After that, those who are not able to establish that their thoroughfares have been taken over, may appeal to the Sheriff against their decision.

What is, in reality, the fight over railway rates took place at Westminster this week when a Joint Committee of the Lords and Commons sat to consider the objections by traders and others to the proposed rates for the carriage of goods which have been scheduled by the railway companies. The movement began several years ago, upon objections by traders with reference to differential rates which existed. Now, when the railway companies have made an attempt to equalize their rates, many of the traders are still not satisfied. As metropolitan traders, the Edinburgh and Leith Gas Commissioners were interested in respect of the rates to be charged for the carriage of coal to their works. A deputation of their number, with Mr. Mitchell and Mr. Linton, have been in London; and they were able to come to terms with the railway companies, without the intervention of the Parliamentary Committee. I understand that the proposal of the railway companies was to raise the maximum rate—2½d. per ton has been mentioned; but I have not very complete information on the subject, and must speak with reserve. At all events, what looks like a counter-move on the part of the Gas Commissioners was attempted in a clause which they proposed to have inserted in the Provisional Orders of the railway companies, to the effect, practically, that the charges for carriage were to include terminal and junction services. A compromise having been come to, however, the clause was withdrawn. I cannot yet say whether the railway companies are to amend their schedules in terms of the compromise, or whether the traffic will be conducted by agreement outwith the Provisional Orders. I rather incline to the view that the latter would be an illegal procedure, and that the schedules will have to be amended; but that stage has not been reached yet.

The Dufftown Gas Company, which is being smothered to make way for an electric light installation, have resolved to wind up their affairs as at May 15 next. At the meeting, at which the resolution to wind up was adopted, the shareholders were informed that the electric lighting installation would not be ready this season; but they were assured that it was coming. One is tempted to ask what they will do with it when they get it?

Moffat, as is well known, is one of the most popular health resorts in Scotland. From whatever cause I cannot say, but it is a place where fortunes are not made; and the people who permanently reside there are mostly poor. This circumstance probably explains the fact that it has not been threatened by an exploiting electric light company. The Police Commissioners themselves, however, took the matter up; and on Monday night they had before them a report by Professor Jamieson, of the Glasgow and West of Scotland Technical College, upon a scheme for the lighting of the streets by electricity. The proposal was the now familiar one of taking power from a local stream—in this case the Euan, two miles distant. Even with this cheap source of power, the Professor's report showed that the cost of electric lighting would be double or treble that of gas lighting. The Commissioners accordingly, and very sensibly, resolved to postpone further consideration of the proposal till after the November elections.

Just as I expected, the Corporation electric lighting scheme of Bradford is being trotted out for the purpose of carrying wavering Corporations over the point of decision when they come to decide whether or not they shall go on with an electric lighting scheme. The Subcommittee of the Aberdeen Corporation on Electric Lighting have been caught by it. At their last meeting, they had before them information, which it has taken them several months to collect, as to the working of installations in various towns. Bradford was the particular instance

which impressed them. "It was shown," it is reported, "that while (in Bradford) 2½ years ago the first half-year's report after the introduction of the light had shown a deficit of £1000, matters had steadily improved; and now, when the fifth half-yearly report has been issued, there is a balance to the good of over £900." The Sub-Committee resolved to proceed with the Aberdeen installation; but "in the meantime," they resolved to ask Professor Kennedy to give them the benefit of his professional advice. Possibly some of your readers, who are better acquainted with this department of work than I am, might be able to tell the Aberdeen Committee what the advice is which they are likely to get. Professor Kennedy's notions are, I presume, quite well known by this time, just as Mr. Preece's or Professor Forbes's are. I wonder why the Aberdeen Committee cannot do a little thinking for themselves. For one thing, it is quite evident that they omit to take note, with reference to Bradford, that the contracts there were for three years; that the time for some of them has therefore nearly expired; and that the seventh half-yearly report—that is the first report after the contracts with the Corporation's first customers for electric lighting have expired—may be very different from the fifth. If the Chairman of the last meeting of the Edinburgh Merchants' Association, as mentioned in my "Notes" of April 12, spoke the sentiments of only a few of the users of electric lighting in Bradford, the prospect of the Corporation in obtaining the renewal of contracts is very slight.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The month closes without any quotable change in prices; and so far as the better qualities suitable for house-fire purposes are concerned, these are still moving off pretty freely at late rates. Best Wigan Arley remains firm at 12s. 6d.; Pemberton four-foot and second qualities of Arley, 10s. 6d. to 11s.; and common house-fire coals 9s. to 9s. 6d. per ton, at the pit mouth. Other descriptions of fuel are becoming more plentiful in the market; and for these prices are showing a weakening tendency, although list rates remain unchanged. Common round coals are in but indifferent request for iron making, steam, and general manufacturing purposes; and the depressed outlook in the principal coal-using industry, affords but a discouraging prospect for the immediate future. For inland sales, steam and forge coals are quoted at about 8s. to 8s. 6d. per ton at the pit mouth; but for shipment, the demand for which although slightly better than last week is still extremely slow, 9s. 6d. per ton represents about the full average figure obtainable for ordinary descriptions of steam coal, delivered at the ports on the Mersey. The dispute in the cotton trade and the lock-out at a large number of mills throughout Lancashire, is necessarily seriously affecting requirements for engine fuel, and a good deal of slack is just now being thrown upon the market. The principal colliery firms are, however, for the most part preferring to get, or put down into stock, rather than force surplus supplies upon the market at low figures during the temporary stoppage of the mills; but there are low sellers, and special clearance sales are made in some instances considerably under the current quoted rates. At the pit mouth, the best qualities of burgy still average about 6s. 6d., and the best qualities of slack, 5s. to 5s. 9d. per ton, with common sorts not averaging more than 3s. 9d. to 4s. per ton.

Northern Coal Trade.—The coal trade has been erratic and excited of late, partly through expectations of some of the collieries resuming work, and partly through the demand increasing for export. Best Northumbrian steam coal is higher in price, as the season for shipment approaches for the Baltic; and about 12s. to 12s. 6d. per ton, must now be looked upon as the current rate. Even unscreened coal has been sold as high as 11s. 6d. per ton, or at equivalent prices for home use. Second-class steam coal is about 9d. per ton less than best. Small steam is in demand for manufacturing purposes; and where prompt delivery can be given, much higher prices have been offered. It is said that as high as 7s. 6d. per ton has been paid for this class of coal—or double the price of a few weeks ago. There are, however, large quantities of both Yorkshire and Scotch coal being brought into this district; and the gas coal from Scotland has been offered delivered in the Tyne at less prices than that of the Durham quality of gas coal, which is still obtainable from one or two collieries. For local gas coal, as high as 12s. per ton, f.o.b., is still asked. Household coal is more abundant and is dull in price; and similar remarks apply to the bunker coal for steamships. One or two of the Durham collieries not in the Coalowners' Association have been recommenced; and others are expected to follow in a day or two; so that it would appear as if the beginning of the end of the long strike in Durham had come. Coke is still very scarce; and the price of blast-furnace coke is unaltered. Gas coke is quiet, with rather a weak tendency in the price.

Scotch Coal Trade.—Events have taken a turn this week which may have important results, and which at present have the effect of showing that the coal trade is far from being in a healthy condition. It seems that a considerable number of miners who have released themselves from duty in the Durham district have found their way to Scotland in search of work. There is thus a plethora of pitmen; and orders not being very abundant, the coalmasters in Lanarkshire have given notice of a reduction of wages by 6d. per day—about 10 per cent.—and the men show no signs of resistance. In Fifeshire, where a reduction of 7½ per cent. was recently agreed to by the miners, another similar reduction is threatened, and must also be accepted by the men unless a demand for coal springs up. Appearances are against this happening; in fact, it is stated that the demand is so slack that stocks are accumulating, main and splint coal being specially plentiful. The prices quoted last week had consequently receded a little. Main, 7s. 6d. to 7s. 9d.; ell, 8s. 6d.; splint, 8s. 3d. to 8s. 6d.; and steam, 10s. to 10s. 3d. Shipments during the previous week amounted to 147,581 tons, an increase of 6000 tons over the shipments of the preceding six days. For the year, the shipments have been 1,952,564 tons; an increase of 269,747 tons over the corresponding period of last year.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, April 30.

Sulphate of Ammonia.—In spite of a poor demand, there is little, if any, variation in prices; and the market generally may be considered steady. The quotations at Hull and Leith remain at £10 3s. 9d.; although buyers are trying to get in at £10 2s. 6d. The Liverpool price is £10 1s. 3d. Stocks keep moving off fairly; and it is therefore improbable that the decline predicted in some quarters will take place. There is a fair inquiry forward, but at low prices. Nitrate is rather weak at 8s. 9d. to 8s. 10½d.

LONDON, April 30.

Tar Products.—The position of these generally is easier than last week. Benzols have had a further drop; and 1s. 6d. for 90's and 1s. 3d. for 50's is about the current value, although but little business is reported. Creosote and oils are lifeless; and anthracene is considerably weaker—some "B" quality having been sold as low as 7d. Pitch keeps fairly steady for prompt delivery, at from 27s. to 28s.; but forward business is spoken of at several shillings per ton lower. Prices are: Tar, 10s. to 12s. Pitch, 27s. to 28s. Benzol, 90's, 1s. 6d.; 50's, 1s. 3d. Toluol, 1s. 2½d. Solvent naphtha, 1s. 2d. Crude benzol naphtha, 30 per cent., 9d. Creosote, ½d. Naphthalene salts, 20s.; pressed, 45s. Carbolic acid, crude, 60's, 1s. 1d.; 70's, 1s. 4d.; crystals, 5d. Cresol, 8d. Anthracene, 30 per cent. "A" quality, 10½d.; "B" quality, 7d.

Sulphate of Ammonia.—There is no change in this market; and prices are much about the same as those mentioned last week—viz., £10 to £10 3s. 9d., less 3½ per cent. Gas liquor (10-oz.), 5s. to 6s. 6d.

The Profits of the Wigan Corporation Gas Department.—At a meeting of the Wigan Corporation Gas Committee last Thursday the Borough Treasurer stated that the profits of the gas undertaking for the past year, after providing for interest, sinking fund, and all other expenses, amounted to £9140, which together with £3105 brought forward from the previous year, leaves the sum of £12,245 in the hands of the Committee. It was decided that £12,000 should be handed over in aid of the general district fund.

Sales of Shares.—At a recent sale of original consolidated 10 per cent. stock in the *Cambridge Water Company*, lots of £50 realized from £134 to £136 each; and similar lots of consolidated 10 per cent. stock, £126 each—a lot of £10 fetching £28.—At West Hartlepool recently, £5000 of stock in the *Hartlepool Gas Company* was sold at premium; ranging from 50 to 60 per cent.—Last Thursday, at Rochester, four £50 shares (paying a dividend of 10 per cent.) in the *Rochester, &c., Gas Company*, were sold at £112 each, and four at £112 10s. each; two £12 shares in the same Company (paying a dividend of 7½ per cent.) fetching £19 5s. each, and four, £19 10s. each.

Cooking by Electricity.—Last Friday evening, a number of gentlemen assembled in the Royal Hotel, South Shields, on the invitation of Mr. Farquhar M. Laing, to witness experiments in cooking by electricity. Among those present were the Mayor (Mr. J. M. Rennoldson), Mr. W. J. Warner, the Engineer, and Mr. J. H. Penney, the Secretary of the South Shields Gas Company. The experiments were conducted by Mr. J. Patterson and Mr. Horace Angus, of the Newcastle and District Electric Lighting Company. The utensils used were two pans, each about the size of a saucer, with flat tops and small rims. The American machines have already been introduced in Newcastle, and Mr. Laing, being desirous of showing his friends in South Shields this new means of cooking, arranged for the demonstration, which was completely successful.

The Electric Lighting Scheme for Portsmouth.—The Portsmouth Town Council having applied to the Local Government Board for power to borrow £60,000 for electric lighting purposes, Mr. Arnold Taylor, one of the Board's Inspectors, held an inquiry into the matter a few days ago. The Town Clerk (Mr. A. Hellard) stated at the outset that the original application was made on a scheme prepared by Mr. Shoolbred; but this part of the resolution was afterwards revoked, and a scheme by Professor Garnett adopted. The latter gentleman explained his proposals at some length; and he concluded by saying that the cost of the scheme would, he estimated, be £55,300. Mr. B. C. Miller, a councillor, questioned Professor Garnett's capabilities, and suggested that, as he had been called in to report upon Mr. Shoolbred's scheme, someone should be requested to give an opinion upon the Professor's. The present scheme was, he said, only carried by the casting vote of the Mayor. Although Portsmouth was a large borough, with a considerable population, the traders were small people; and he was quite satisfied that the cost of introducing the electric light into their establishments would deter them for many years from superseding their gas supplies, which were obtained at the low price of 2s. 4d. per 1000 cubic feet. He urged that the Corporation were not in a position to undertake any new expenditure of this kind. The Mayor explained that his casting vote was not given as between high and low tension, but in favour of the matter being dealt with at once rather than postponed. Mr. E. J. Pearce put several questions, and said that, while he was in favour of the electric light if it would not entail any extra burden on the ratepayers, he was of opinion that, unless this could be promised, the whole scheme ought to be knocked on the head. Professor Garnett, in reply, said the scheme was only brought forward in the full belief that it would provide for the repayment of capital, with interest, as well as the working expenses, and then furnish some profit. If this was doubted, there would be no difficulty, in the course of a few weeks in getting the whole of the necessary capital subscribed for the undertaking. At 6d. a unit, the electric light was making headway more and more every year against gas at 1s. 9½d. per 1000 cubic feet. Mr. M'Askie said the Corporation had been reproached for having allowed the gas and water supplies of the town to become monopolies. If the ratepayers as a body were to declare that they did not want the present scheme, he as a member of the Corporation would say, "Very well, only don't blame us by-and-bye for not having given you the chance of benefiting yourselves." Mr. Kennedy supported the scheme, on the ground that it would be suicidal to leave it to be carried out by a company. After some further discussion, the inquiry closed.

Sale of Debenture Stock in the Bristol Water Company.—Messrs. Daniel, Selfe, and Co., last Thursday, submitted for sale at Bristol £20,000 of 3½ per cent. debenture stock, created under the powers of the Bristol Water Company's Act of 1888. Prior to offering the stock to the public, Mr. Daniel stated that the present market quotation of the shares was 105 to 107; but he had been informed that there was no stock to be had at that price. Of the £160,000 stock already created, and to which the £20,000 now offered would be allied, there was none on the market that day; and there had been only eleven transfers of the stock referred to, which showed how well it was held. The stock was offered in lots of £100, and they produced the following prices: 90 lots, £105 10s.; 2 lots, £105 7s. 6d.; 11 lots, £105 5s.; and 97 lots, £105.

The Gaslight and Coke Company Fined.—At the Lambeth Police Court, on Monday last week, The Gaslight and Coke Company were summoned, at the instance of the London County Council, for having, on the 11th of December last, supplied gas at the testing-station in the Lambeth Road of less illuminating power than it ought to be under the Act of Parliament. There was a second summons against the Company in respect of gas tested at the station on the 15th of January. Mr. C. A. Roberts, from the Solicitor's Department of the London County Council, appeared in support of the summonses; Mr. Horace Avory, barrister, representing the Company. Mr. Roberts stated that the result of the testings showed the illuminating power of the gas on the dates specified in the summonses to be 15·2 candles in each case; being a deficiency of 0·8 candle, which carried a forfeiture of 40s. Upon the results of the testings being communicated to the Company, they appealed against them to the Chief Gas Examiner for the Metropolis (Dr. A. W. Williamson, F.R.S.); but their appeal was dismissed. Some formal evidence was given in support of the summonses. Mr. Avory said he was prepared to prove that upon the 11th of December the gas was tested by the Company at their station, and the average illuminating power was found to be 16·24 candles; and upon the 15th of January, 16·9 candles. Therefore it was obvious, if the Council's figures were right, that the difference must have arisen from some unavoidable cause or accident. Mr. Hopkins fined the Company 40s. and 23s. costs on each summons.

The Newington Water Company's Provisional Order.—Major Marindin, one of the Board of Trade Inspectors, opened an inquiry at Hull, a short time ago, with reference to the application made by the Newington Water Company for a Provisional Order, extending their power to procure water for the supply of their district. Mr. Scott-Fox appeared on behalf of the Company; and the Town Clerk of Hull (Mr. R. Hill-Dawe) represented the Corporation. Mr. Scott-Fox, in opening the proceedings, stated that, though the sources of the Company's supply were not failing them, there had been a deterioration in the quality of the water. The Directors, therefore, made investigations, and eventually chose Dunswell as the source from which to draw a further supply of water. Here a borehole had been made, and water was found in every way suitable for domestic supply. Evidence was then called; and subsequently a consultation was held between the Town Clerk and Counsel for the Company, in consequence of the former having intimated that he and several of the witnesses would have to leave that night for London in connection with a Railway Bill. As a result of this, the following agreement was come to: "That inasmuch as circumstances prevented an inquiry into the merits of the objection of the Corporation, and with a view to enable the whole matter to be considered by Parliament, it is agreed that, if an Order be made, it shall be without prejudice to the rights of either party, including that of the undertaking to object to the *locus standi* of the Corporation before Parliament, but the Corporation to have such rights of opposing the confirmation of the Provisional Order in Parliament as they would have had as petitioners against a Bill promoted by the Company for a like purpose." The inquiry thereupon terminated.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

For Stock Market Intelligence, see ante, p. 790.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon invest. ment.
£			p. c.					£ s. d.
GAS COMPANIES.								
590,000	10	13 Apr.	10½	Alliance & Dublin 10 p. c.	10	15½-16½	..	6 7 3
100,000	10	"	7½	Do. 7 p. c.	10	11-12	..	5 5 0
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105-107	..	4 13 5
100,000	20	27 Nov.	8	Bahia, Limited	20	12-14	..	11 8 1
200,000	5	12 Nov.	7½	Bombay, Limited	5	6½-7	..	5 5 9
40,000	"	"	7½	Do. New	4	4½-5½	..	5 14 1
380,000	Stock.	26 Feb.	12½	Brentford Consolidated . . .	100	210-215	..	5 14 1
150,000	"	"	9½	Do. New	100	160-165	+2	5 12 2
220,000	20	11 Mar.	11½	Brighton & Hove Original . .	20	40-42	..	5 9 6
888,500	Stock.	11 Mar.	5	Bristol	100	95-100	..	5 0 0
320,000	20	13 Apr.	11½	British	20	42-44	..	5 2 3
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	10	19-20	..	5 15 0
51,510	10	"	8½	Do. 7 p. c.	10	14-15	..	5 13 4
328,750	100	"	—	Buenos Ayres (New) Limited	100	6½-7½	..	—
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	93-96	..	6 5 0
150,000	20	26 Feb.	8	Cagliari, Limited	20	25-27	+1	5 18 6
550,000	Stock.	13 Apr.	13	Commercial, Old Stock . . .	100	230-235	..	5 10 8
165,000	"	"	10	Do. New do.	100	185-190	..	5 5 3
130,000	"	30 Dec.	4½	Do. 4½ p. c. Deb. do.	100	118-123	..	3 13 2
800,000	Stock.	30 Dec.	13	Continental Union, Limited .	100	221-226	..	5 15 1
200,000	"	"	10	Do. 7 p. c. Pref	100	190-195	+2½	5 2 7
75,000	Stock.	30 Mar.	10	Crystal Palace District . . .	100	185-195	..	5 2 7
486,090	10	29 Jan.	10	European, Limited	10	19-20	..	5 0 0
354,060	10	"	10	Do. Partly paid	7½	15½-14½	..	5 3 11
5,470,820	Stock.	12 Feb.	12	Gaslight & Coke, A, Ordinary	100	202-207	-8	5 15 11
100,000	"	"	4	Do. B, 4 p. c. max.	100	94-97	..	4 2 5
665,000	"	"	10	Do. C, D, & E, 10 p. c. Pf.	100	245-250	..	4 0 0
30,000	"	"	5	Do. F, 5 p. c. Prt.	100	116-121	..	4 2 9
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	169-174	..	4 6 2
1,300,000	"	"	7	Do. H, 7 p. c. max.	100	153-156	..	4 9 9
463,000	"	"	10	Do. J, 10 p. c. Prt.	100	244-249	+1	4 0 4
476,000	"	"	—	Do. K, 6 p. c. Prt.	100	146-150	..	4 0 0
1,061,150	"	11 Dec.	4	Do. 4 p. c. Deb. Stk.	100	113-116	..	3 9 0
294,850	"	"	4½	Do. 4½ p. c. do.	100	118-123	..	3 13 2
908,000	"	"	6	Do. 6 p. c. do	100	163-168	..	3 11 5
3,800,000	Stock.	12 Nov.	12	Imperial Continental	100	224-228	..	5 5 3
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4-4½	..	6 13 4
560,000	100	1 Apr.	5	Met. of Melbourne, sp. c. Deb.	100	106-108	..	4 12 7
541,920	20	27 Nov.	6½	Monte Video, Limited	20	14½-15½	..	8 7 8
150,000	5	27 Nov.	10	Oriental, Limited	5	8-8½	..	5 17 8
60,000	5	30 Mar.	7	Ottoman, Limited	5	4-5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited	10	2-3	..	—
People's Gas of Chicago—								
420,000	100	3 Nov.	6	1st Mtg. Bds.	100	105-108	..	5 11 1
500,000	100	1 Dec.	6	2nd Do.	100	105-108	..	5 11 1
150,000	10	15 Oct.	10	San Paulo, Limited	10	8½-9½	+½	—
500,000	Stock.	26 Feb.	15½	South Metropolitan, A Stock	100	270-275	+3	5 12 9
1,350,000	"	"	12	Do. B do.	100	220-225	..	5 6 8
200,000	"	"	13	Do. C do.	100	235-240	..	5 8 4
725,000	"	30 Dec.	5	Do. 5 p. c. Deb. Stk.	100	140-145	..	3 9 0
126,500	100	"	6½	Do. D 7½ p. c. do.	100	130-135	..	4 16 3
1,155,066	Stock.	11 Mar.	11½	Tottenham & Edm'ton, "A"	100	225-230	..	5 0 0
WATER COMPANIES.								
729,331	Stock.	30 Dec.	10	Chelsea, Ordinary	100	250-255	+2	3 18 5
1,720,252	Stock.	13 Apr.	8	East London, Ordinary . . .	100	193-198	..	4 0 10
544,440	"	30 Dec.	4½	Do. 4½ p. c. Deb. Stk. . . .	100	136-140	..	3 4 3
700,000	50	11 Dec.	8	Grand Junction	50	96-99	..	4 0 10
708,000	Stock.	12 Feb.	10½	Kent	100	250-255	..	4 2 4
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max.	100	218-223	+1	4 5 2
406,200	100	"	7½	Do. 7½ p. c. max.	100	184-189	+1	3 19 5
260,000	Stock.	30 Mar.	4	Do. 4 p. c. Deb. Stk.	100	120-123	..	3 5 0
500,000	100	12 Feb.	12½	New River, New Shares . . .	100	320-330	..	3 13 6
1,000,000	Stock.	29 Jan.	4	Do. 4 p. c. Deb. Stk.	100	126-129	..	3 2 0
902,300	Stock.	30 Dec.	6½	S'thwk & V'xhall, 10 p. c. max.	100	145-150	..	4 6 8
126,500	100	"	6½	Do. D 7½ p. c. do.	100	130-135	..	4 16 3
1,155,066	Stock.	11 Dec.	10	West Middlesex	100	240-245	..	4 1 7

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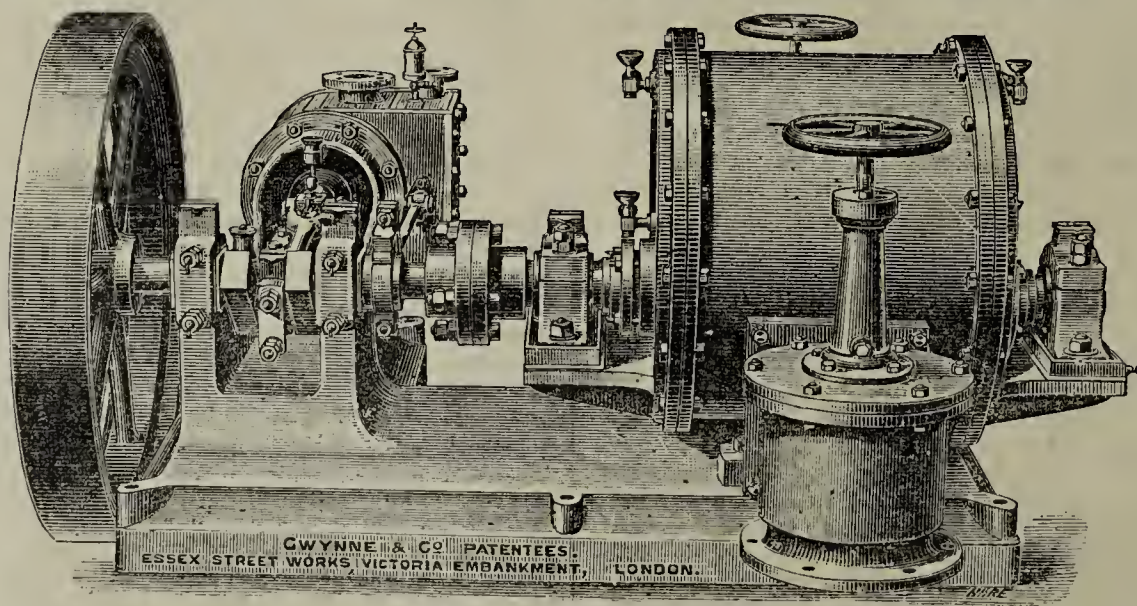
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THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MAY 10, 1892.

Unearned Increment—The Turn of the Market.

THERE was a very instructive debate in the House of Commons last week upon the interesting subject of "unearned increment," which most people have occasion to think about once or twice in the course of their financial dealings. It arose out of a proposal brought forward by Mr. Haldane to enable County Councils to acquire land, after having assessed its value in a sufficiently remarkable manner. It was proposed that any County Council might cause any land which they might covet to be valued under the provisions of the Lands Clauses Acts; and then, having obtained the valuation, they were to have the power of purchasing the land at the same figure at any

time within the next twenty years. There was no obligation to purchase, nor was there anything to prevent the same authority from demanding a second valuation of the land at the end of the period, and so hanging up in perpetuity as much property as they might think fit to meddle with. The object of the proposal was obviously that, in cases where the land so dealt with happened to rise in value, the County Council should be enabled to step in and appropriate the increase; while they might leave severely alone any property which happened to go down in the market. It is not to be wondered at that such a one-sided proposal was summarily rejected by the common-sense of Parliament. The author of the scheme and his supporters had the "unearned increment" fairly in sight; but their reverse is tantamount to a reminder that Parliament, which in this regard undoubtedly reflects the public sentiment, is not disposed to legislate upon the principle of "heads I win, tails you lose," even when a Local Authority is to do the tossing. This experience of Mr. Haldane and his backers reminds us of the futile efforts of the defunct Metropolitan Board of Works which preceded the enactment of the sliding scale for Gas Companies. With true municipal one-sidedness, this body tried to bind the Gas Companies to lose dividend rateably with any increases in the price of gas which they might find it necessary to impose; but it never occurred to them to offer a scale of dividends and prices sliding both ways. Without this, however, Parliament would never have adopted the sliding scale as an equitable equivalent for the statutory guarantee enjoyed by the Companies.

It is not to be supposed that the modern sport of "chasing the unearned increment" will be checked by Mr. Haldane's collapse. All that will ensue from this will be the understanding that Mr. Haldane was on the wrong scent; not that the chase is utterly vain. Indeed, we should be the last to attempt to conceal from the public the strength of the current of feeling which is setting now-a-days in the direction of attempts at securing for the community some of the financial benefits of social existence which now find private receivers. The capture of the "unearned increment" is a sport in which we are all too deeply interested to ignore its vicissitudes. Difficult even to hopelessness as is the legal problem of defining this term, its meaning is plain enough to ordinary people. It is most intelligible, of course, in regard to land, and especially so when illustrated by some sufficiently glaring instance—such as that which is supplied by the financial history of the London estates of the Duke of Westminster and Lord Portman. Here we see cases of real estate which double themselves in capital value every generation, or less, without the slightest assistance from their owners, and merely because they happen to occupy a favourable situation with regard to the needs of a growing population. If any man holds land in such conditions which is worth to him one million sterling, it will be worth twice as much to his son; and meanwhile no sort of credit for this increase of value is due to him. The question is, whether he is justly entitled to put all this enhanced value into his own pocket. This is, put in a few words, the question of the "unearned increment."

The first difficulty which meets one in attempting to make up one's mind upon this subject, is that the unearned increment may be balanced by an undeserved decrement; and it is a curious question how far Society is justified in assuming a right to the one without incurring liability for the other. The second difficulty has reference to the extent to which any acceptable theory of the public right to the unearned increment should be carried. For it must be remembered that this subject is not to be dealt with as if it concerned only such properties as the Grosvenor or the Portman Estate. It would be easy enough to say (the owner and his heirs being willing) any future expansion of value of the Duke of Westminster's London property should be handed over to the County Council to be applied in any way this body might think fit. But how is the principle to be made universal, so as to avoid the creation of that dreadful iniquity "one law for the rich and another for the poor"? Again, supposing a by no means uncommon case of a proprietor of land in the country and in a large town, what is to be done if the former decreases in value while the latter increases—a very ordinary complication? Or, we may say, that since, by making a road diversion, a Local Authority improves the value of certain premises, the owners of the latter ought to pay something

for their advantage; but supposing that by the same means traffic is withdrawn from another thoroughfare, and with the traffic the custom of the frontagers falls off, are these to be compensated? These are a few of the most obvious difficulties of dealing with the unearned increment, even when the value of land only is in question.

When the principle is conceived of as extended to other classes of property besides land, the difficulties increase enormously. Take the case of gas property, in point. Has not the value of non-statutory as well as of guaranteed gas stock risen markedly of late? Who has the best right to this increase? To this question, we may reply in Irish fashion by asking another—namely, How has the increase been brought about? Not by the consumers; for their contribution per head to the profits of the concern may be less than it was when the stock had a lower market value. We may ascribe the effect to the lower value of gold, or how we please; practically it is an unearned increment, which now goes to the people in possession. Broadly speaking, we are driven at length to the conclusion that the new-fangled term “unearned increment” means little more than the old-fashioned phrase “turn of the market,” which has always been looked upon as an element in the dealer’s and investor’s risk. If it were, or if it could be, confiscated, would anybody be really and truly the better off? These be close questions, which we prefer throwing out to answering.

The Imperial Continental Gas Association.

THE report of the half-yearly meeting of the Imperial Continental Gas Association last Tuesday will be found in another column. Although we do not, as a rule, discuss the affairs of the many Gas Companies carrying on operations abroad whose head-quarters are in London, seeing that the circumstances of these undertakings usually deprive their policy of general interest, the Imperial Continental Gas Association is such a striking institution in various respects, that it is bound to attract a good deal of notice. It is of British origin, and most of its strength is derived from its firm rooting as an English enterprise; yet it is truly international in its localized developments. Its different stations, or installations, situated in the principal European countries, share the commercial circumstances of their districts; and it is a cardinal principle with the Board to assimilate, in every possible way, their localized affairs with their surroundings. Much of the credit for this practical cosmopolitanism is due to the Chairman of the Association (Sir Julian Goldsmid, M.P.), who conducts the far-reaching and multifarious concerns of the undertaking with consummate address. The Association appears to be Dutch in Holland, German in Germany, French in France; but all the leading wires go to London, where they are held very firmly and judiciously, if one may judge by results. It is the more interesting to glance at the fortunes of this great organization just now, in view of the uproar that is being made throughout the civilized world by those who would persuade the public that the gas industry is on the wane. We know that this is not so in the United Kingdom; but what do the accounts of the Imperial Continental Gas Association show? Surely, having most sensitive feelers out in all directions, this vast undertaking must be among the first to register the commencement of any serious alteration in the influences affecting the prosperity of the gas industry. Well, it will be found, on a perusal of the Directors’ report and the Chairman’s speech, that the Association has, as a matter of fact, felt a variety of modifications of its business environment during the past half year. The balance of profit shows a slight falling off, instead of the usual increase; but this is distinctly traceable to very ordinary causes. Like all other Gas Companies, the Association has been troubled with strikes and rumours of strikes. Coal has been dear; and the labour agitations alarmed some of the station managers, who accordingly laid in heavy stocks of coal—bought for the purpose, unfortunately, at high prices. Excess of prudence in some respects, and perhaps a little rashness in others, landed the Association in a good deal of extra expenditure, which the Chairman unaffectedly deplores. But what then? The undertaking is organically sound, prosperous, and growing. The output of gas shows an increase for the half year of 2·36 per cent.; and the number of burners supplied has augmented by 3·88 per cent. Thus it is not possible to discover, in the record of the doings of the Association all over Europe, any indication that gas is one whit less popular or

necessary than it has ever been. It is not to be expected that a gas-supplying organization, based upon the concession system, can always maintain the high profits which were obtainable under this system a generation or so ago. As the old concessions run out, the local authorities are very keen upon cutting away the margin for profit in the renewed contracts; and some of the best-paying districts are occasionally lost altogether, upon the termination of the Company’s lease. In the case of the Imperial Continental, the Board have evidently recognized that their days of protection are well-nigh over, and that henceforward they will have to work under something very like open competition everywhere. They have therefore taken the prudent step of appointing Mr. Corbet Woodall to the responsible post of Consulting and Inspecting Engineer for the undertaking as a whole; and there can be no doubt that the Association will benefit greatly by his advice and supervision. It is hardly necessary to remark that the Imperial Continental Directors could not have made a more satisfactory appointment; Mr. Woodall being the one available Consulting Gas Engineer now in active work who most conspicuously unites practical skill with wide administrative experience and a *savoir faire* and kindness which will ensure his discharge of the delicate personal responsibilities of his newly-created office, not merely without giving offence to anybody, but even so as to heighten the *esprit de corps* which honourably distinguishes the staff of the Association.

The Gasholder Patents Case.

THE gasholder patents case was again before Mr. Justice Kekewich during two days last week, when only one more witness—Mr. E. Lloyd Pease, of the firm of Messrs. Ashmore, Benson, Pease, and Co., Limited, the real defendants in the action—was examined; and, Counsel having been heard for the parties, judgment was reserved. The proceedings will be found fully reported in another column. Mr. Pease’s evidence did not throw much light upon the points at issue, as neither in his examination-in-chief nor in cross-examination was he taken through the merits of the competing inventions. The case has been fought throughout upon strictly legal points; and thus it remains under the consideration of the Judge. Evidence has been given, however, to show that both parties to the action have proceeded in perfect good faith. Mr. Pease is alleged to have infringed a patent of Messrs. Gadd and Mason; but there is no imputation that this was done with the object of imitation, colourable or otherwise, of a successful invention. It is purely a question of two parties having brought out what appears to be the same invention, independently of each other, and of the earlier patentee attempting to use his legal remedy against the later. Mr. Warmington, Q.C., addressed the Court for the defendants in a speech which was full of point, and conspicuous for its clearness. He divided his statement into three sections. The first referred to the alleged prior publication of an integral portion of Messrs. Gadd and Mason’s patented arrangements by Mr. Terrace; the second dealt with the alleged anticipations of Messrs. Gadd and Mason by Malam and others; while the third was devoted to the question of the existence of disconformity between the plaintiffs’ provisional and complete specifications. Next day the Attorney-General replied on the whole case for the plaintiffs; traversing Mr. Warmington’s arguments in order, and speaking with his wonted power and persuasiveness. He had to show that Mr. Terrace’s remarkable communicativeness did not in law result in the publication of his invention; to throw discredit upon the alleged “paper anticipations” of Standfield and others; to establish a fundamental difference between Malam’s devices and those of the plaintiffs; and to demolish the plea of disconformity between the plaintiffs’ specifications. How he did this, may be gathered from our report. Pending the delivery of judgment, we must content ourselves with recognizing the ability of the professional gentlemen engaged in the case, which has been a good lesson in the law of patents, if not upon the technicalities of gasholder construction and guiding.

Labour Sunday and Its Consequences.

ONE of the best of the many novels written by the late Lord Lytton has for its title the provoking question “What will he do with it?”—which is an inquiry that, once suggested, clings to the mind until it forms a habit of thought. How many things there are which men strive after with all the desire evoked by the apparently

unattainable, only to find in the event of success that they do not know what to make of their victory! Last Sunday week, for example, was May Day; and almost ever since that day twelvemonths, all the professional Labour agitators in London had been—we were on the point of saying working, but the term would obviously be inapplicable to individuals who so successfully cultivate the idleness, if they fail of the beauty, of the “lilies of the field”—scheming to make the occasion memorable by securing the biggest mass-meeting vote on record in support of the Legal Eight-Hour Day. It is not so many months ago that the expenses of the meeting of 1891 were liquidated; for the “masses,” although they willingly “enthuse” to order, do not so willingly pay for the luxury. However, what with the help of all sorts of popular organizations, this year’s May Day meeting in Hyde Park was made into a very big thing indeed, so far as numbers go. On this particular Sunday, London presented the truly wonderful spectacle of a capital given over to the largest organized mob ever collected for the purpose of effecting a political demonstration—a mob which far outnumbered the destroyers of the Bastille, or any other popular assemblage credited in history with having changed the face of a nation by brute force—and not a window was broken, nor a single assault committed in the name of the People. Without digressing by a hair’s-breadth from their duty, the police force present on the occasion attended the crowd rather than controlled it; not a soldier of the meagre garrison of London was confined to barracks; not a gun was moved in the defence of law and order. The whole of the supposititious army of the unemployed of London—that seething mass of outlaws which sensational journalists have described as awaiting an opportunity for breaking in upon the superficial civilization of the English capital, and exposing its hollowness and weakness—was invited to rendezvous on the Thames Embankment; and what was the result? Alas! the very success of the organizers of the great meeting proves how little justification there is for their perfervid demands for legislative interference with the conditions of adult labour. They got together a well-behaved and decidedly cheerful crowd of teetotallers, social democrats, trades unionists, and so forth; and after some frothy oratory, which was not too rigidly confined to the subject under consideration, they carried a resolution in favour of the Eight-Hour Day. Then the mob went home, having given most of the publicans on the lines of route a happy, if a busy, day—lasting, moreover, considerably longer than the magic octave.

But the organizers of the demonstration were left with the responsibility of their resolution; and the question speedily arose, What was to be done with it? They offered it to the leaders of the Houses of Lords and Commons, and to the head of Her Majesty’s Opposition; and, to their amazement and grief, these noble and honourable gentlemen agreed for the nonce in begging to be excused from having anything to do with it. They next hunted out the Metropolitan Members of Parliament, to whom individually and collectively they proffered the support of the constituents of the Hyde Park meeting in return for their adherence to the Hyde Park programme. But they got nothing by it; they only fell into the snare set for them by that artful “gentleman “of the long robe,” Sir Charles Russell, who suggested that they should put their demands in writing—well knowing that there is hopeless disagreement among the Labour agitators as to the necessity or desirability of limiting working time by legislation. And so the great meeting has failed to impress anybody. Of course, the demagogues are furious. They expected to be fawned upon by politicians of every shade, and to receive various gratifying acknowledgments of their asserted power to sway the mass of the working population of the Metropolis. And behold! everybody gives them the “cold shoulder” instead. Perhaps the disappointment will teach them a useful lesson. The truth of the matter is that the same remark which is made about the supposed demand for Woman Suffrage is equally applicable to the cry for the Legal Eight-Hour Day. If those who are so loudly declared to be in want of it were so in fact, and had one mind on the subject, they would get their desire forthwith. There is not the remotest likelihood of the triumph of the Eight-Hour Day agitators; while of the workers who have taken the trouble to express an opinion on the matter, a good half reject it with contumely.

WATER AND SANITARY AFFAIRS.

THE Royal Commission on the Water Supply of the Metropolis proceeds at a steady pace. Documentary evidence precedes the oral, and proves so extensive that the latter is unavoidably delayed. The Metropolitan Water Companies have sent in their statements, as also the Corporation and the London County Council. In addition, communications have been invited from all the County Councils, Town Councils, and Local Boards in the basins of the Thames and the Lea. These outlying authorities, so far as we can learn, take the course which might be expected of them, and are unanimous in declaring that their districts have no water to spare. We suppose if the Welsh authorities were asked they would say the same thing. All the several statements have to be examined by every member of the Commission—necessitating printed copies in every instance. The Metropolitan Water Companies duly met this requirement; but the County Council—perhaps out of regard to the ratepayer—sent their statement in manuscript. We apprehend that the Local Authorities generally have taken the same course. The Commissioners meet again to-day; but it is not expected that witnesses will be examined until Monday next—the following day being devoted to the same purpose, and possibly the Wednesday. It will be seen by our report of a speech by the Chairman of the West Middlesex Company, that it is thought the Commissioners rather want the Companies to show they could supply the coming wants for the next forty years. This is certainly, as Sir W. H. Wyatt remarked, “a stiff order.” But that such a requirement is entertained by the Commissioners is, we believe, little more than a conjecture on the part of the Companies, though the latter have seen fit to provide against the chance of such a condition being laid down. So far as relates to the physical facts, we may take it as perfectly certain that the population of London and its environs will not increase at the same rate during the next forty years as in the forty just past. We mentioned last week that the New River Company reckon on maintaining the supply for more than half a century, if the population merely advances at the same rate as during the last two years. If the higher rate of preceding years is maintained, the supply will be adequate for forty years; but the full reckoning, based on the lower rate of increase, goes as far as sixty years. It will be very important to have this clearly shown before the Commission; for if the supply is thus abundant in the valley of the Lea, there ought to be no difficulty in respect to the Thames. The New River Company rely much on their wells. The Thames Companies, we understand, are prepared to carry out a system of compensation reservoirs, so as either to swell the volume of the river when the stream is running low, or to feed the supply when it is undesirable to draw from the river. The idea that the ground will not permit such reservoirs to be constructed appears a very odd one, seeing how many reservoirs already exist in the neighbourhood of London. We apprehend that a far more difficult problem is that of conveying water from Mid-Wales to the Metropolis, with all the risks of a severe winter as affecting an open conduit, and dynamiters in relation to a pipe. But distant sources of supply will form no part of the investigation which is now commencing. The resources of the Thames and Lea Valleys form the actual subject of inquiry; and there are some indications that the position of the New River and East London Companies will be taken in hand first, before the Commissioners proceed to deal with the case of the Thames Valley.

The speech made by the Chairman at the half-yearly meeting of the West Middlesex Water Company last Tuesday, although brief, touched on several points of interest. We have already alluded to some extent on the part which dealt with the inquiry just being opened by the Royal Commission. Concerning this matter, we may further remark that the Chairman was doubtless justified in saying that the Directors of the Metropolitan Water Companies had “an anxious time” before them; while he was equally warranted in arguing that the Royal Commission was preferable to a Committee in the House of Commons. We may add that the consumers in the West Middlesex district have great reason to prefer the Water Company to the County Council. Should the latter obtain possession of the water supply, there would be an immediate end to the 7½ per cent. rebate now enjoyed by the Company’s customers. A consideration of this kind

should also have weight with those who pay for water in other parts of London. If the Companies are left alone, it is probable that one after another will, in course of time, be able to give a discount on their rates; whereas whenever the supply becomes municipalized the result to be expected is not that of a liberal discount, but a charge on the ratepayer as well as the consumer. But the gift of £17,000 per annum from the West Middlesex Company to the consumers in their district, is a matter concerning which the Daily Press has little or nothing to say, reserving its energies for a diatribe when one of the Companies takes the necessary steps for enforcing payment from some contumacious consumer. Whether the Press will be any better satisfied with the County Council, should the latter take the place of the Companies, is at least doubtful. That a change is to come, is an event which Sir W. H. Wyatt contemplates; but he cannot believe that the proprietors of the existing undertakings will be deprived of that which is their due. That an effort will be made to perpetrate such damage may be anticipated; and the prospect has doubtless produced the recent "panic" in the Share Market to which the Chairman made reference. But the attempt is destined to fail, unless the British Parliament is to be overshadowed by the County Council.

Mr. H. G. Wilson, of the Southwark and Vauxhall Water Works Company, was elected an associate member of the Institution Civil Engineers at the monthly ballot last Tuesday.

A New Electrical Term.—A new feature will be introduced in the Provisional Orders granted to electric lighting undertakers by the Board of Trade in the present session. According to the *Electrician*, the Board have approved of the word "kelvin" as the definition of an electrical unit; and, Lord Kelvin (better known to many people as Sir William Thomson) having acquiesced, the words "hereinafter called a kelvin" will be inserted after the word "unit" throughout the Orders.

Association of Municipal and County Engineers.—The members of this Association, of which Mr. T. Cole, Assoc. M. Inst. C. E., Secretary of the Incorporated Institution of Gas Engineers, is Secretary, had a very successful meeting at Nottingham on the 29th and 30th ult., under the presidency of Mr. T. de Courcy Meade, of Hornsey. Mr. Arthur Brown, M. Inst. C. E., Borough Engineer of Nottingham, read a paper on "Municipal Works in Nottingham;" and Mr. W. Spinks, Assoc. M. Inst. C. E., one on the "Public Health Acts Amendment." The members visited the subways in course of construction in the town; and also the Corporation sewage farm. After the first day's business, they dined together.

A Plea for the Methven Standard of Light.—A correspondent whose position precludes his communication from appearing in our "Correspondence" columns, writes to plead for the retention of the Methven standard of light—not to the prejudice of any other, but in recognition in the future, under proper regulation, and standardizing if necessary, of its worth as a convenient and ready measure of the illuminating power of coal gas. He points out that it has long been an accepted fact that a 3-inch flame in a "London" Argand burner gives a light of 16 candles, and that this was made the basis of the construction of Mr. Sugg's illuminating power meter some twenty years ago. The difficulty of exactly estimating the height of the flame appeared to be the principal objection to the use of that instrument; and the introduction of the Methven standard removed the difficulty, by allowing only the light from the central portion of the flame to pass through a screen provided with a slot of fixed dimensions—the light being, it was asserted, a constant one, equivalent to two candles. Our correspondent remarks, however, that what is being dealt with in the Methven standard is a beam or pencil of light, which cannot, by its very nature, follow the law of inverse squares as in the case of light radiating from a centre. So that it is not surprising to find that the Methven screen, when used in the ordinary way, can only be relied upon within certain limits of illuminating power. But this difficulty may, he says, be largely overcome by fixing the disc at a definite distance from the screen (preferably at the point corresponding to 16 candles in a 60-inch photometer), and noting the consumption of gas required to maintain a 16-candle flame at the other end of the bar, and making the necessary correction. This will make the standard much more constant, as there will be a fixed illumination of the disc at that particular distance, of the same colour as the light to be examined—an important point; and the gas to be tested will be consumed at all times under more regular conditions than by adjusting to 5 cubic feet per hour. Used in this way, and free from all carburetting complications, the Methven standard will, he considers, bear comparison with any of its rivals, on the score of constancy, readiness to hand, rapidity of working, cheapness, and convenience to the operator. The absolute value of the standard, used in the manner suggested, might, our correspondent thinks, be a matter for the Standards of Light Committee to determine.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 865.)

THE condition of affairs in the Stock Exchange in the past week was fairly satisfactory, for signs of recovery, howbeit slow and gradual, are beginning to manifest themselves. The favourable tendency was apparent on Tuesday, when the Exchange opened after its usual holiday on the first working day in May, and found that the May Day demonstrations had not disturbed the peace of Europe. Then the abundance of money practically compelled buying; and although this was at first, and has for some time past been, confined to first-class securities, yet the supply would not hold out for ever. The result was that second-class stocks had to be taken; and by the continuation of the process, and applying it to the issues less sought after, the normal condition of business will gradually be restored. As for the Money Market, it is scarcely an exaggeration to say that there is no market for money, so difficult is it to find employment for it. The Gas Market has been active, owing to the dealing in Gaslight "A;" but with the exception of this stock, transactions generally have been limited. The set against Gaslight "A" was continued on the opening day; and it looked very much as if it was going to touch the level 200. But 202 was the lowest reached; and it oscillated between that figure and 205—the quotation closing with a fall of 1 only. It recovered the lost point, however, the next day, and continued to amend slowly; regaining two more points, and business being done more than once at 207. Meanwhile the demand for secured investment stocks had put up the 10 per cent. preference; and the debenture issues changed hands at good prices, but without any advance in the quotations. A great deal more business was done in South Metropolitans; the "A" being in good demand, and rising 5. But "B" was depressed by a special bargain at 220; and the quotation was lowered 3. Nothing at all was done in Commercials; but the new stock was put down 2½, in sympathy, perhaps, with the recent retrogression in the old. Suburbans and Provincials have scarcely been touched; and the only move is a rise of 1 in Alliance and Dublin. Continentals are quiet and steady; Imperial sticking fast at 225-226. Among the rest, the only features to note are an advance of 1 in Buenos Ayres debenture, and a fall of 2 in Chicago second mortgage bonds. Business has been very quiet in the Water Companies; but the recovery in prices proceeds, and most of them have risen moderately.

The daily operations were: Sharp business in Gaslight "A" marked the opening on Tuesday, and the quotation fell 1; but South Metropolitan "A" rose 5. Lambeth and West Middlesex Water rose 1 each. On Wednesday, Gaslight "A" recovered 1, after some brisk dealing. Chicago second bonds fell 2. On Thursday, prices throughout the list were well maintained; but nothing varied. Friday brought the decisive turning-point in Gaslights. The "A" rose 2; "C," "D," and "E," 2; and "J," 1. Alliance and Dublin also improved 1; but Commercial new fell 1. In Water, Chelsea and Kent advanced 2 each; and Lambeth and West Middlesex, 1 each. Prices were for the most part good on Saturday; and Buenos Ayres debenture rose 1. But South Metropolitan "B" receded 3. In Water, Southwark "D" rose 3; and Lambeth 7½ per cents, 1.

ELECTRIC LIGHTING MEMORANDA.

The Effect of Strange Company upon Gas and Water Fittings—The Affairs of the Metropolitan Electric Supply Company—The Trouble at Taunton—Mr. Shoolbred on the Bradford Experiment.

WE have received from the Secretary and General Manager of The Gaslight and Coke Company copies of correspondence between the Board of Trade and the Company, and of two reports—by Major Cardew, R.E., and Mr. G. F. L. Foulger respectively—relating to the destruction of gas-meters in Pall Mall and Piccadilly, by electricity supplied by the St. James's and Pall Mall Electric Light Company. The substance of these communications will be found elsewhere; and our abstract should be carefully noted by anyone who may still be inclined to credit all that electricians say about the harmlessness of lighting currents, even of the low voltage variety. It appears from Major Cardew's statement that electric lighting currents are capable of playing strange tricks, not merely with gas-pipes but also with water-fittings. It is unnecessary to go through Major Cardew's remarks in detail, which show that the laying of electric lighting mains does, as a matter of fact, introduce an element of danger of a novel and, what is worse, a mysterious kind into districts where gas and water mains and services exist. It is no defence to this impeachment to say that, where the electrical work is perfectly done, the danger disappears. We have to live in a world in which perfection is not to be found either in regard to electrical or any other class of work; and therefore Major Cardew is fully justified in remarking of the Piccadilly "accidents" that "the steps to be taken by the Board of Trade

to provide against the recurrence of similar faults and their consequences will require very mature consideration."

We referred last week to the affairs of the Metropolitan Electric Supply Company, and commented upon the circumstance that in this concern, as in so many other central station electric lighting undertakings, the capital expenditure appears to run a race with the revenue. We have since received copies of the report and accounts issued by the Directors up to date. This year's statement shows that the Company have the equivalent of 96,000 lamps of 8-candle power connected for service. The most interesting information relating to the position of the Company is, however, to be extracted from the accounts; for, like many Directors' reports, that issued for the comfort of the Metropolitan shareholders is more instructive by its omissions than by its disclosures. The accounts are made up in the statutory form, according to which the revenue is distinguished from the capital entries; but it is within the discretion of the Board how the line is to be drawn. It has been reported that the revenue account of the Company for the past year shows a profit balance of £9719; but when the account is examined, it appears that this result is secured by the simple expedient of only charging to revenue a "proportion" of the running expenses. Thus the important items of salaries, rents, rates, and taxes, Directors' fees, and "other expenses"—this last being an exceedingly elastic term—are divided arbitrarily between revenue and capital; the proportion ascribed to the latter for the year being no less than £33,894, which, if duly put against revenue, would have changed the nominal profit of £9719 into the very substantial deficit of £24,175. Last year, also, a so-called interim dividend amounting to £4708 was paid, which must have come out of capital, just as this year's dividends will do. No wonder the Company have spent all their money and now want to raise more on debentures, in order to finish work in hand. It is all very well to argue, as the Directors probably do, that, while a big undertaking like this is in course of development, some of the administrative expenses should be borne out of capital; but the process had better be confessed in their report than left to be discovered by dissection of the accounts. The resort to this expedient, in the desperate attempt to show a profit balance, is too significant to be overlooked.

Taunton, as our readers are already aware, is in trouble about its electric lighting. The local company are in trouble, and the Directors have the full agreement of the proprietors in declining to continue throwing good money after bad; and so they will very soon stop the works if the one alternative fails of selling the whole thing to the Corporation as a going concern. The Corporation are literally at their wit's end to know how to act. A Committee of the Town Council and the Borough Surveyor have reported against the purchase; but the Mayor and some of the local magnates seem to be most anxious to help the Company—out of the rates, of course; and so they procured a remit of the question of purchase to a professional expert to be recommended by the Board of Trade. The choice fell upon Mr. Gisbert Kapp, of whose competence there can be no question. Mr. Kapp has now reported most fully and fairly, but dead against the proposed purchase. What was to be done? The expert having refused to play the part of blessing the purchase scheme, some of the local people pretend to have discovered in him the existence of a bias against the system submitted to his inspection; and they have succeeded in getting the Town Council to postpone for awhile taking action upon his report. It does not seem to have occurred to these ingenious partisans that it does not need much "bias" on the part of an expert to advise against the expenditure of public money in purchasing a loss. If there are people in the Taunton Town Council so enamoured of the local electric lighting experiment that they decline to hear anything against it, why do they not form a new company to take over the concern and work it for all it is worth? There will be no difficulty in obtaining an expert to approve such a resolution; but, happily, Mr. Kapp has rendered it impossible for the higher powers to sanction the raising of any money upon the security of the Taunton rates for any such purpose.

Mr. J. N. Shoolbred, the Consulting Engineer for the Bradford electric lighting scheme (which, it should be remembered, was decided upon in 1888), read a paper last Wednesday before the Society of Arts, describing the installation, and expatiating upon its results. He maintains that the low-pressure, continuous current system recommended by him, and adopted for this experiment, has proved itself to be the best that could have been tried for the purpose, inasmuch as it lends itself to more applications suited to the needs of a manufacturing and commercial centre than any alternative system. In view of the clamorous appeals for recognition of "improved" systems that are now being raised by rival electricians, Mr. Shoolbred has a fair right to defend himself in this way. He makes out that the Bradford experiment has been completely successful; and so perhaps it has been, from the point of view of the consulting electrician. When Mr. Shoolbred himself, however, so far quits the mere technician's standpoint as to ascribe much of the success of the enterprise to the business qualities of Alderman Priestman, the Chairman of the Gas and Electricity Committee, and Mr. W. T. McGowen, the Town Clerk, we are inclined, without cavilling at this award, to suggest that the principal reason why

the Bradford electrical experiment has done even so well as it has, must be looked for in the fact that it has been supported on the broad back of the Corporation gas undertaking. There is not the slightest reason to doubt that electric lighting in England would flourish exceedingly if it could always be similarly circumstanced.

GAS CONSUMED IN WORKS AND OFFICES.

A good deal is written and said from time to time upon the subject of the responsibility of suppliers of gas for assisting their customers to make the best use of it for the different purposes for which it is consumed. It is undeniable that a very great advance in the recognition of such a responsibility has been made in recent times. The old opinion that the gas company or the gas department of a corporation, as the case might be, have nothing to do with the manner in which the consumer uses the gas supplied to his premises—that the technical interest of the manufacturers and distributors of gas ends with the meter—has been very greatly modified, if it has not been wholly discarded, by the more progressive order of modern gas-works administrators. It is true that the most hide-bound of gas managers, in the days when it was held to be the best policy for a gas company to keep itself as much as possible out of sight of the public, was continually being compelled to recognize the fact that his responsibility extended in popular estimation beyond the meter, and even further than the burner, by having his attention repeatedly called to complaints of bad gas, dirty ceilings, poor light, and so forth. It is a fair generalization on the attitude of the old-fashioned gas company to say that, as a rule, they never interested themselves with what the consumer did with his gas until he began to complain; and even then, if the inspector sent to investigate the cause of complaint could report that it did not arise "on the company's side" of the meter, the thing was forthwith dismissed.

However heartily many of us may admire the "good old times," few that have any liberal views about gas-works administration will deny that it was a notable improvement when gas managers began to emerge from their snells, and to demonstrate to their customers and fellow-citizens that they felt an interest in the proper application of gas which did not need to be stirred up by complaints. The local exhibitions of gas apparatus, the displays of first-class fittings at the gas offices, the emergence of the gas company among the best business firms of the town instead of lurking down by the canal or the railway goods' yard, the appearance of the gas manager upon the lecture platform—these and other signs of awakening enterprise on the part of gas manufacturers are worthy of being classified among the evidences that go to prove that the modern time is better than the old. Where is the old-fashioned gas agitator? Where the once ubiquitous gas-burner peddler? If not extinct, they lurk in the darkest and most neglected holes and corners of the most benighted towns. It has taken the modern race of gas-works administrators some time, and cost them no little effort, to dispel the bad old superstition that gas companies foster the worst and most wasteful descriptions of consumers' apparatus, from the notion that the more gas that is burnt, anyhow, the better it will be for the sellers. There are cities and towns of the United Kingdom where it is now commonly understood that the gas company prefer ten willing and satisfied customers to one grudging and constrained consumer. Of course, it may be remarked that this changed aspect of the gas companies is not due to simple virtue on their part; but that self-interest has a good deal to do with it, and that even a gas company can be complaisant when it is discovered that the commercial and private classes of gas consumers in any locality are not so restricted to this one means of lighting as was formerly the case. There is something in this argument, and we do not claim for the modern gas-works administrator who does his best to be agreeable and helpful to the community, credit for anything more than obedience to the promptings of an enlightened self-interest. He looks for his *quid pro quo*, of course; and he gets it. But the fact remains that, in helping himself, the enterprising gas-works administrator does a great deal of good to his fellow citizens individually; and this ought to be acknowledged, even if there is no need to give the shrewd man of business the thanks due to a more disinterested benefactor of the public. We may also, moreover, comfort ourselves with one reflection bearing upon this point—that the man who does something for his fellows, for sound commercial reasons of his own, is less liable to make mistakes than the professed philanthropist, whose benefactions are always in danger of doing more harm than good. If in showing a tradesman how to render his shop front brilliant by the proper use of a good gas-burner, the gas engineer arouses the emulation of neighbouring traders, whereof he reaps the benefit in the long run, this does not detract from the merit of the service done to the individual shopkeeper.

A great deal more might be accomplished in this way than most gas companies yet think necessary; and not less so for the positive reason that shopkeepers and people in business are, to all intents and purposes, and notwithstanding anything that can be advanced to the contrary on behalf of electricity and cheap mineral oil, as much compelled to burn gas as ever. With the cheapest electric light working out to something between 6s. 6d.

and 8s. per 1000 cubic feet for 16-candle gas, it must be a very long time before the average shopkeeper can afford to make much use of the incandescent electric lamp; and even when he does, for the sake of advertisement, his next door neighbour can always beat him in brilliancy of illumination by simply increasing the number or power of his gas-burners, and yet keep his lighting bill low in comparison. And no tradesman who respects himself and desires to pose as a solvent individual can afford to light his place of business with oil, unless he deals in it or in lamps; and then the general effect is seldom good. So that the business man must have gas; and we desire to impress upon all whom it may concern, the eminent desirability, in the interest of the gas industry, that he should be encouraged in every possible and legitimate way to lose sight of the compulsion to burn gas, in the advantages of the practice compared with any available alternative.

With this view, we argue that it is the plain duty of the gas manager to so keep himself abreast of the progress of the trade in all kinds of gas-consuming appliances, as to be able to express an independent, reliable opinion respecting their merits and demerits. It is not for the gas manager to force developments of this or that type of application, albeit he has a perfect right to draw attention to neglected points. Like many another man in a conspicuous office, the gas manager can effect most good by judiciously following as well as leading public opinion. No useful service is ever done by finding fault with the public taste, unless a better way is at the same time disclosed and followed. The public may be the victims of artful advertisement, and may betray a tendency to patronize the "cheap and nasty" instead of the good and reliable. It requires judicious treatment to wean people from this weakness; but most can be done by example.

This chain of thought leads up to a very clear and definite issue. Gas companies have indeed done very much of late years to familiarize the public with good appliances for the use of ordinary consumers; but can it be said that, in the majority of gas-works, the owners of factories of a similar character will find instruction in the art of effective and economical lighting? We fear not. In the half-yearly accounts of the London gas companies, and of some other undertakings, there appears regularly a considerable entry for "Gas consumed on the works"—this amounting to about 1 per cent. of the gross production. So habituated are technical critics to this entry, that few probably stop, in their scrutiny of more salient matters, to ask themselves whether this is a necessary and reasonable condition of gas manufacture. It means that gas-works are among their own largest consumers; and we are certain of not being contradicted when we say that this is a state of things which rarely strikes the gas manager with due force. In many works, the number of flaring lights needed to enable the workmen to see their way about and do their ordinary duty, is enormously disproportionate to the real needs of the case. Day and night these lights flame away—most of them miserable examples of how not to burn gas—and nobody stops to remark that the annual cost of thus lighting up dingy, dark, and noisome sheds and shanties would go a long way to pay interest on the capital cost of new, light, and airy structures. In all old gas-works, and in many new ones, too much gas is wasted. The old saying about the blacksmith's horse and the shoemaker's wife naturally occurs to mind with reference to this state of affairs; but there is no excuse, although there may be much truth in a proverb.

This is a matter that gas managers generally should see to, for their own credit's sake. And it is a question not only of waste of gas in the works, but also in main-laying. Nine companies' workmen out of ten do not seem to entertain the smallest idea that gas, which is "raised out of the same," is something to be treated with respect. Partly on this account—the neglect of good gas-lamps in gas-works—it has now come about that well-designed and economical factory lights are so rarely seen. We do not forget or overlook the fact that particular patterns of high-power street gas-lanterns are to an extent adopted for factories; but it must be obvious there are many situations in works of all kinds, and especially in gas-works, where a street lamp would be unsuitable. Are these cases sufficiently looked after? The answer must, we fear, be in the negative.

Now, unless gas managers make a proper use of gas themselves, and treat it intelligently for their own purposes, they can hardly expect that the heads of other factories will do so. Waste, as a matter of fact, does go on in many a factory, mill, and yard; until one fine day the amount of the bill strikes the consumer as exorbitant, and he forthwith looks up other methods of lighting his premises, and makes his comparisons of cost not with gas at his best, but between gas at its worst and something else at an ideal efficiency. Wherefore we counsel gas managers generally to pay attention, where this has not already been done, to this illusive entry for "gas consumed on the works," which there is only too good reason to suspect of often covering a perfectly scandalous neglect of the first principles of effective gas consumption in the very places where, of all others, these should be most systematically practised and exemplified. The matter is worth looking into, not only for the sake of the immediate economy to be realized in many instances; but even more for the sake of the consistent example which a well-lit gas factory shows to proprietors of coal-yards, iron-works, and similar establishments.

NOTES.

American Shell Lime.

The industry of shell-lime burning forms the subject of an illustrated description in a recent number of the *Scientific American*, although there is nothing particularly scientific about the processes involved. The manufacture, however, is a peculiarly American one, inasmuch as it has been created as a consequence of the enormous consumption of oysters and clams in the City of New York, which again is due to the remarkable richness in shell fish of the waters in this neighbourhood. The collection and dealing with the empty shells gives employment to many hundreds of people; and the lime produced by burning them commands a ready sale, especially to the gas companies, who find it the best and purest they can obtain for use in purification. The shell-kilns do not differ from any other lime-kilns of the simple continuous kind, and are fired with coke; the idea of regenerative gas-kilns not having penetrated to the neighbourhood of New York. The quick shell lime sells for 8s. per bushel on the spot; and the daily output of the seven firms in the trade in New York and Brooklyn is from 12,000 to 14,000 bushels—the greater part of the raw material coming direct from the fish markets.

The Efflorescence on Brickwork.

Mr. H. C. Standage writes to the *Builder* upon the subject of the efflorescence on brickwork, which so often disfigures newly-built walls with white, semi-crystalline powdery patches, and which is so troublesome to architects and builders. He accounts for the formation of the patches as follows: Suppose the soft, porous brick to have imbibed water from a passing shower of rain, whereby some of the sodium salts are dissolved. As the surface of the brick dries, this salt of soda will become dry and be converted into the anhydrous sodic oxide, which is the white efflorescence complained of. So long as any soluble salts of soda remain in the mortar, to be dissolved out by the water imbibed by the porous brick, so long the formation of the efflorescence continues, until every particle of the soluble salt has been dissolved out and brought to the surface. The nearest approach to a successful remedy discovered by Mr. S. Standage in the various proposals for dealing with the mischief that have come under his notice is hydrochloric acid. If the bricks could be saturated with this acid, the trouble would not arise; but such a remedy is obviously impracticable. Acting on the hint conveyed by the fact that excess of sodic hydrate in soap-making is expelled from the soap by salting it—i.e., strewing the surface of the soap with common salt as it floats on the ley—Mr. Standage applied a solution of salt to the white efflorescence on some bricks that were badly stained with it. In every instance where the solution was applied, the white efflorescence was instantly removed, and what is more, has never reappeared. In obstinate cases, three applications—or well saturating the bricks even once—have sufficed to effect the desired result. Seeing, therefore, that the remedy seems to be a choice between hydrochloric acid and common salt, Mr. Standage recommends the latter. The bricks may either be dipped in the solution before being laid, or the wall well washed afterwards, until the bricks are thoroughly impregnated. It is not stated whether or not Mr. Standage has considered the effect of salt in keeping a wall damp during humid weather.

Compounds of Acetylene and Metals.

A somewhat remarkable chemical compound, the preparation of which seems to throw some light upon the vexed problem of the origin of petroleum, has been described in the *Comptes Rendus* by M. Maquenne. It may be regarded as an acetylide of barium—that is, a compound formed by the substitution of the hydrogen of acetylene by metallic barium. Its chief peculiarity is that of evolving pure acetylene gas with great rapidity when brought into contact with water. M. Maquenne has obtained the new substance by the direct action of metallic barium, in the form of an amalgam consisting of one part of barium to four parts of mercury upon powdered retort carbon. On distilling such a mixture in a current of hydrogen, when the mercury had been expelled and the mass brought to redness, an energetic reaction was found to occur between the barium and the carbon, with production of the new carbide or acetylide. The hydrogen takes no part in the reaction, and may even be replaced by nitrogen. The new substance, as formed in an atmosphere of hydrogen, consists of a grey, friable mass, which remains unaltered when heated to bright redness. The moment it is thrown into water, however, it is decomposed, with rapid effervescence and the evolution of acetylene, which is remarkably pure. This is a new method of synthesizing acetylene, which M. Maquenne considers interesting with regard to the formation of the natural hydrocarbons. He thinks it probable that other metals possess the same property of forming acetylides under the influence of high temperatures. If, therefore, as M. Berthelot has attempted to show, it is a fact that acetylene forms the primary material, or starting-point, for the formation of other hydrocarbons, it is quite possible that compounds of some metals with carbon, upon coming into contact with water under conditions of more or less pressure, may have given rise to the immense stores of natural hydrocarbons which exist in different parts of the world.

TECHNICAL RECORD.

NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.

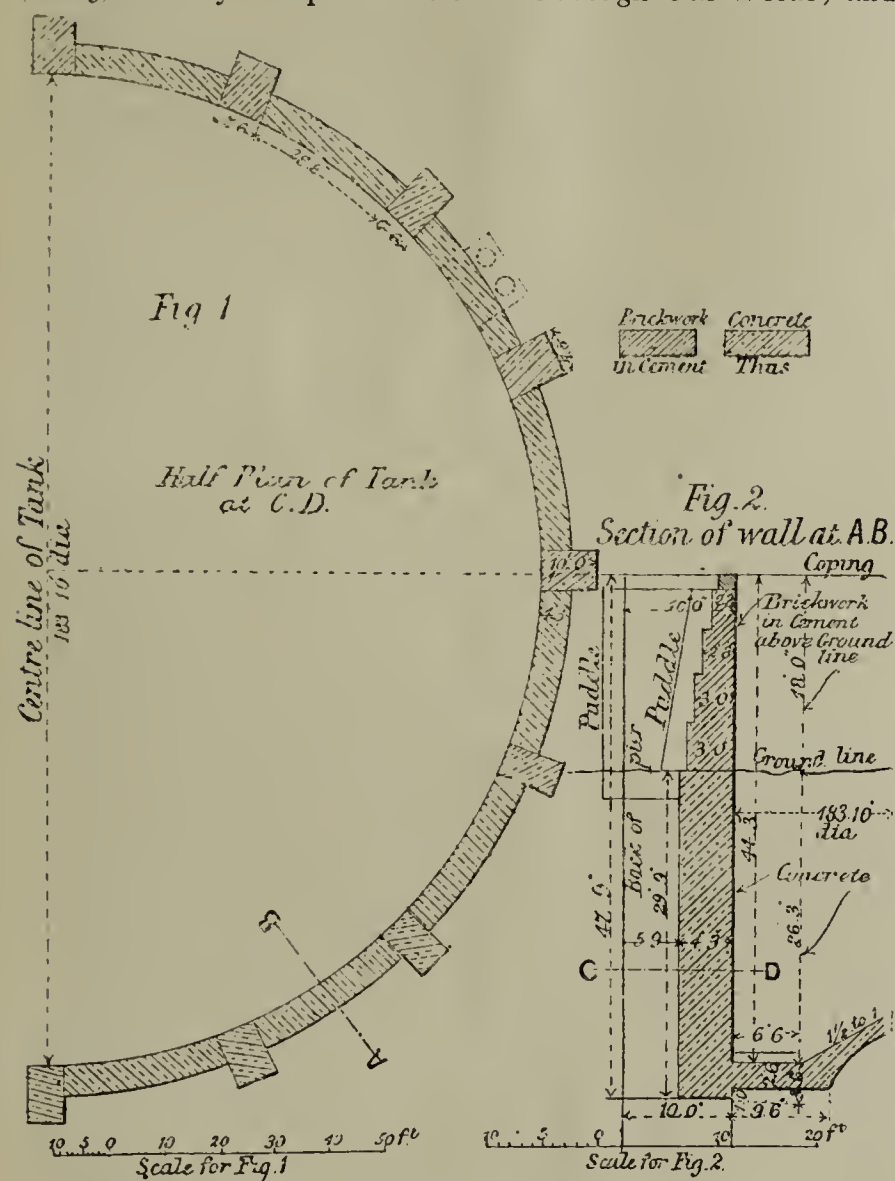
The Half-Yearly Meeting in Newcastle-on-Tyne.

In the JOURNAL last week we published a general account of the proceedings at the meeting of the above Association on the 30th ult., and also the paper read by Mr. W. J. Warner, on the subject of the action of the sliding scale (*ante*, p. 799). We now complete our report by giving the two papers read by Mr. V. Wyatt, briefly summarized last week, and the discussion on the three.

Mr. WYATT's first paper was as follows:—

NOTES ON TANK CONSTRUCTION.

I read a paper to this Association in April, 1889, on "A New Departure in Tank Building." I proposed, in forming the wall of a tank, to dispense with the all-round continuous timbered trench, and substitute for it a sectional construction for the portion of wall below the original ground level. The tank is a horizontal arch, composed of monolithic blocks, or *voussoirs*, side by side resisting the pressure of earth behind the wall. This principle has been carried out in the last gasholder-tank (No. 5) recently completed at the Redheugh Gas-Works; and



it may be of sufficient interest to some to repay a visit of inspection. The diameter of the tank is 184 feet, and its depth 44 ft. 3 in. clear, inside the walls, to receive a gasholder of three million cubic feet, in three lifts. The wall from the foundation up to a height of 29 ft. 9 in. (the original ground level) is of concrete, and constructed of 32 blocks, or sections built *in situ*. There are 16 sections, each 29 ft. 9 in. by 10 ft. by 7 ft. 6 in., for the piers under the wrought-iron standards; and 16 panels between, each 29 ft. 9 in. by 28 ft. 8 in. by 4 ft. 3 in. In one of the panels is introduced the pier of concrete, 29 ft. 9 in. by 10 ft. 6 in. by 10 ft., for enclosing inlet and outlet pipes. The monoliths radiate from the centre of the tank, and close in upon each other to form the horizontal arch, which is immovable, except by absolutely crushing the material.

The sections are built alternately in the first place, so as to allow about a week's rest for consolidating the concrete before commencing the adjoining ones. They are not bonded together beyond the ordinary hoop-iron strips which I use in tank walls. A section or block can be completed in four or five days, when the timber is at liberty for another portion. There is no fear of inequality of settlement, as the ground at these depths is incompressible by an ordinary tank wall; and Portland cement work will not, under any form of construction, admit of movement after a few days' completion.

The method described has the following merits: (1) It removes all risk and expense due to a large, exposed, continuous earth-work trench, full of timber, and kept open sometimes for months. (2) The tank can be pushed forward and operated, at same time, on the four quarters of the circle. (3) The earth

pressing behind the wall is maintained in its natural cohesive condition; being exposed only for a very short time. A less thickness of wall is therefore required for the same tank. (4) Backing of newly-made earth, which is usually scamped, is dispensed with.

The cost of this tank was 1'6d. per cubic foot of internal tank capacity—being the area of the top water multiplied by the clear depth of the side wall, above the floor of the tank; and this for a tank with 20 per cent. extra strength of side wall to resist the swelling tendency of the tough clay behind, when exposed to atmospheric conditions.

Mr. WYATT's second paper was entitled—

ANOMALIES IN GAS UNDERTAKINGS.

About 2500 years ago, the almond-eyed, yellow Chinaman, Confucius, was asked by one of his followers for a word as a rule of conduct, when he replied, "Reciprocity." This word, in its most comprehensive meaning, of the so-called "barbarian," covers the moral codes of most communities and nations. Gas companies need to practice more largely this virtue of reciprocity, and study the interests of their customers, the consumers of gas, to the utmost; giving them the best value in good gas for the rates charged. Emerson wrote years ago: "When I asked an ironmaster about the slag and cinder in the railway iron, 'Oh,' he said, 'there's always good iron to be had; if there's cinder in the iron, 'tis because there's cinder in the price.'" This is reciprocity with a vengeance, and has a commercial taint about it. In the remarks which I shall make upon this subject, I shall endeavour, as much as possible, to speak from the consumers' point of view, or standpoint; so that we who are on the gas or tested side of the screen may view the light by which we are regarded by our customers and the public.

Gas undertakings have their rights, parliamentary and otherwise; but they have also their duties. The manufactured article—coal gas—which they retail to the public, should be worth the price charged for it, and that price should be the most reasonable possible, consistent with net cost and fair dividend, where the monopoly in the supply of the article is, as in this instance, protected by an Act of Parliament. There should be a mutual interchange or reciprocity of interests between producer and consumer, to induce that feeling of perfect peace and satisfaction between the contracting parties, which alone can insure the perpetuity of a monopoly in this very free country. The gas undertaking, of course, must pay its reasonable dividend to the shareholders, who find the backbone of money to carry on the concern. But still the consumer and customer should be respectfully and even tenderly treated, and supplied with the best article for his money, as he cannot as a rule go to any other source for light than the gas company. All monopolies should be merciful when they are fully fledged with powers; and they should be able to do their business cheaper and better than the merchant or private trader can. Otherwise the pervading and almost universal-suffrage instincts of the gas constituency will combine, sooner or later, and assert itself in its impatience, by some new departure. Take the example of the railway companies at the present time, where we find that about 6 or 7 per cent. is the highest limit of dividend paid; and where, in many instances, Parliament has contradicted itself again and again after pressure from without, and granted triple competition to the leading towns on the main routes of traffic.

The Government and constituencies of the country have a mortal antipathy to perpetual monopolies. This is most noticeable in the output of men's mind work, in the shape of literature copyright and patents, where the exclusive profits on a man's creations are limited to a few years, and then handed over to the community for common use and benefit. Perhaps this is wise and just; or some people and their posterity would grow too rich and aggressive. Again, it is not quite wise to incense the gas consumers too much, as in some recent cases where gas companies, with ample revenues for paying dividends of 7 to 8 per cent., and with a falling market in coal prices approaching 20 per cent., have suddenly raised their charges for gas 12½ per cent. to keep up high dividends. The power of charging under the sliding scale is delightfully simple! The vestries and consumers become exasperated beyond measure, or, as one of the district boards said, "the gas company is sticking it into us rather warm."

It may be asked, "Is it prudent to stir up these wasps' nests without the most urgent necessity?" The railway companies dare not charge up to their maximum rates, and they have no sliding scales. Were they suddenly to lift their fares 12½ per cent., you can fancy what a rumpus there would be from one end of the country to the other, especially among third-class radical riders. At one time the railway companies got into the habit of paying a 12 per cent. dividend, or something like it, when there ensued a railway mania, and the Committees of the House of Commons let slip the dogs of competition, by granting double and triple lines to the same points, and brought down the high bearing of these corporations. We must sooner or later convince the gas consumer that the gas-providing company can and will supply him with one of the necessities of life—artificial light—at a more economical charge than can be done by the ordinary trader; and this in exchange for a monopoly of the supply from Parliament.

The sliding-scale system of working, under which many of

* See JOURNAL, Vol. LIII., p. 803.

the gas companies assess their charges for the supply of gas, will have to be, as has been expressed of the House of Lords, "either mended or ended." In its present form it is very confusing to the consumer—"a sort of red herring drawn across his path, to take him off the true scent," as alleged. Different companies under the sliding scale have different standards, whence to deduce the rise or fall of dividend and price. The standard usually is not a reasonable one, and is not based upon the current prices of coal, gas residuals, or wages; it is purely conventional, and fixed at the mere caprice of a Parliamentary Committee, assisted by sharp-witted barristers who have "axes of their own to grind." The standard rate should be based upon economical grounds, as, for instance, where, as in the best-managed undertakings, 16-candle gas is sold at the rate of 2d. per 1000 cubic feet for every 1s. per ton of coal delivered in the retort-house (as was the case in London a year or two ago, and even is so at the present time here at Newcastle, Leeds, and elsewhere). This is a fair and economical rate as a standard for a gas company, especially so when the net cost of the gas, including distribution, amounts to about 1½d. for every 1s. per ton paid for coal. This would make the London standard about 2s. 6d. instead of 3s. 9d. Take an instance away from home, that of Brussels, where the coal formerly cost 16s. 9d. per ton, and the charge to the consumer was 2s. 8½d. per 1000 cubic feet. Now coal has gone up there; and the price per 1000 cubic feet is 3s. 1¼d. In London at the present time, with coal costing in the retort-house about 15s. per ton, the charge for gas over two-thirds of the Metropolis has gone up to 3s. 1d. per 1000 cubic feet—all owing to the sliding scale, with, as you all know, the grandest demand for gas per mile of main on any ground or district in the world. The corporation undertakings stick well to their rates, and do not jump up and down like a Jack-in-the-box in their charges, and irritate their customers by constant changes—because they have no sliding scales. Still, their rates are too high; and they follow the very questionable principle of causing the gas factory to lay the golden eggs for an annual subsidy to the town rates; thus making the gas consumer pay virtually higher rates than his non-consuming neighbour, to provide town improvements and statues to defunct local celebrities. The corporation undertakings will, however, in the near future, by means of their sinking funds, have the pull on company schemes in being able to wipe out their old overcharged capital accounts; and, whenever they chose to sell gas at cost price, throwing dividends to the winds. Then will come the tug of war, and a *regime* under which the company undertakings, capitalized up to the hilt, will have their work cut out for them.

The capital accounts of the company undertakings should be consolidated, reduced, and rearranged in order to make them comprehensible to all who have money to invest, and to insure a juster distribution of the profits among the proprietors. All priorities and preferences of dividends should be dispensed with in sound concerns, and only be visible in the balance-sheets of semi-bankrupt schemes, where the original shareholder goes to the wall. The capital could be readily consolidated into a 5 per cent. stock, as is now being done by some of the companies under Act of Parliament; and then it could be gradually reduced in amount, half year by half year, by a sinking fund of 1 or 2 per cent. annually. This should be continued over such a reasonable period as would reduce the capital to an amount corresponding to the true structural value of the works and plant, excluding all bogus or watered stock which had been created from time to time. The *nominal* capital of the undertaking should be its *real* capital—that is to say, such an amount should be written in the company's books as would at any time reinstate the works and plant. Thus, we know that for gas-works of a manufacturing capacity of one million cubic feet per diem the capital cost need not exceed £5 for each ton of coal carbonized a year; and for works of a greater capacity than this, the cost need not be more than £4 per ton of coal carbonized. This computation will give sufficient capital to provide an efficient establishment and plant to supply gas to a district. Upon these figures alone should interest be paid; and at this point must all sound gas undertakings arrive sooner or later. Some of the corporation works have, by means of their sinking fund and other arrangements, brought down the capital to as low, in one case, as £1 10s., and in another to £2 per ton of coal carbonized a year. It is not, however, desirable to reduce the capital below the structural value of the works and plant, as consumers of gas in a town should pay for its true cost, including interest upon capital. The different classes of stocks which are found enumerated in the balance-sheets of some gas companies, such as "ordinary," "preference," "debenture," and so forth, should be gradually sponged out. Take the instance of one company, where there are eleven kinds of stocks (besides the premiated capital) on the Stock Exchange list, to bewilder the investor, and even to confound the artful stock jobber; and it takes something to do this. Verily there are many reforms necessary for the simplification and adjustment of gas stocks.

The amalgamation of the gas companies into grouped concerns, in well-defined districts of the country, would be a rare success; and it would conduce to good management and economy of working. Instead of a number of small gas-works dotted about the land, there might be agathering together of several establishments into one proprietary and management—

following in this way the practice of other joint-stock undertakings. Establishment expenses would be saved; and a uniformity and improvement in the general working of the business would result. Thus, take for an instance the economy and independence which could be insured in the business of disposing of the residuals from gas-works. A combination of several small works could have its own chemical, tar, and sulphate factory, placed in some central position, to which could be transported in the company's own rolling stock, at low freights, the whole of the tar and liquor produced at the several works, and there manufactured into saleable compounds, such as benzole, naphtha, carbolic acid, creosote, anthracene, pitch, black varnish, sulphate of ammonia, and so forth. This would get rid at once of the middleman, who runs away with the lion's share of the profits, and rigs the market. In these combined establishments could be concentrated the best plant, chemical ability, and the soundest trading knowledge to be found in the country, as the ready money would be there to pay for these requisites. The raw material comes in regularly to be manufactured and disposed of, free from the outside riotous competition of the market. Gas companies operating with this combined strength might, and should, dare to go to Parliament and ask for an Act to enable them to purchase and work a coal mine for their own exclusive business; and they would thus operate a flank movement on "coal rings" and other manœuvres in that sublimely black art, the coal trade. A railway company is now permitted to roll steel rails, manufacture locomotives, rolling stock, and plant, and carry out other works for its exclusive use; and why should not a gas company win its own coal for its own operations? By the amalgamation of smaller concerns into a large combination, the companies would present a bold front, and even the House of Commons could be faced.

A gas undertaking should not only manufacture coal gas and fructify its residuals, but should also perform the whole work of distribution of the gas up to the point of consumption—the burner; including service and house pipes, meters, and ordinary burners, at an inclusive price per 1000 cubic feet, giving reliable information to the consumers as to the best method of consuming the gas with proper burners, ventilation, &c., to prevent the discolouration of ceilings and walls of decorated rooms, which latter nuisance has done more than anything else to introduce electric lighting into first-class residences. The finishing touch of gas distribution should not be handed over to that objectionable unit, the plumber, either "registered," "licensed," or "unlicensed," whose hand creeps into your pocket before you can say "Jack Robinson." There are many houses in which there are two sets of service pipes and fittings; the first lot being so unskilfully laid and fixed that they could not be patched further, and so a second set of services had to be laid on new and better lines. Given a first-class set of floors in a house, perfectly joisted and sound; and a plumber or gas-fitter is the best man you can find to weaken the same. In my own case, the plumber refused to put in a set of revised house-service pipes according to my directions, as he said it was not "tradesmanlike;" and so I employed one of my foremen carpenters on the job, who turned out a rational and economical result in place of the first attempt of the plumber, which was botched and costly. That man has to be much pitied who grants *carte blanche* to a plumber in carrying out a job. I observe that some of the gas-fitters now advertises, under the auspices of the gas companies, to provide and fix house services, plain gas-fittings, ordinary gas burners and meters on the "hire system" for an inclusive price of 2d. per week for the smaller houses, at rents up to about £30 a year, or at an extra charge for gas of about 6d. per 1000 cubic feet. The gas companies are only just beginning to come in touch with their customers, and practice ordinary business tact in their transactions. They will have in the future to undertake all the detail work of introducing gas into a house, including the inspection and upholding the fittings from time to time, and reasonable wear and tear, for an inclusive gas-rate; and then they will do a roaring trade in artificial light.

The present method of assessment of gas-works for "rateable value" is most objectionable. The experts and counsel employed on appeal-rating cases have mystified the course of procedure in the Courts most mightily—and all for costs. They have trotted out the "hypothetical landlord" and the "hypothetical tenant"—who are mere creatures of the imagination, bogies conjured up to frighten companies and owners of gas properties, and to increase the rates. These hypothetical "bogie men" are not even alluded to in the Parochial Assessment Acts. Persons, imaginary or otherwise, are not alluded to therein; there is only the word "hereditaments," which means that only absolute fixed property, "lands and tenements," are to be valued. Nothing is said about tenant's profits or business incomes derived from the use of the "hereditaments," and created solely by business skill. The structural works only can be dealt with for rating purposes; the business profits of a company or owner are not involved in settling the rateable value of a property; for these are brought into account under the Income-Tax Acts and specially taxed. If we have to recognize the "hypothetical landlord and tenant," we shall some day get into a great fix on a rating appeal, where the *real* tenant may be marched into the witness-box, backed up by a syndicate offering to take over the concern

and pay a fixed yearly rent for the same; and upon this, it may be argued that the *rateable value* should be apportioned. In such a case this proposed *real tenant* might offer (and call it a rent) even a greater sum than the then net business profits of the company, as, possibly he, as a keen manager and business agent, might economize on many items of expenditure, overlooked by companies' salaried officials. The only safe and just mode of procedure to deduce the "rateable value" of gas-works is to take the structural or present cost value of the works as a basis, pure and simple; and perhaps no better course can be adopted for this purpose than to estimate such value from the total tons of coal carbonized each year at the establishment, and multiply this figure by £4 for the larger, and by £5 for the smaller works, being the true cost of gas-works. To arrive at the "gross rental value," take the annual interest paid by the gas company for this sum; and by deducting one-sixth, we deduce the "rateable value" of the property and works, appraisable under the Parochial Assessment Acts. Here we have a foundation from which to evolve the rent, or annual interest payment, as a rent, for this expenditure of capital.

Let us assume, for example, that each ton of coal carbonized per year requires, in the language of the Act, for fixed "hereditaments" and structural works to utilize the same, an outlay of £5 as capital. If this money be raised by the gas company at 4 per cent., then the clear rent or interest to be paid for this outlay would be 4s., which is the "gross yearly value." From this has to be deducted one-sixth, in ordinary cases under the Act, for taxes, rates, and insurance (although manufactories in the Valuation Act are allowed one-third, as a deduction, and why not gas factories?), to arrive at the "rateable value," which would be 3s. 4d.; and on this latter amount the assessment of so much in the pound would be made. Supposing the rates to be levied at 5s. in the pound, then the amount payable for rates to the parish per ton of coal carbonized per year would be $40 \div 4 = 10$ d. per ton. Also, if the works were of the larger type, then the rate would not be more than 8d. per ton of coal carbonized per year. There is one large corporation gas-works which pays 10d. per ton of coal carbonized per year for rates; and one gas company which pays 8d. per ton of coal. I will not mention names lest these may be surcharged like other properties, and swooped down upon by the assessment vultures and brought to account. These are wonderful exceptions to the rule, and must be spoken of with bated breath. Some gas undertakings are mulcted in double these amounts for rates, and pay 1½d. to 2d. per 1000 cubic feet of gas sold.

In one rating appeal, recently decided, as to the Drainage Outfall Works at Woolwich, in 1891, a reasonable decision was arrived at, where the structural value of the buildings, and first cost of the land, were alone taken into consideration, and the "gross rental value" for assessment was taken at 3 per cent. on the prime cost of the land, and 4 per cent. on the structural cost of buildings and works; and from each of these amounts one-sixth was deducted as statutable deductions to arrive at the "rateable value," upon which the actual rate, say, of 5s. in the pound, was chargeable. An Act of Parliament was proposed in 1887 for Scotland, whereby the "gross value" was mentioned at 3 per cent. on the structural value of water-works, less one-sixth for deductions, repairs, &c., to arrive at the "rateable value" for assessment. In many appeal cases the results have been astounding; as, in one instance, where an amount for assessment was put down at £45,000, and was reduced on appeal to £12,000. Discrepancies quite as wild in their claims are continually cropping up. The present mode of trying assessment appeals is ruinous and awful in its results. One recent case occupied over twenty days in the hearing; and it absorbed the united talents of twenty-nine barristers, a legion of experts (who were too numerous to count) swearing unheard-of inventions, the one against the other, and at a cost of upwards of £30,000. Truly we shall soon be devoured by professional locusts, and have not a wing to fly with. One expert was asked why he valued differently in certain named cases. He replied: "If I were valuing for a landlord, I should go one way; and if for a tenant, I should go another." Chastened individual! And yet this expert was on his oath, and he is "an honourable man." As Mr. Commissioner Kerr said in a case at the City of London Court, a few weeks since: "You can get any opinion you like to pay for." So much for the battledore and shuttlecock play with the "hypothetical landlord and tenant," in Courts of Law called justice.

The standards of light used and proposed for testing the illuminating power of coal gas are in an unsettled condition. The sperm candle, as a standard, is very primitive, unsatisfactory, and pleases no one. Each and all complain of it; and yet all English gas companies and Acts of Parliament bow down before it and adopt it. The everlasting sperm dip of the brimstone-match period holds on as the standard of light, and defies the scientist to kick it aside. One authority says: "Photometrists have very little knowledge as to causes of variability of the candle. It is a mere rule of thumb. In the published papers, a difference of from 1 to 4 candles is very conspicuous between the tests made on a constant quantity of gas. Candle experiments have been made in the past at random. The wicks were anyhow." Another authority says: "An examiner can report gas 1½ candles higher than another by employing candles in two different ways; there is a difference between using fresh candles and those used several times." And

so on, and so on, *ad infinitum*, to the discredit of the ancient candle, and to the folly of the generations who have been bored and misinformed by it so long. Experts might say, on the part of the consumer, why not then abolish forthwith the candle and the tallow chandler, as a standard test light, and give us the full value in sperm, say for a 16-candle standard, $16 \times 120 = 1920$ grains of sperm, consumed in a lamp per hour, under the best conditions.

The standard sperm burner, some think, should have devoted to it as much skill in its manufacture, and be as good in design as well as use, as the London Referees' standard burner, which goes on the opposite side of the photometer screen. Both burners would then be equal, at their full power, and complete lights, and be placed in juxtaposition with each other; and therefore the atmospheric, barometric, temperature, and other environments, would be identical for both burners, and dispense with corrections. There would be a burner at each end of the photometer, equi-distant from the disc fixed in the centre. The London Referees' standard burner for gas with 24 holes, a 6-inch chimney, 1½ inches diameter, for 16-candle gas, consuming its full quantity of 5 cubic feet of gas per hour, brings out the maximum light (short of a regenerative burner); and when brought into use some years ago it raised the value of the gas about 1½ candles—say, 10 per cent. Then why not, it might be said, give the same chance to the full development of a 16-candle sperm standard burner? Supposing the Referees' standard burner was split up into sixteen jets of light, as is the case with its humble rival, the sperm candle in the photometer, what sort of a show would it make? If you compare lights the one with the other, in rivalry, let them both be the best of their kind, with their respective light qualities fully evolved.

The late Mr. Keates proposed a 10-candle sperm-oil standard burner, with a moderator lamp; but it seemed to war against certain interests, and was avoided. The French use a Carcel lamp of 9½ candles, with colza oil specially tested for the purpose. The 16-candle sperm compact burner would be more comprehensible to the consumer as a standard, and at the same time consume the legal weight of sperm, but *minus* the tallow chandler and his wicks, than the new proposals of a petroleum vapour lamp with a Greek name (how people do like Greek names for their creations, instead of Anglo-Saxon ones); or the slotting off portion of the same gaslight, which is to be tested an eighth, and calling it a standard burner, which latter must, of necessity, partake of the qualities of the gas tested, being identical in nature—whether it be good, bad, or indifferent. Like should produce like, say or think as we will, and qualify, as we may, by words such as "average," "approximation," and so forth. We can multiply the standards of light as we please, by setting up other standards of equivalent light value. Thus we can have a 16-candle standard on the French Carcel system, burning colza oil, which is said to consume 1092 grains of colza per hour for this amount of light. Or we can have the best lamp for consuming refined mineral oil for the same light power. A rape-oil lamp of 16 candles is supposed to consume 2500 grains per hour. In all and every case the standards would be identical as to light, and the number of grains of lighting material consumed in each instance would be regulated to insure the desired result. I apprehend we could soon devise a just standard of light for photometric purposes, if only the demon of "vested interest" could be snuffed out and prevented from intervening in scientific matters, by taking away the common sense of rival parties. Men may come and men may go; but clique goes on for ever.

Let us have "reciprocity" of interests between the gas producer and the consumer; let the monopolies live and flourish if you will, but let us have reasonable, legal, nay, moral checks, not only to insure the best article for the money paid, but also to induce peace, goodwill, mutual benefits, and ample light, nay, more light—mental as well as physical.

Discussion.

Mr. J. HEPWORTH (Carlisle) remarked that, as he came along that morning, the thought occurred to his mind that it would be a very great advantage if the members could have prints of the papers before they heard them read; and he was the more of this opinion after hearing such valuable contributions to their proceedings as those to which they had listened. He had always looked upon Mr. Wyatt as a model engineer in gas matters. But after that day he thought he should regard him as a model statesman; for certainly his paper was full of statesmanlike wisdom concerning the anomalies of gas undertakings. If they could bear in mind his leading idea—reciprocity—they would possibly escape some of those anomalies. Mr. Wyatt had, at any rate, pointed out very well how they ought to make the attempt. He (Mr. Hepworth) listened with great interest to Mr. Wyatt's references to the sliding scale. Of course, that did not affect him very closely, because he happened to be connected with a Corporation gas undertaking; but he was much struck by the suggestion made by Mr. Wyatt, where he put forward 2d. per 1000 cubic feet for every 1s. per ton of coal as an equitable basis for fixing the price of gas. The contrast he put before them, of Newcastle and London, would, he (Mr. Hepworth) thought, do something to emphasize his view. It was, of course, a difficult problem to work out; and they would no doubt find it many-sided when they came to apply it to their several undertakings. But it was a statement that was

worthy of all the consideration they could give it. He ventured to say that round this point they should turn their thoughts many a time after that day; and if some of them happily (or unhappily, it might be), deviated very much from a standard of this kind, they would very likely ask themselves the reason why. Everyone, he thought, would agree with Mr. Wyatt as to the desirability of putting the capital accounts of their undertakings in a clearer light. It did look somewhat absurd to see, as they did in the case of one Company, no less than 10 or 12 different kinds of stock. Simplicity ought certainly to be possible in these days, after so much experience in the conduct of gas undertakings, and so much legislation upon gas accounts. He should be very glad if it were in the power of the Association, or of any of their members, to do something to further this object. Mr. Wyatt made a suggestion with reference to the rate of dividend upon capital, which struck him as being not only somewhat new, but certainly most valuable. It was obvious that corporations who had largely reduced their capital would be able to run a very good race with private companies who had done nothing in that way. Mr. Wyatt's suggestion that shareholders in gas companies should be content with a return of 5 per cent. on their capital, was one which he (Mr. Hepworth) thought those who represented companies might very well consider. In conjunction with this there should be a setting aside of a reserve, which would, in course of time, be the means of extinguishing the burdensome capital which was on many undertakings. For instance, if their capital to-day stood at £100,000, and the works might very fairly be taken as of a structural value of only £80,000, and if 2 per cent. per annum, or whatever might be agreed upon, were applied to the reduction of capital until they made their capital and the value of their works equal, this would be a sensible course to follow. With reference to amalgamation, he thought he knew several districts in which amalgamation would be exceedingly valuable. He had heard it mentioned in that room as being the dream of some of the engineers who sat round the table; but there could be no doubt that, where amalgamations were possible, they might, as was done in many other industries, reduce the standing expenses. They could, by the treatment, in a wholesale way, of residuals and other matters, do a good deal to increase the prosperity of several undertakings. But, of course, even amalgamation was a question which had two sides. It was exceedingly doubtful, for instance, whether any advantage had accrued, by amalgamation, to a Company of which he was thinking—a Company which had to deal with nearly 20,000 tons of sulphate a year. He very much doubted whether this Company had benefited by amalgamating the whole of its undertaking. At all events, the Company, by the sale of their liquor, a few years ago produced a much larger return for residuals than they could now. It seemed as if the middleman had not been moved quite out of the road in that particular case; and unless they adopted the very best means of disposing of their residuals, when dealing with them in a large way, they might not gain by amalgamation. These remarks, however, need not be taken as an argument against amalgamation, but as one for better management. He was highly pleased to hear what Mr. Wyatt said about rating. A much simpler basis than the existing one should be arrived at; and in his paper he had given them one, based, not only on reason, but on the illustration of the London sewage works. He (Mr. Hepworth) was not quite sure how it would work out in each individual case; but if they could adopt a basis such as that which had been suggested by Mr. Wyatt, it seemed to him that it would be a good basis. With respect to the standard of light, he was sorry he had had no experience with the Carcel lamp; and therefore he did not know if the consumption of sperm oil in the way suggested by Mr. Wyatt would show any advantage over that lamp. But it seemed to him that it would be an exceedingly sensible thing to dispense with the wick which they had used for so many years, and consume the oil in the way suggested. He hoped someone who had not too much respect for the vested interests would proceed, as speedily as possible, to the manufacture of an oil-lamp by which this matter might be tested, and as there was now a Standards Committee, as he might call it, he should very much like that this question of the consumption of sperm should be fully considered by them in the way referred to by Mr. Wyatt. With respect to the excellent paper by Mr. Warner, he could not help noting that there was a strong desire on the part of those who were interested in gas matters to secure a fair adjustment of opposing interests. This was the origin of the sliding scale. He did not know that anyone there would contest one of the points raised by Mr. Warner. For his own part, he thought Mr. Warner had been exceedingly fair throughout the whole of his paper. Speaking generally, it certainly did appear to him that the sliding scale ought to be one of the happiest ways of adjusting opposing interests; and yet it came to be objected to when, under it, a dividend of 12 or 14 per cent. was paid—a situation which reminded him of the man who said "there ought to be a voluntary rate, and everybody should be compelled to pay it." People could not see why they should pay never too low a price for gas, when dividends were going at the rate of 12 or 14 per cent. It was very likely that the sliding scale would some day be brought up for reconsideration. He had had his faith in it shaken very greatly by its application to residuals. He was more and more distressed when he thought of the

losses sustained by those (he was not one of them) who had sold their residuals upon the sliding scale; for he was perfectly certain that when the price of sulphate, for instance, came to a very low figure, there was no inducement whatever for a manufacturer to do anything to get out of the low prices. All his interest was in keeping to the sliding scale—keeping the price of sulphate low—because the profits were shared all the same; in fact, he (Mr. Hepworth) was not sure the manufacturer's profits were not larger than when the price was high.

Mr. L. H. ARMOUR (Gateshead), referring to the sliding scale, said it was very agreeable to the consumer when the price of gas came down; but he was irritated when it was obliged to go up. There were two things the public needed. The one was the lowering of the price; and the other, in his humble judgment, the raising of the standard of the gas. There was no provision in any Act of Parliament, as far as he was aware, whereby the dividend was made to depend in any way upon the standard of the gas. And yet, how often did one hear of the standard in a discussion upon the quality of gas in different places? Many would rather have a better gas supplied than get the trifling concession in price. He spoke not merely of private opinion, but of that of corporate bodies. It seemed to him that this would meet one of the points set forth among the many that were worthy of consideration in the excellent paper by Mr. Warner. If the dividend to the proprietor did not depend altogether upon the price, but upon the standard of the gas supplied, there might be a certain amount of grumbling if the quality was reduced; yet the lowering of the quality to accommodate the dividend would certainly make it less irksome to the public.

Mr. M. RICHLEY (Shotley Bridge) said the gentlemen who had spoken were gas engineers; but he might be allowed to say a few words from a non-professional standpoint. How did the anomalies arise of which they had heard? One engineer told them that the cost of construction of a gas-works was £250 per million cubic feet capacity; another gentleman had stated, before the Association, that it was £350; whereas Mr. Newbigging, in his "Handbook," said it was from £500 to £600. They need not be surprised that anomalies should find their way into gas-works, when they met them at the commencement. He quite agreed with Mr. Wyatt as to the mode of assessing gas-works. But when they put experts into the witness-box they might advocate that the assessment should be made upon the structural value; or, if the company had a high capital and low profits, they might advocate that the assessment should be upon the profits. In each of these cases, they could bring legal opinion of the very highest authority to support their view. As Mr. Wyatt had said, the capital cost was brought in in the case of sewage works. This, however, had nothing to do with it, because in all that county the mode of assessing iron and other large works was only by the structural cost.

Mr. H. LEES (Hexham) thought the most important point in Mr. Wyatt's paper was that of the control of the gas to the point of ignition, upon which he laid special stress. If this were adopted, it would, to some extent, meet the objections Mr. Armour had raised as to complaints about the quality of the gas. The probability was that, in many cases where complaints did arise, the defects were to be traced entirely to defects in the consumers' fittings. If they had full control over these, all defects could be remedied. Mr. Wyatt was somewhat strong in his denunciation of plumbers. His own experience was that this was the case in every town. Gas managers had frequently great difficulty in getting regenerative lamps introduced. The plumber would not look at them. If the gas manager recommended a regenerative lamp, the plumber suggested something cheaper, but which, to the consumer, might be much more expensive. If the manager made a suggestion, the consumer seemed to be somewhat doubtful as to his sincerity. He (Mr. Lees) was certain that, if they took over the full control of the gas, they would benefit to a very large extent.

Mr. WYATT said he was very much obliged to his friend Mr. Hepworth for the very able way in which he alluded to his paper. It was his intention in the paper merely to throw out suggestions of which they might make something. What they wanted were exact figures—something fixed. Let those anomalies go to the winds, and let them have something which would help them to get rid of subterfuges.

Mr. WARNER, on rising to close the discussion, showed a piece of flexible metallic tubing, with which, he said, he had been very much pleased. It had been tested to a very high pressure, and would be suitable for water as well as gas. With regard to the reductions of capital, he thought the best answer to this was the premiums they obtained; and where they had the sliding scale they effected that. He did not think the sulphate incident was a reply to the advantages of amalgamation. He had written a few notes—strange to say, only on the previous night—upon this very point of the advantages of amalgamation, with special reference to the Newcatlse district; and he supported Mr. Wyatt in what he had said upon the subject.

VOTES OF THANKS.

Mr. T. BOWER (West Hartlepool) proposed a vote of thanks to Mr. Wyatt and Mr. Warner for the very able papers they had submitted. The members would agree with him that they were all very much indebted to the writers of these papers, not only for the services of that day, but for the very valuable aid they

had rendered to the Association in the past. He was thinking, as he sat there listening to the papers, that the example set by these two pioneers was very worthy of emulation by some of the younger members of the Association. If they only had those gentlemen coming forward with papers as freely as they had Mr. Wyatt and Mr. Warner, he was quite sure that, in the future, the Association would maintain the high standard it had reached.

Mr. W. FORD (Stockton) seconded the motion. He said he thought the pleasant sarcasm which ran through Mr. Wyatt's paper ought to be the means of stimulating the younger members to the reading of papers. The older hands were not only getting more advanced in years, but were less inclined to exercise what was supposed to be their maturer judgment. These were the days of higher education; and the more ancient had a good deal to learn from the younger members. He felt very deeply the President's reference to the loss the Association had sustained by the removal of their dear friend Mr. Cox's son. If he had been spared, he would have shown such an example as would have conduced not only to the advantage of the Association, but have induced others to follow in his footsteps.

The motion was carried.

Mr. WYATT, in acknowledging it, said that reviewing one's experience, in a paper such as he had given them, made him feel a younger man. He agreed with what Mr. Bower had said as to the junior members giving their experience. Every man possessed a certain amount of originality, and only required to bring it out. Let them all speak—each in his own way; or the younger members might give papers which would assist them in their theories.

Mr. WARNER also returned thanks.

The remainder of the proceedings have been already reported.

Proposed Official Inspection of Tar-Works.—By the Bill which has been introduced this session to amend the Alkali, &c., Works Regulation Act, 1881, tar-works—that is to say, “works where gas tar is distilled or is treated in any manufacturing process”—will be included in the scheduled works coming within the operation of the Act. If the Bill passes, it will come into force on April 1, 1893.

Death of Mr. F. C. Hills.—We regret to announce the death on Tuesday last, at his residence, Redleaf, Penshurst, of Mr. Frank Clark Hills, whose name will be remembered by most of our readers in connection with his process for the purification of gas in closed vessels, by employing the ammonia contained in the gas as the agent in arresting other impurities. It may be recollected that shortly after the meeting of The Gas Institute last year we had occasion to mention that Mr. Hills was in a very bad state of health; and this condition unhappily continued until his death, which took place at the advanced age of 84.

The Measurement of High Temperatures.—At the first *conversazione* of the Royal Society for the present season, which took place at Burlington House last Wednesday, Professor Roberts-Austen added a further example to those he has already given of the great service the measurement of high temperatures can render in revealing the molecular structure of metals and alloys. He exhibited the optical pyrometer of Professor H. le Chatelier, of Paris, who has done so much within the last few years for pyrometry. By an elaborate arrangement, Professor Roberts-Austen demonstrated the method of eliciting the concurrent testimony of a thermojunction and of the optical pyrometer as to the temperature of a glowing mass of platinum heated to whiteness. The temperature of an incandescent electric lamp, as indicated by the latter instrument, proved to be 1850° C., or less than a fourth the latest estimations of the temperature of the sun.

Death of Professor Hofmann.—We regret to record the sudden death last Thursday night, as the result of an attack of pulmonary apoplexy, of Professor August Wilhelm von Hofmann, the celebrated chemist, and the discoverer of the aniline dyes. While still a young man, he devoted himself, under the direction of Liebig, at the University of Giessen, to the study of the bases of coal tar and the metamorphoses of indigo; but it was not until several years later that his important discovery was made regarding the composition and chemical character of analine red—a discovery the importance of which to the industry of the world, in connection with the manufacture of coal-tar dyes, cannot be over-estimated. After spending three years at Bonn, Professor Hofmann was, in 1848, on Liebig's recommendation, appointed Superintendent at the Royal College of Chemistry in London. The institution made rapid progress under his direction; and in 1853 it was merged in the Royal School of Mines as the Chemical Section. In 1855, Professor Hofmann was appointed by the British Government a Warden of the Royal Mint. In 1864 he was selected to fill the Chair of Chemistry at Bonn, whence he was summoned to Berlin in the following year; and he occupied the Professorial Chair of Chemistry there until his death. He made numerous contributions to the *Annalen der Chemie*, to the Transactions of the Chemical Society, and to the Philosophical Transactions of the Royal Society, of which latter institution he was elected a member in 1851, in recognition of his services to science. In 1854 he was awarded a Royal Medal for his “Memoirs on the Molecular Constitution of the Organic Bases.” Professor Hofmann was in his 75th year.

THE CONSTRUCTION OF LARGE GASHOLDERS.

Should External Guide-Framing be Abolished?

The Salford Corporation Gas Committee lately had under consideration the construction of a four-lift holder, 150 feet diameter by 120 feet deep; and the question occurred as to the advisability of dispensing with external guide-framing. This matter was fully discussed between the Mayor, Mr. Phillips (the Deputy-Chairman of the Gas Committee), Mr. S. Y. Shoubridge, and Mr. George Livesey; and the last-named gentleman was asked to submit a written statement of his opinions on the subject. It was as follows:—

Experiments with a view to the improvement of almost all parts of gas apparatus—although probably nineteen out of twenty will be failures—are necessary for the advancement of the industry. The failures being merely a money loss, can be estimated and provided for; but, in the case of large gasholders, experiments which may fail and wreck the holder, and cause irretrievable damage and loss of life, are out of the question. Before adopting radical alterations in large gasholders, there must, above all things, be a perfect assurance of their safety. A guarantee by the maker or the inventor of the new system, is not sufficient, because no mere money pledge, or an undertaking to restore the holder in the event of failure, can either provide against, or compensate for, a disaster such as might easily result from the destruction or overturning of a large gasholder.

The question, therefore, is not only whether large gasholders without external guide-framing are safe, but also whether those who are responsible for ordering their erection are thoroughly assured of their safety. There must be no doubt about it, just as the designers of the Forth Bridge assured themselves—and, to be perfectly safe, they put excessive strength into the structure—that under no conceivable conditions, except an earthquake, could the bridge fail, as the unfortunate Tay Bridge failed, and cost over a hundred lives, a few years previously.

I willingly give both to Mr. Gadd and Mr. Pease every credit for the great ingenuity of their respective inventions; and to small holders of not more than two lifts, which do not rise to any extent above the surrounding buildings, I have little doubt that either invention may be safely applied. But when we come to the large holders which are now becoming so common, and which tower to great heights into the air above all other erections, and are thus exposed to the full force of the wind, the circumstances are entirely changed. I have myself, at the top of a gasholder 90 feet high at the Old Kent Road, London, in a gale in 1881, seen a gust of wind balance more than 5 inches of water in a “King's” pressure-gauge—equal to a pressure of 28 lbs. on the square foot—though this was probably not over a large area. To be safe, however, it is necessary in this country to provide for a possible wind-pressure of not less than 40 lbs. on the square foot, which on the large area exposed by a gasholder is a maximum not at all likely to be exceeded. But this is not all. It is quite possible to have snow and wind combined; and as the snow will be deposited in the greatest thickness on the leeward side of the crown of the holder, the wind and the snow will both tend to overturn the gasholder in the same direction. Hence the necessity for the strongly-braced guide-framing which is always applied to large and lofty gasholders.

If to resist the overturning forces of the wind and snow, separately or combined, guide-framing such as is commonly seen is necessary—and I firmly believe it is—it follows that, if the guide-framing be abolished, the forces acting on the gasholder which it (the guide-framing) has hitherto transmitted to the ground, must be transmitted through the gasholder itself, which being of circular form, and constructed of thin sheet iron, is not suitable for that purpose. With external guide-framing, there are practically no cross strains or stresses on the sheeting of the holder; it has merely to carry its own weight. But take away the guide-framing, and the whole of the work hitherto done by it must be done by the side sheets, which will then be subjected to continually varying strains, and will in all probability cause them to become leaky at the joints, and to wear out sooner than is now the case.

To illustrate this, take an openwork wicker waste-paper basket; place it upside down on the table; and hold it down by what will then be the lower edge. Then bring horizontal pressure on the upper edge; and the distorting effect will at once be seen, which corresponds closely to the effect of wind pressure on the side of a gasholder guided or kept in position by attachments on its lower edge or bottom curb.

The tendency to distortion in gasholders without external guide-framing, is dealt with very thoroughly in Mr. Cripps's standard work, on “The Guide-Framing of Gasholders,” published by Mr. W. King, of the JOURNAL OF GAS LIGHTING, which is well worthy of study by all who contemplate innovations in their construction.

Gasholders of large dimensions are in use, and others are being built with shortened guide-framing—that is one lift in a three-lift holder is allowed to pass above, and to rise quite clear of, the guide-framing, thus causing the side sheeting of the top lift to be exposed to the diagonal stresses above referred to. But these stresses are very slight; so slight in fact that

they may be ignored when that part of the gasholder which is unsupported by guide-framing does not exceed one deep or two very shallow lifts, or (say) a total height equal to one-fifth of the diameter, which would be exactly equivalent to one lift of your holder. If you were to allow the two lifts to go unsupported, the stresses would be greatly increased, in the proportion of one on the first to four on the second lift, to nine on the third, and to sixteen on the fourth; and these proportions apply not only to the sheeting but also to the rollers or attachments that would be used on the bottom edge of gasholders without external guide-framing. This rapid increase is due to the fact that two lifts unsupported expose double the surface to the wind, while the leverage is also doubled. Three lifts expose three times the surface, and the leverage is trebled; and so on. Therefore while one lift unsupported is undoubtedly safe, doubt at once comes in when an extension of the principle is contemplated; and, in my opinion, it would be wrong to run any risk until the doubt is completely and satisfactorily removed.

There is considerable uncertainty, not only as to the amount of force exerted by the wind, but also as to the effect of such force on a gasholder. A considerable reduction must be made for its cylindrical shape. I believe the French engineers take it in its resistance to wind pressure as equal to 57 per cent. of a plane surface. Therefore in the case of your gasholder, 150 feet in diameter, the equivalent would be 85 feet, which multiplied by the height, 120 feet, gives 10,200 square feet of surface exposed to the wind. For convenience, let us say 10,000 feet; and taking the wind pressure at only 28 lbs. to the foot, we find that there is a force equal to 125 tons tending to overturn the holder. But to be safe, taking into consideration the possibility of greater wind pressure, and also the danger of snow on the crown, it will be necessary to considerably increase the 125 tons as the possible force to be resisted. I think I should double it. But taking it at 200 tons only—because with an exceedingly strong wind, snow would not be likely to lodge on the crown to any extent—the rollers or attachments at the bottom curb will have to bear a much greater strain than they should be submitted to in the absence of external guide-framing; and be it remembered that it is quite impossible so to adjust them that each one does its proper share of work, and no more. The probability is that, under some circumstances, nearly the whole of the work will be thrown on two or three only; and should one or more give way, increased work would be cast upon those nearest to the broken ones—to be perhaps broken themselves in turn, and so on until the holder goes over.

It is also necessary that both guides and rollers should have a rigid and firm bearing. The rollers on Gadd's system, and the attachment of the wire ropes on Pease's system, being fixed to the cups and curb, are safe enough; but the guides are only attached to the sheets, or at intervals to other supports, which in neither case are, in my opinion, sufficient for safe working. It is also of great importance that, as far as possible, the rollers should be accessible, which is the case with a large proportion where external guide-framing is used.

For the above reason, I dare not erect, nor advise others to erect, a large gasholder without external guide-framing, and until I am assured of its perfect safety, I shall hold the same opinion.

(Signed) GEORGE LIVESSEY.

P.S.—A gasholder without guide-framing may stand safely for many years, because it may not be subjected to a great storm. I have not seen a storm like that of 1881, since that time. The fact, therefore, that such a gasholder may work safely for a considerable time is no proof that it may not ultimately fail.

In the result, we understand that the Committee have decided to adopt Mr. Livesey's suggestion to erect the holder in question with the fourth lift going above the guide-framing; and Messrs. Ashmore, Benson, Pease, and Co., Limited, of Stockton-on-Tees, have taken the contract for the work.

OHIO (U.S.A.) GASLIGHT ASSOCIATION.

Annual Meeting at Columbus.

The Eighth Annual Meeting of this Association was held at Columbus on the 16th of March, under the presidency of Mr. H. Wilkiemeyer, of Evansville, Ind.

The question of the representation of the gas industry at the Chicago Exhibition was considered at some length. Mr. A. C. Humphreys, of Philadelphia, having been introduced by Mr. Faben, gave an account of the steps that had been taken, similar to that laid before the New England Association,* and also particulars of some of the difficulties that had been encountered in the way of obtaining a suitable site for the building on the exhibition grounds. He also explained that, as the buildings for electric light exhibits were to be provided free of expense, and that a loan was to be granted by the government for the purposes of the exhibition, steps had been taken for the purpose of entering a protest, on the part of the gas interest, against the granting of such a loan, unless their industry also received proper consideration. As taxpayers, the

gas undertakings contributed a great deal more to the government than electric companies, and therefore claimed that they had a right to at least equal privileges. Mr. Faben then moved a proposition that the Ohio Gaslight Association should heartily approve of the work done by the Gas Industry Council, and also earnestly protest against the unfair discrimination that had been exercised against their industry by the managers of the exhibition. Mr. M'Millin, in seconding the proposition, spoke highly of the work done by Mr. Humphreys and other members of the Council in connection with this matter. Mr. Cantine thought the resolution a little too mild; and that they might agree to request the Ohio delegates at Congress not to vote one dollar to the exhibition until the gas industry had been fairly and properly recognized. Mr. Printz agreed; saying that at his little works he could influence one gentleman at Washington. The resolution was then unanimously adopted. It was also agreed that copies of a protest suitable for laying before members of Congress be at once printed and circulated amongst the members.

The President then delivered his Inaugural Address. He referred with satisfaction to the steady and continual growth of the Association, which was not a trade union, but a society for the promotion of knowledge, and as such worthy of countenance and support from all. After a most eloquent account of the advantages secured by membership of the Association, he proceeded to refer to the prospects of the gas industry, insisting that "small profits and quick returns" was the sure road to success with gas, as well as with other things. At the same time, care should be taken to keep up the quality of the gas. A reference was next made to the present low price of tar, which was not likely to be permanent; and the President concluded by noticing several matters of local interest.

Mr. M. A. Gemuender read a paper on "A Basis for Equitable Rates to all Consumers." He defined an equitable rate as a fair proportionate return to each consumer for the actual payment received, treating all alike, without discrimination in favour of any one class of consumers. It did not necessarily follow that varying rates or discounts were evidence of discrimination; because one class of consumer or one kind of consumption might mean a different net cost to the company than another. In order to be just, all charges against a consumer must be strictly in proportion to the cost of the service given. It was therefore necessary, as a first step, to carefully analyze the nature of the service rendered to a consumer by a gas company. So far as manufacture and storage were concerned, he argued there was no reason why a large consumer should receive any concession, as compared with a small one. But in the matter of distribution, a large consumer might claim that he cost the company less per 1000 feet used. Against this, however, distance from works might be brought in; and a small customer close to the works might claim to cost the company less than a large one at a distance. For this and other reasons, it was obviously impossible to assess each consumer with a proportionate charge for distribution; and therefore the mains and services must, for purposes of argument, be taken as an extension and a part of the storage. Mr. Gemuender did not approve of the charge for meter-rent, saying that it was contrary to the legislation of the country; and he recommended instead a "service-charge" covering the cost of office and collecting expenses, maintenance of service-pipe, &c. He argued that these were entirely independent of the quantity of gas used; that they could be easily estimated for each customer, and therefore should be a matter of separate charge; but that the cost of meter maintenance bore a close relationship to the quantity of gas measured, and might therefore be included with the general cost of gas. Where a large meter was required with a small annual consumption of gas, he thought that the difference in cost, as compared with that of a meter sufficient to measure the actual consumption, should be a matter of a special charge to the consumer; or that in such cases the consumer should find his own meter. Roughly speaking, the "service charge" would average about 1s. per consumer per month; and this in the aggregate would represent a considerable increase of income to companies encumbered with a large number of small customers. The question of considerably cheaper rates for day consumption was then dealt with; the writer arguing that such could not be justified unless it could be shown that the special discount was unavoidable in order to secure the same. The day business certainly involved no increase of capital; and therefore this class of consumption might be allowed a discount equivalent to the interest on capital. It was shown that this item would not exceed about 4d. per 1000 cubic feet; and any reduction in excess of this amount, was a favour granted to the day at the expense of the night consumer. Further, certain classes of the latter kind of consumption might reasonably claim to participate in the lower terms. A company should aim at reaching permanent conditions, leaving aside such acts as afforded a temporary advantage at the sacrifice of principle, or which could be characterized as unjust.

Mr. Padan opened the discussion by remarking that the paper read as beautifully as the Golden Rule; and he thought it would be as hard to execute in practice. The sentiments expressed in it might be adopted where there was no local competition. Mr. Faben agreed that there should be a more direct proportion between the actual service rendered and the price charged. Theoretically, the arguments were sound; but it would take a

* See ante, p. 577.

lifetime to educate a community to the accepting of them. In his case, the only reason why he was not a convert to a rigidly enforced uniform rate was because he did not find such to be advisable at present. It was quite correct that the law did not countenance a charge for rent of meter, though in some cases the local authorities were empowered to fix a maximum for that item. With regard to a concession to large consumers, in his case they took 65 per cent. of the total consumption, and rendered it possible to supply the small customers at a moderate figure. In many other towns also, he thought it could be shown that, after a liberal discount to the large consumer, the small consumers were supplied with gas at a cheaper rate than would be possible if they received an independent supply. Mr. Graeff supported the principles that were laid down in the paper; and he considered that, whether practical or not, the time was come when gas consumers should be taught to understand them. He agreed with the uniform price, but not exactly with the uniform service charge. Something of the sort should certainly be levied upon consumers of a trifling amount. Under present circumstances, it certainly was advisable to offer gas at low rates for fuel and power; and he considered the proposition in the matter of large meters and small gas bills to be quite impracticable. The term "service charge" was certainly preferable to "meter rent," which conveyed a wrong impression. Mr. Chollar argued that the large consumers were the backbone of the business; and that allowances could be made to them without injuring the small customers. Mr. M'Millin thought there must be a charge for meter-rent or some equivalent to it; and that the law would not forbid it in the case of a consumer of a very small quantity of gas, at any rate. A man might have a meter and service-pipe laid on, not intending to use gas regularly, but merely as a reserve in case of the failure of the electric light. He quite agreed that the business should be run on definite rules, and quoted several examples from his own practice. Mr. Hayward contended that it was not possible to work on rigid rules; but that the policy generally exercised in getting and retaining business of all kinds must be followed—particularly under the pressure of competition. Stoves and gas-engines could not be introduced without cheaper rates. Mr. Humphreys argued that it was not right to reject the principles laid down in the paper as unpractical. It would not hurt the meeting to consider theoretical matters; and if they turned out to be right and just, then they must be taken as a standard to be worked to as nearly as popular prejudice would allow. He questioned whether the cost of maintenance of meters bore any recognizable proportion to the quantity of gas used. In any case, the repair and control of the meter should be retained by the seller. It would be a very difficult matter to arrive at a uniform service charge; and he did not agree with the argument that day gas should be sold at but little if any lower rates than the ordinary consumption. Mr. Starr said the object of a meter-rent was to get payment for the meters that were not in regular use, rather than for those that were. He did not consider it practicable to figure out to such minute proportions as those in the paper; he believed in charging a fair price sufficient to cover incidentals. Mr. Allen could not see the difference between gas and any other business; and any commercial house that adopted a one-priced system would certainly fail. He believed in discounts to large customers, and in being guided by local circumstances. Mr. Gemuender, in replying, did not insist that meter-rents were illegal, but only that there was a feeling against them. He had assumed it as granted that all should be treated alike, and had merely endeavoured to arrive at some practical unit.

A paper on "The Testing of Ammoniacal Liquor" was read by Mr. G. Osius, of Detroit, who pointed out that the "Twaddell" was only an approximate in the case of crude, and quite inapplicable to concentrated ammoniacal liquor. He described the "distillation" and the "saturation" tests, the preparation of standard acid, &c.; and said that each 4 oz. strength represented 1 per cent. of ammonia in the liquor. In connection with the paper the following from the question box were considered: "What should be the strength of a liquor in order that a pound of it should yield a pound of sulphate?" "Can liquor above 8 oz. strength be safely stored in cemented tanks?" "What is the strongest liquor that can be shipped without danger of crystallization?" In the course of a conversational discussion, it was stated, in answer to the first question, that a liquor conforming to those conditions would be 100 oz. strength; as regards the second, that liquor did not act on cement; and in reply to the third, that any concentrated liquor containing carbonates was liable to deposit them.

The next paper was read by Mr. C. H. Marden, of Coshocton (Ohio), and was entitled, "How to put a Small Gas-Works on a Paying Basis." Referring to the difficulties encountered in re-establishing a concern that had been badly managed, he said they were much greater than those incurred in starting a new undertaking. After instancing the multifarious nature of the duties to be discharged by the manager of a small gas-works, he insisted on the importance of supplying good pure gas, at the lowest remunerative price.

Mr. Clapp heartily supported the recommendations in the paper; and Mr. Starr, in following on the same lines, said there was one thing omitted, and that was to give away plenty of big burners. When gas consumers get a bright light, they will not object to their bills. Mr. Cantine said that the most

economical burner for coal gas was one using about 9 cubic feet per hour. Mr. Taylor advocated more energy in pushing the sale of gas in small districts, especially in the way of day consumption. He quite agreed as to giving away large burners, and also using them in the public lamps. He did not mind giving more gas in these than was paid for, as it was a good advertisement; and he never had complaints about bad gas. Mr. Nash said the one important essential was to put the apparatus in good shape. A small gas plant with old apparatus would not pay.

Mr. H. Padan, of Portsmouth, Ohio, read a paper on "The Relation between Increase of Output and Decrease in Cost of Manufacture and Distribution," which he characterized as an important feature in all lines of business. Formerly, the only object of increasing business was to secure a corresponding ratio of profit; but now, in many cases, the only way of keeping a business alive at all was to increase it, so as to admit of introducing economies in production that were not possible on the smaller scale. The question had been carried so far as to lead to the formation of gigantic corporations, that attracted the attention of legislators; and corporate monopoly seemed to be in harmony with the genius of American legislation, which afforded protection to home industry, and which meant, when analyzed further, protection to the margin of profits as well as to labour. In some businesses, the extent of operations was simply circumscribed by the amount of capital at command; but in the gas industry this did not apply, as the demand in the district supplied governed the size of the works. Yet it was a fact that, in the gas business, the smaller the scale of operations the larger was the proportion between capital and revenue; and this was the more marked because the capital, under the most favourable circumstances, would be three times as great as the annual revenue, whereas in some businesses the yearly turnover was many times greater than the capital employed. It was this that was mainly instrumental in bringing about the low prices of gas to-day, which were about half those of 20 years ago. Having illustrated this point at some length, the writer proceeded to consider the effect of the proportion between minimum and maximum output, as regards the cost of making gas; and also the difference of a large, as compared with a small works. Taking a million cubic feet per day as the standard, he thought that a 500,000 cubic feet production would add 10 per cent. to the selling price; a 100,000 feet make, 25 per cent.; a 50,000 feet, 50 per cent.; and a 25,000 feet, 100 per cent.

Mr. Gemuender expressed a strong dissent from the assertion that "corporate monopoly seemed to be in harmony with the genius of American legislation." He also asked for further information as to how the figures quoted at the end of the paper were arrived at. Mr. Printz said that he was now selling 50 per cent. more gas than was the case eight years ago, with practically the same staff at the works and in the office. Mr. Thompson claimed that there were other things to be considered, in addition to the proportion between capital and labour, in comparing the cost of gas 20 years ago with that at the present time. Great improvements had been made in apparatus, enabling better returns to be obtained from the materials used. Twenty years ago little or nothing could be got from the tar; the ammonia went to waste; and the price of coke was much less than it was now. At the same time, the increased output was perhaps the chief factor concerned in securing the desirable result. He agreed that a certain amount of emulation prevailed in a large works, that was not found in a small one.

(To be continued.)

Ipswich Scientific Society.—A very successful *conversazione* was held by the above-named Society on Wednesday evening last, in the Town Hall, Ipswich. The Mayor (Mr. D. Ford Goddard), as a Past-President of the Society, being desirous of showing his continued active sympathy with its objects during his mayoralty, regarded the visitors as his guests for the evening; and, in conjunction with the President (Mr. E. P. Ridley), he personally received them on their arrival. Apart from the interest attaching to the gathering from the association with it of Mr. Goddard, it was noteworthy for the excellent collection of gas and electric appliances shown by Mr. Edwin C. Sayer. They included one of Suggate's "radio-photometers," the object of which is to record lights of varying intensity in terms of the standard candle. It consists principally of vanes of a light material, accurately balanced on a spindle revolving on crystal points, which, by the well-known laws of absorption and repulsion, revolve with greater or less speed according to the intensity of the light to be measured. The revolutions having been ascertained, the illuminating power is read off direct by reference to a table. It is used by the Ipswich Sanitary Authority to test the gas supplied by the Gas Company, and is highly valued as affording a more expeditious and much easier method of calculating illuminating power than the standard photometer. Mr. Sayer also showed one of Sugg's illuminating power meters; Mr. Vernon Harcourt's aërothometer; various kinds of photometers; one of Brownhill's gas-meters; a cheap gas-engine of his own construction; the Lux gas-balance; and a small electric arc lamp, with reflector, given to him in 1867 by Lord Rayleigh. The *conversazione* was one of the best the Society has ever held; and at its close a hearty vote of thanks was accorded to the Mayor.

REGISTER OF PATENTS.

Charging and Drawing Retorts.—Ruscoe, J., of Hyde. No. 8479; May 16, 1891.

This invention relates to further improvements in apparatus for actuating or working the moveable division-plate for charging inclined gas-retorts described in Trewby's patent No. 19,256 of 1889; though it may also be applied to operate an ordinary charging-scoop or drawing-rake in inclined retorts. Instead of actuating the apparatus as described in Ruscoe's patent No. 14,720 of 1890 by means of gearing, it is now proposed to move the several parts as required by direct-acting rams or pistons actuated by fluid pressure, with the object of lessening the number of working parts by doing away with wheels and gearing.

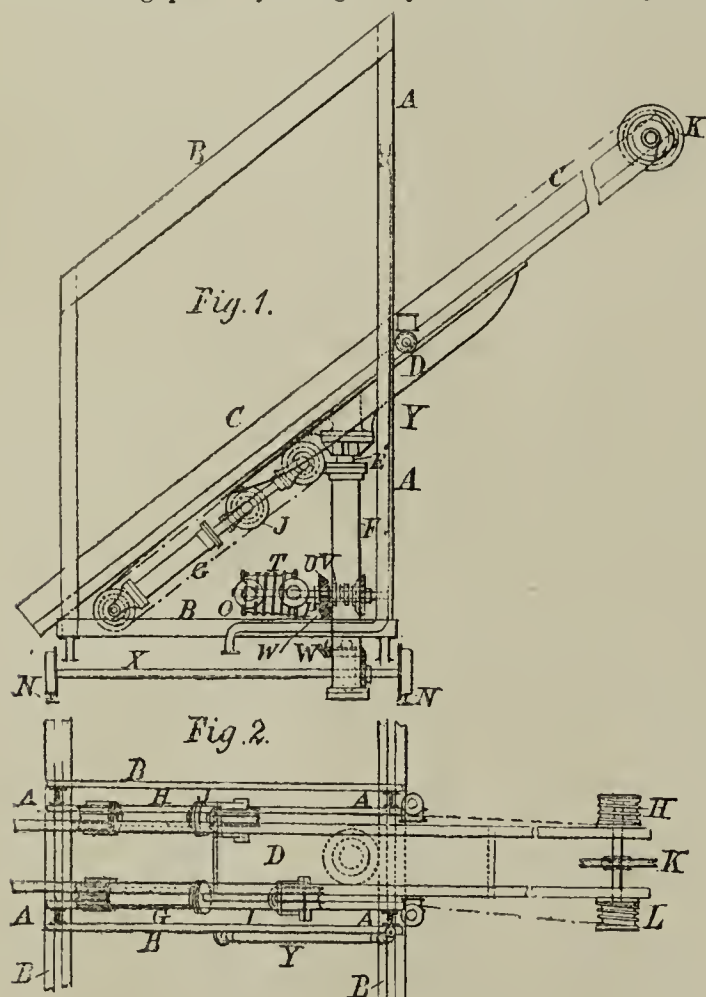


Fig. 1 is a side elevation of the apparatus; and fig. 2 a plan of the division-plate frame.

The framework is (as described in the former patent) preferably built up of upright beams or girders A and transverse beams or girders B. The division-plate is similar to that shown in the former patents; and so it is not again given in these drawings. It is mounted in a similar way upon the vertically moving frame C. To the frame is connected a table or plate D, capable of sustaining its entire weight; and to the table is attached a ram or plunger E of a hydraulic cylinder F, securely bolted to the framework. To the division-plate frame, there are also attached two hydraulic cylinders G and H with rams I and J, which actuate the division-plate, and draw it into and out of the retorts as required. These hydraulic cylinders are fixed side by side directly under the longitudinal members of the division-plate frame at the bottom end between uprights; and they are constructed with sheaves or pulleys at the ends, arranged in the same way as in hydraulic cranes. The chain by which the division-plate is raised and lowered is led round the pulley K, carried on a shaft at the upper end of the frame. On the shaft are two chain drums L M, by which it is rotated. Chains pass round the pulleys of the hydraulic cylinder and ram G and I, to the chain drum L; and from the pulleys of the cylinder and ram H and J, to the chain drum M. The chains are wound on to the drums in opposite directions; so that, when the ram I is in the act of unwinding its chain from the drum L, the chain from the other ram J is being wound upon the drum M, and the ram pulled back into the cylinder H.

The travelling gear for traversing the retort-house on the rails N, comprises two more hydraulic cylinders O P, and rams R S, affixed to the lower members of the structure, with chains therefrom passing round a drum T. These chains are also wound in opposite directions round the drum; so that, by alternately forcing out one ram and then the other, a reciprocating rotary motion is given to the drum. On the shaft which carries the drum T are two loose bevel-wheels U with a clutch V between, which slides on a key. The bevel-wheels U gear with a bevel-wheel W; and by alternately moving the clutch V to gear with one wheel or the other, as the motion of the drum T and shaft is reversed, a continuous movement in one direction is obtained for the gear-wheels W W¹, which latter drive the main axle X whereon the wheels are carried that rest and run upon the rails. Each machine is preferably fitted with an upright pipe Y, or other chamber, to which the several parts can be connected by flexible pipes.

Regulating the Passage of Water from Mains to Service-Pipes.—Taylor, J. J., of Newgate Street, London. No. 8649; May 20, 1891.

It is well known, remarks the patentee, that in some cases (more especially abroad, and for comparatively small supplies of water) meters are not used because of their expense; but that, instead thereof, a sealed tap is used intermediate between the service-tap, or ball-tap, and the water-main, for the purposes of limiting the supply of water to a customer to a certain maximum quantity in a given time—proportionate to the amount paid by him. According to the present invention, it is proposed to employ an apparatus of peculiar construction, which may be either screwed direct into the water-main and have the service-pipe

connected thereto, or be so arranged that it can be inserted into any suitable part of the service-pipe.

The apparatus is constructed as follows: A body or casing of gun-metal is provided, having a perforated stem adapted to screw into a hole tapped in the water-main, or to be connected to a pipe coming therefrom. Above the stem, the body or casing is widened out into a conical chamber, which has a branch formed thereon adapted to have secured thereto one end of the service-pipe, the service-tap, or the ball-tap, as the case may be. The lower end of the conical chamber is formed into a valve-seat round the passage leading from the bottom of the conical chamber through the stem. The upper part of this passage is tapped to receive the lower screwed end of the stem of a valve, adapted to close as nearly water-tight as possible against the valve-seat. The upper end of the valve-stem is continued up through a cap screwed on to the top of the body or case; and it is furnished with means by which it can be turned from outside the casing. The part of the spindle which passes through the cap is screwed; and the hole in the cap through which it passes is tapped to correspond. Into the conical chamber is fitted a hollow conical plug provided with radial holes of various sizes at the level of the branch leading to the service-pipe or other outlet. This conical plug is provided at the top with notches, or other means, by which it can be turned, by a suitable tool, into any desired position in the conical chamber.

Assuming now, for example, that the apparatus has been screwed into the main, that the service-pipe has been connected to the branch, that the valve is shut so as to prevent water passing from the main into the service-pipe, and that it is desired to adjust the apparatus so that not more than a certain quantity of water can pass to the consumer in a given time—the cap is first unscrewed and removed; and the valve still remains closed against its seat by the lower end of its stem being screwed into the passage leading to the main. A proper tool can then be introduced; and the hollow conical plug turned to bring that opening in it which is of suitable size to pass the required quantity of water, opposite the service-branch. When that is done, the cap is screwed on again; and the valve is opened by turning its spindle so that its screw threads will cause it to rise free of the passage leading from the main, and to close with its upper surface against the underside of the cap, so as to prevent leakage of water past the screw-thread on the spindle where it passes through the cap. Water can then flow to the service-pipe, but only in quantity dependent upon the size of the hole made in the conical plug that has been brought exactly opposite the service-branch.

Should it be desired to alter the quantity that is to be allowed to pass in a given time, the valve is first closed, then the cap is removed, and the position of the hollow plug altered so as to bring the radial hole in it which is suited to allow the particular quantity of water to pass, opposite the service-branch. The cap is then replaced, and the valve re-opened. If it is desired to shut off the supply of water entirely from any particular service, without interfering in any way whatever with the adjustment limiting the quantity supplied, it is only necessary to close the valve.

The proper position in which the hollow plug should be placed, to allow of the passage of a certain quantity of water, may be indicated by figures marked on the plug, and a point marked on the body or case to which one of such figures must be brought in order to bring the hole of the required size into position.

Setting and Heating Gas-Retorts.—Boult, A. J.; communicated from A. Klönne, of Dortmund, Germany, and F. Bredel, of Milwaukee, U.S.A. No. 9310; June 2, 1891.

This invention consists of (1) An improved method of charging the fuel in the generator or fire-box from one side of the bench, and doing the clinking from the opposite side. (2) An improved method of supporting retorts which are set at an angle to the horizontal line.

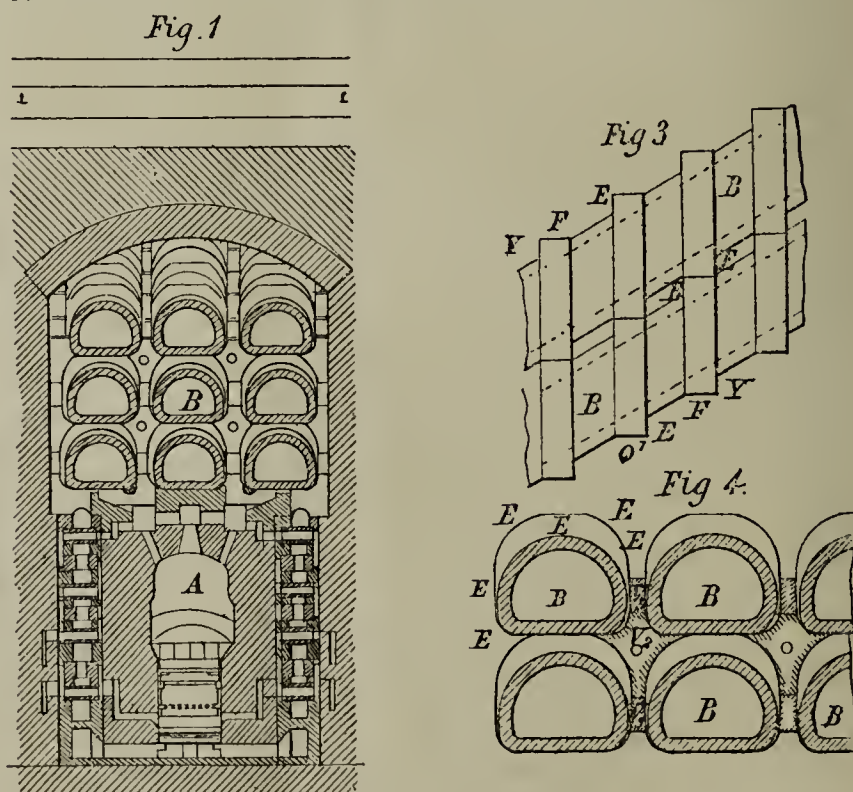
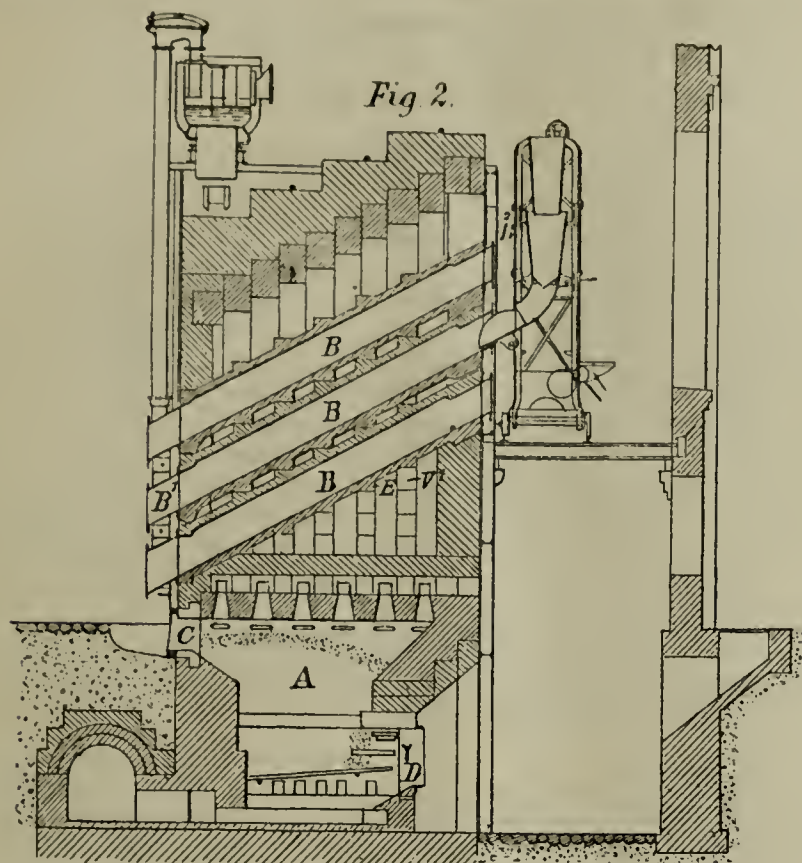


Fig. 1 is a sectional elevation of a retort furnace embodying the invention. Fig. 2 is a vertical section. Figs. 3 and 4 are detail-views and section of supports for retorts.

A is a generator or fire chamber, with a grate partly or wholly beneath the retort-setting, and filled with combustible material for heating the retorts B. The fuel is supplied to the furnace through a filling door C at the front side of the retort-bench. The clinking door D is on the opposite (or back) side of the bench. The object of this improvement is to do away with excavation or an elevated stage or floor on the discharging or front side of the retort-bench, which would



otherwise be necessary in front of the bench, so as to provide for the clinkering and stoking of the fire and discharging of the retorts.

E and V¹ show an "improved" way of supporting inclined retorts as detailed in figs. 3 and 4. It has been customary, say the patentees, in setting inclined retorts, to support them on blocks, piers, tiles, or other suitable structures of refractory material, shaped to correspond with the angle of inclination of the retorts. This has not provided a substantial support, as the weight of the retorts will tend to drive the supporting walls out of their vertical position, and thereby give the retort a tendency to sag or bend downward. To obviate this, the retort, wherever it is supported by piers V¹ and V² on both sides exposed to the heat of the fire, is constructed with a circumferential ring or offset E, made in one piece with, and forming part of the retort B, and having a horizontal supporting surface when the retort is in its inclined position; thereby giving a substantial support, and preventing all sliding tendency and side pressure against the supports. A general idea of the supports as arranged between retorts is shown in fig. 4 by V² and V³.

Charging Inclined Gas-Retorts.—Gibbons, B. and W. P., of Lower Gornal, Staffs. No. 9366; June 3, 1891.

This invention refers to apparatus for charging inclined through gas-retorts; the charging mouthpiece being at the upper end of each retort.

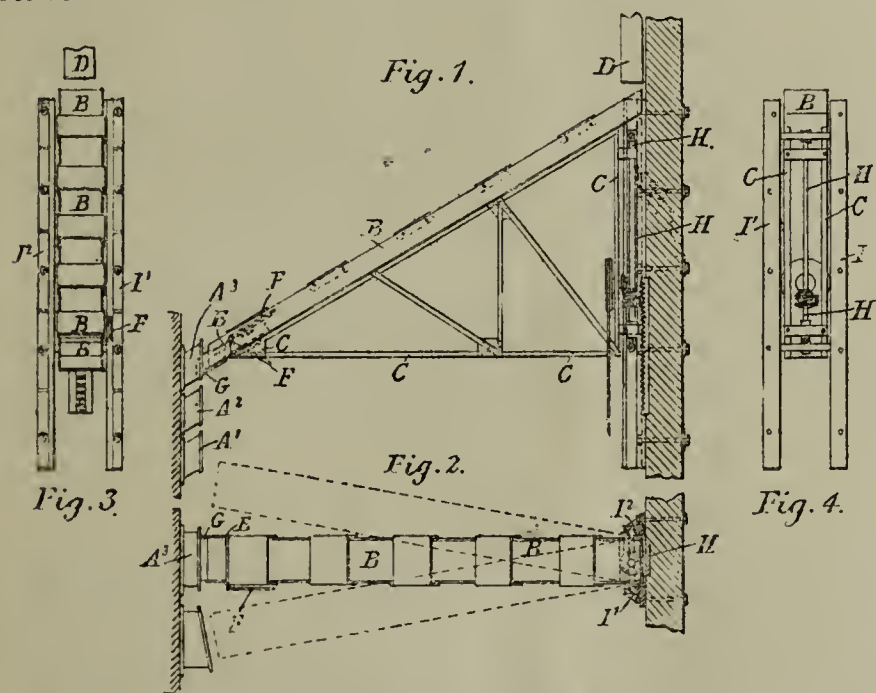


Fig. 1 represents in side elevation (partly in section) an arrangement of the apparatus; fig. 2 is a plan; fig. 3 is a front elevation; and fig. 4 is a back elevation.

The patentees propose to provide beyond the charging mouths A¹ A² A³ of the retorts an inclined coal-shoot or coal-trough B, by preference parallel, of about the same cross sectional area as the retort to be charged, and of about the same length. The inclination of this shoot to the horizontal is the same as the inclination of the retorts—that is, preferably a little steeper than the angle of rest of the coal or slack with which the retorts are to be charged; say, from 30° to 33°. The shoot is carried by a framework C, which can be moved so as to bring the lower end of the shoot opposite the mouth of any retort in one bed or group, or in one tier in the different beds or groups. The upper end of the shoot is adapted to receive coal from an ordinary overhead hopper, or other source of supply, the bottom of which is shown at D, and the lower end is provided with a hinged or other gate E, which can be opened by the lever F, and also has a moveable lip or tongue G, which can be moved to-and-fro, and inserted into the mouthpiece of the retort, or withdrawn therefrom.

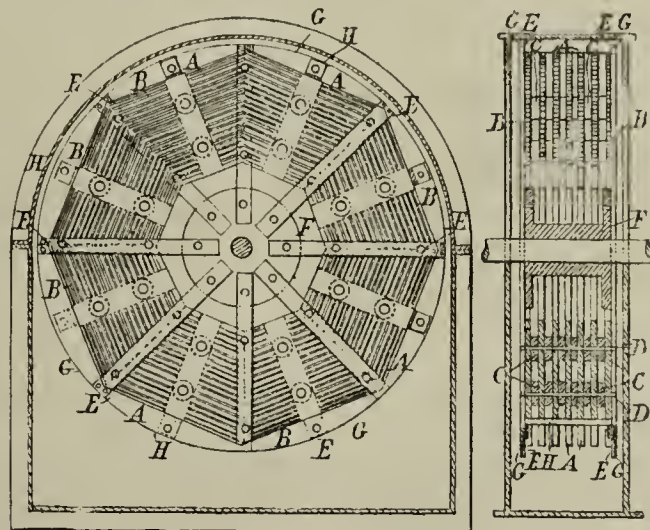
When it is desired to charge any one of the retorts, the lid on the mouthpiece is opened, and the shoot or trough is moved so as to face the open mouthpiece into which the lip or tongue G is inserted. The bottom end of the shoot is closed by its gate E; and the gate or lid on

the hopper D is opened, and the coal moves down into the shoot, and gradually fills it with the required charge. The outlet of the hopper is now closed, so as to prevent any more coal passing out into the trough; and then the gate E at the lower end is opened, and the charge moves down into the retort. If the trough and the retorts are set at the proper angle, the charge of coal moves down into the retort *en masse*; and a regular stratum of coal in the retort is the result.

The upper end of the shoot, or the frame supporting it, may be pivoted to allow of the trough being turned rapidly, so that its lower end will correspond with either of the retorts in one tier in the same bed; and the trough may be also provided with means for vertical adjustment, so that it can be raised or lowered to reach either of the tiers of retorts. This is shown in figs. 1, 2, 3, and 4, where it will be seen that the frame C carrying the trough B is pivoted so as to turn about an upright shaft H, which, at its upper and lower ends, is carried by cross pieces, which can be moved up and down in upright guides I¹ I² fixed to the wall opposite the bed of the retorts. As shown by the dotted lines in fig. 2, the trough can be turned about the shaft H, so that its lower end will correspond with the outer retorts in the bed or group. The vertical adjustment of the shoot or trough is thus obtained by the worm fixed on the shaft H, and gearing with the rack fixed to the wall; this worm and the shaft being turned by the bevel-wheels, and wheel worked by an endless rope or chain from below. The faces or the mouthpieces of the outer row of retorts in each bed may be made slightly bevelled as shown in fig. 2, in order to more conveniently reach them by means of the trough B and the lip or tongue G.

Washing or Scrubbing Gas.—Chandler, J. C., of Brixton Road, London. No. 10,918; June 26, 1891.

This invention relates to gas washers or scrubbers of the kind described in patent No. 7691 of 1888, in which the wetted surfaces against which the gas impinges are composed of bundles of laths. Instead of employing laths, it is proposed to use boards having therein a number of saw-cuts or slits for affording a large amount of wetted surface. A number of such boards would be made up into a bundle; suitable distance-pieces being placed between them.



The illustration shows a sectional elevation of such a bundle held in position in the washing apparatus; and a cross section—both when applied to a horizontal washer, such as is described in patent No. 422 of 1877.

A are the boards; B, the slits or saw-cuts therein; C, the distance-pieces between the boards; and D, bolts passing through the boards and through the distance-pieces and serving to clamp the whole together. A series of these segmentally-shaped bundles are formed into discs, which are caused to revolve in order to retain the surfaces properly wetted, in the usual well-known manner. As shown, several bundles are clamped between pairs of arms E to form a disc; the arms being secured at their inner ends to a hub or boss F, and at their outer ends connected by plates G. H are cross-bars bolted between the plates G on opposite sides of the bundles, in order to retain the bundles in their proper positions between the arms.

Heating the Charge in Gas-Engines.—Edwards, E.; communicated from G. Petit and E. Blanc, of Voiron, France. No. 260; Jan. 6, 1892.

This invention relates to apparatus for heating uniformly and to a sufficient degree, a mixture of air and gas or inflammable vapour, in order to form a readily explosive mixture in gas-engines or other apparatus of the like kind.

Supposing the apparatus is applied to an ordinary gas-engine having a piston working in a cylinder the outer end of which forms a combustion chamber, it is proposed to arrange in this chamber a smaller chamber of cast iron or other suitable material, provided with a number of partitions (the number and size of which may be varied as found desirable) round which the explosive mixture circulates. The inner chamber is made to project for a considerable distance behind the combustion chamber; and it is surrounded by another chamber or casing through which the exploded mixture is made to pass and circulate after having actuated the piston. An exhaust-valve, operated in the usual manner, is arranged between the combustion chamber and the chamber last described. In this way the explosive mixture before, entering the combustion chamber, and while passing round the several partitions in the inner chamber, is highly heated by the burning mixture round that part of the latter chamber which enters the combustion chamber, as well as by the passage of the burnt mixture surrounding the end of the inner chamber, which projects outside the combustion chamber, as such burnt mixture passes to the exhaust-pipe; and in this way it is claimed that efficiency and economy are attained.

Manufacture of Gas.—Wilson, G. M. S., Toronto, Canada. No. 535 Jan. 11, 1892.

This invention relates to apparatus for manufacturing gas, of the variety in which hydrocarbon oil is vaporized and combined with steam or water and air for the production of the gas.

In the manufacture of such gas, says the patentee, one of the main difficulties encountered is the perfect decomposition of the vapour so as to convert it wholly into a fixed gas. Usually it occurs in apparatus designed for this purpose that a large percentage of the oil escapes in one form or another with the waste product, leaving in many instances only a comparatively small percentage actually converted into gas. The present invention is designed to make this larger product available by reason of the arrangement and construction of the retorts, the method of heating them, and the combination which is formed with steam and air in the retorts.

The retorts employed consist of five several pipes or tubes, and an inside return pipe within the central upper tube. The three upper tubes occupy the full width of the inside of the furnace, set substantially against one another along their contiguous sides and against the walls at each side, so as to furnish a bed for a fire to be built upon them, especially for heating the retorts upon their upper sides, and serving at the same time to heat a boiler. The commingled oil, air, and steam are forced into these retorts by steam pressure. Air likewise is admitted under valve control; and oil under suitable control is also admitted—both the air and the oil making their entrance in front of the jet of steam, so as to be carried by the force of the jet forward into the respective tubes. The steam will, of course, contribute to the atomization and vaporization of the oil, immediately on coming in contact therewith; and the oil, steam, and air issue together into the tubes through perforated or other suitably-constructed nozzles, which serve to break up and spray the oil, air, and steam, or the vapour of the oil, as it may be admixed with the air and steam at this point. This admixture is now in condition to be converted into a fixed gas by a proper decomposition in the retort tubes, which are heated to a sufficient degree to produce this result. Exposure to the requisite degree of heat and a considerable distance of travel of the gas are required to make the decomposition complete. Hence the gas travels zig-zag through all the tubes, and thence to the washer. In this way, such perfect exposure of the gas to the heat of the furnace is obtained, and for such length of time is the gas detained within the retorts as to practically decompose all the hydrocarbon vapour, and convert it, with the air and steam, into a fixed gas which is exceptionally clean and free from condensation.

Gas-Pressure Governors or Regulators.—Altmann, A., of Berlin. No. 719; Jan. 13, 1892.

This invention relates to gas governors or regulators which act automatically to ensure uniform pressure of the gas passing therefrom notwithstanding fluctuations in the pressure of gas in the mains. The use of mercury is dispensed with; glycerine or thin machine oil being employed instead.

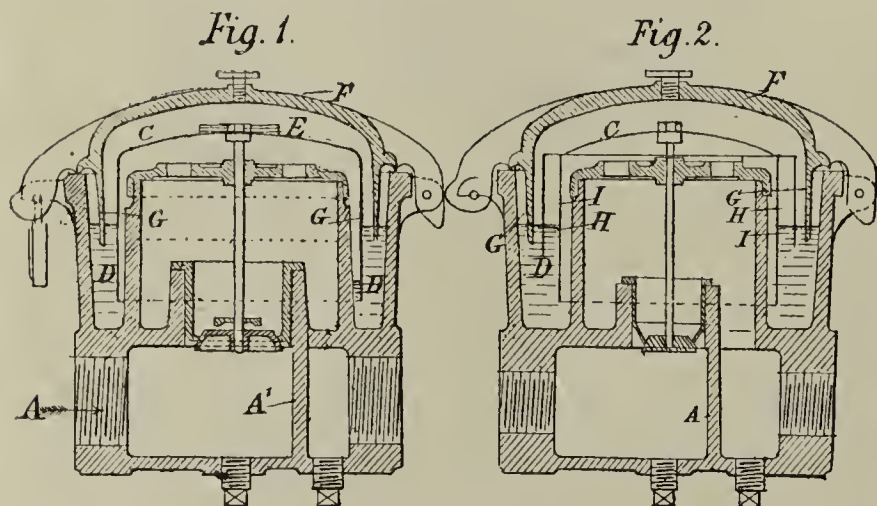


Fig. 1 is a vertical section through a governor suitable for regulating the pressure of gas intended for illuminating purposes; and fig. 2 is a section of one intended for regulating the pressure in a gas motor.

The gas enters from the gas-main at A and leaves the governor at B (at the other side of a partition A') after it has been reduced to the desired pressure. The reducing-valve and the bell C fixed on the valve-spindle, balance the gas pressure in the interior of the governor in the usual manner. The bell dips at D into water, glycerine, or thin machine oil, to prevent the escape of gas to the exterior. By loading the bell with weights E, the pressure of the gas passing out can be increased or diminished at will. The cover F of the governor in fig. 1 has a ring G of such length as to dip into the liquid which seals the bell, and which thus forms a hydraulic joint. The air enclosed between the cover and the bell cannot escape in any other way than through an opening in the cover, formed by a screw which has a wedge-shaped recess. By increasing or diminishing the area of the opening by raising or depressing the screw, a cushioning action can be obtained which influences the speed of lift of the bell.

While the braking action for the lift of the bell in the arrangement of governor used for illuminating plant is sufficient for a good governing action, the employment of the governor with gas motors (as fig. 2) necessitates a brake which shall also act against the descent of the bell. For this purpose, the following arrangement is provided: The case or body of the bell C is made with double walls H and I, forming an annular space which is closed at the top by the bell, and at the bottom by the sealing liquid. At a suitable place within this space, there is provided a small air-pipe, which extends upward nearly to the roof of the bell and downward through the bottom wall of the governor. By this means, communication is effected between the inner annular space and the outer atmosphere. In the case of an increased consumption of gas—as, for example, when the engine piston is making its suction stroke—the bell has a tendency to descend, so that the air in the annular space is compressed and can only escape through the pipe. The duration of the downward movement of the bell is thus dependent solely on the quicker or slower escape of air; and by contracting the outflow area of the pipe, the speed of descent of the bell can be reduced as desired.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

The Cost of Enriching Gas by Carburetting.

SIR,—In reply to the letter published in your last week's issue from an anonymous correspondent "Black Coal"—

- 1st. Most of your readers know for themselves that cannel giving 12,000 cubic feet of 30 sperm candle gas cannot be bought at less than 42s. per ton, delivered at works in England.
- 2nd. The coke from cannel of this quality is not only useless in itself, but when burnt with "black coal," does injury to the bulk. Other residuals I did not take into account.
- 3rd. Evidence of an independent and trustworthy character can be obtained from engineers using this process.
- 4th. There would not be any difficulty in testing 100 sperm candle gas with most photometers, if a suitable burner could be discovered; but, as a matter of fact, the candle power is worked out by dividing the total value in sperm candles by the increase in bulk.
- 5th. In enriching coal gas up to 18 sperm candles, no spirit (not oil) is condensed back into the mains; and no loss in illuminating power takes place in storing this gas in holders, or in distributing to consumers.
- 6th. By no means.

I am afraid that this process has not been sufficiently studied by your correspondent, or my paper would not be considered useless even by him.

May 7, 1892.

FRANK W. CLARK.

SIR,—Mr. Clark in his paper (see JOURNAL, p. 751) shows that by the use of 93 tons of coal yielding 10,000 cubic feet of 15.25-candle power gas, mixed with 7 tons of cannel yielding 12,000 cubic feet of 30-candle power gas, he obtains 10,140 cubic feet of 16.28-candle power gas. That this is not so theoretically, is plain by working it out fully.

Theoretically, if you have a coal and a cannel as above, and desire to make a gas of 16.25-candle power (an increase of 1-candle power over that given by the coal), you must use them in the proportion of 94 $\frac{7}{8}$ tons coal and 5 $\frac{7}{8}$ cannel; but the make of gas per ton (to be exact) is 10,114.285 cubic feet.

If, at the initial stage, Mr. Clark bases his calculations on its being necessary to use 7 tons of cannel in lieu of 5 $\frac{7}{8}$ tons, or about 22 $\frac{1}{2}$ per cent. in excess of the quantity required, it is evident the deductions need revision.

May 4, 1891.

BRISTOL.

The Present Position of the Gas-Works Rating Question.

SIR,—With all deference to Mr. Newbigging, I submit that my interpretation of the intention of the law, in relation to gas-works, is neither inaccurate nor likely to lead to confusion. It will be obvious that, in using the term "rent," I do so in a popular sense, as representing the sum which a lessee would actually pay, and from which the deductions mentioned by Mr. Newbigging are invariably excluded. It would be difficult to express in one sentence the meaning of the term "rent" as applied to gas-works in a legal sense; nor would it be any use to do so, because scarcely any two authorities are agreed on the subject. So long as the law admits of one gas consumer being charged 1d., and another 4d., towards the rates, it seems to me that any attempt at a strict definition of the numerous fictitious terms that have been imported into the subject is simply like straining at a gnat while swallowing a camel.

I venture to think that my remarks, so far from complicating the question, will simplify it, by showing the impossibility of dealing satisfactorily with a gas undertaking that is *worked*, as a house that is *occupied*, and the urgent necessity for some better enactment than the present law, which admits of the valuation ranging from one-third up to the whole of the actual profits.

Salisbury, May 6, 1892.

N. H. HUMPHRYS.

Bolton Corporation Gas Department.—At the quarterly meeting of the Bolton Town Council, last Wednesday, Alderman Miles, the Chairman of the Gas Committee, submitted the annual statement of the working of the department. He said that for a few years back they had been enabled to considerably reduce the capital account by doing certain work out of current revenue; but this year they had placed various items of expenditure, amounting to £13,043, to this account. They were, notwithstanding, able to depreciate the account still further by the sum of £5000 transferred from the reserve fund, which left the capital account in a still more favourable position compared with the previous year. The revenue had not been so satisfactory as could be desired; but the increase in the consumption of gas had been gratifying; being 34,625,000 cubic feet, or about 5 $\frac{1}{2}$ per cent. on the year, and representing an increase of £4600. The gross profit on the year's working was £47,127, as against £53,756 in the preceding year; and after providing for the requisite standing charges, they had left £16,351, which the Committee recommended to be transferred to the relief of the district rate. This amount was equal to about 3 per cent. on the capital. The quality of the gas averaged 17.91 candles. One of the most satisfactory items in the balance-sheet was the unaccounted-for gas, which had been brought down to the low figure of 3.47 per cent. The Committee were engaged in still further extending the system of generative firing in a new stack of 288 retorts. With regard to the prepayment system for gas, they had something like 130 meters on the penny-in-the-slot principle. Active work was being pursued in view of the proposed electric light installation. An amendment was proposed that £10,000 of the surplus should be devoted to reducing the rates, and the remainder to capital account, but it was negated.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress was made with Bills last week:—

Bills read the first time: Blackburn Corporation Bill; Brynmawr and Abertillery Gas and Water Bill; Electric Lighting Orders Confirmation Bill (No. 4), to confirm Orders relating to Dublin, Fareham, Liverpool, Oxford, Sheffield, and Waterford; Electric Lighting Orders Confirmation Bill (No. 5), to confirm Orders relating to the County of London (part of), Southwark, and Wandsworth; Electric Lighting Orders Confirmation Bill (No. 6), to confirm Orders relating to Hampstead, Lambeth, Shoreditch, and Whitechapel; Gas Orders Confirmation Bill (Bideford, Glastonbury and Street, Prestatyn, and Willenhall Gas); London County Council (Subways) Bill; Mold Water Bill; Ormskirk Gas Bill; Rhyl Improvement Bill; Southend Gas Bill; Stamford and St. Martin's Stamford Baron Gas Bill; Water Companies (Regulation of Powers) Bill; Water Orders Confirmation Bill (Ross and Sevenoaks Water).

Bills read a second time and committed: Airdrie and Coatbridge Water Bill; East Grinstead Gas and Water Bill.

Bill referred to a Select Committee, consisting of Lord Hamilton of Dalzell (Chairman), Earl Yarborough, Lord North, Lord Dunally, and Lord Seaton; to meet on Tuesday, May 10: Uttoxeter Water Bill.

Bills read the third time and passed: Ashton-under-Lyne, Stalybridge, and Dukinfield District (Water) Bill; Glasgow Corporation Bill; Ipswich Corporation Bill; Pontypridd Water Bill; Swansea Corporation Water Bill; Swinton and Pendlebury Local Board Bill; Western Valleys (Mon.) Water (Gas Purchase) Bill.

HOUSE OF COMMONS.

The following progress was made with Bills last week:—

Bills read the first time: Ashton-under-Lyne, Stalybridge, and Dukinfield District Water Bill; Glasgow Corporation Water Bill; Ipswich Corporation Bill; Pontypridd Water Bill; Swansea Corporation Water Bill; Swinton and Pendlebury Local Board Bill; Western Valleys (Mon.) Water (Gas Purchase) Bill.

Bills read a second time and committed: Electric Lighting Provisional Orders Bills (Nos. 1, 2, and 3).

Bills reported: Barrow-in-Furness Corporation Water Bill; Liverpool United Gas Bill; Oxford Gas Bill; Southborough Local Board Gas Bill.

Bills read the third time and passed: Bristol Gas Bill; Mold Water Bill; Rhyl Improvement Bill; Stamford and St. Martin's Stamford Baron Gas Bill.

HOUSE OF COMMONS COMMITTEE.

Tuesday, April 5.

(Before Mr. CAMPBELL-BANNERMAN, Chairman; Sir W. HOULDSWORTH, Sir H. STAFFORD NORTHCOE, Mr. R. K. CAUSTON, Mr. S. GEDGE, Mr. P. STANHOPE, Mr. POWELL WILLIAMS, Mr. W. JAMES, and Mr. E. H. LLEWELLYN.)

BIRMINGHAM CORPORATION WATER BILL.

To-day the cross-examination of Mr. Mansergh was continued.

Mr. PEMBER questioned witness with regard to the table put in giving the consumption and probable daily demand for water; pointing out that it began in 1891 with 15½ million gallons, and went up in 1955 to 67 millions. He said he supposed that this was for the parliamentary district of Birmingham. Witness replied that it was; and he said that when he spoke of 76 million gallons, he referred to the whole district of supply between Birmingham and the Elan. But the 67 millions were part of a table relating also to the income derivable from Birmingham. Asked if Birmingham was not considered to have a sort of copyright in the area proposed to be taken, because it had been proposed by Sir R. Rawlinson, although it was brought before the Duke of Richmond's Commission by Mr. Fulton as a watershed for London, witness said this had been suggested.

A plan was then put in by Mr. Pember showing the scheme of Mr. Fulton. The Chairman, upon inspecting it, observed that the Elan and Claerwen were only part of the ground then proposed to be taken. There were to be four reservoirs; and three of them were lower than that which received the waters of these two rivers.

In cross-examination by Mr. JOHNSTON EDWARDS, for the Birmingham opposition, witness said he did not think it a dangerous thing for a town to depend entirely on one source of water supply. There was nothing about the construction of the works which would render them susceptible to accident. Besides, they were going to provide locally an additional storage of 200 million gallons; and this would provide against any emergency. A suggestion had been made that there might be a large joint scheme for Birmingham and other cities; but there were objections to this. Besides, the present scheme was large enough to stand alone. There were many objections to the proposed double-service system. It was intended by it to take into the houses only water from the sandstone wells. The present supply could only be increased sufficiently to provide for the growth of the population during six or seven years. It was clear that this did not justify the duplication of mains, services, and reservoirs, and the putting of the town to enormous trouble and annoyance. The double service had not been adopted in many towns in England.

Mr. BALFOUR BROWNE (in re-examination): Would any mutilation of the scheme be a very serious matter for Birmingham?

Witness: It would ruin the scheme.

Supposing the Committee should say, "You may have the Elan, but you must wait for the Claerwen," would that be a very serious matter for Birmingham?—Frightful. You see, we shall want the Claerwen in about 19 years. Under these circumstances, we might have to make our aqueduct too large, because the space for the third pipe might have to remain useless, and £100,000 would be wasted. Besides, we have not allowed for enough storage on the other river alone to deal with all its water. The scheme, in fact, would be so seriously injured as to be practically useless.

Professor Lapworth, examined by Mr. BALFOUR BROWNE, said he had examined the present sources of water supply of Birmingham from the sandstone formations of the neighbourhood, with special reference to their capacity and suitability for the service of the city and district for a lengthened period. He had also visited all the principal wells of the locality. It would appear at first sight that the city, which was situated only a short distance to the west of the central line of a great trough of water-bearing rock, was in an excellent position for obtaining an abundant and permanent supply from wells and borings sunk in the strata of the district. But, unfortunately, three out of the six great sheets of strata forming this trough were locally valueless as water-bearing rocks; and consequently only three formations were available—viz., the pebble beds, the variegated sandstones, and the Keuper sandstone rocks, or waterstones. All three were well known to be more or less permeable and water bearing; and the water they afforded, which was that of the actual Corporation wells, if it existed in sufficient abundance, would be adequate in quantity to supplying the wants of the city. The area occupied by the outcrop of these water-bearing rocks was about 35 square miles; but about 5 square miles was under the control of the South Staffordshire Water Company. The proportion of the collective area of 35 square miles which was covered by the pebble beds was about 18 miles; that of the variegated sandstone, 9 miles; and that of the Keuper sandstone, 8 miles. Three of the Corporation wells—viz., those of King's Vale, Witton, and Perry—were sunk in the pebble beds and conglomerates. In the area covered by the variegated sandstones, there were two wells—viz., those of Aston and Selly Oak. Longbridge was the only deep well belonging to the Water Department which was sunk in the rocks of the water-stones. This was a new well; and the works were at present incomplete. A boring near the Edgbaston reservoir in April, 1868, was carried down through 76 feet of glacial clays and gravels, into the usual red sandstone and clays of the variegated sandstones, to a depth of 272 feet. Hardly any water was met with from top to bottom of the boring. A boring near Harborne was made in the pebble-bed area. The strata pierced were sandstone rocks and marls; and the boring was carried to a depth of 311 feet. It was a failure as regards water supply, as the largest quantity obtained was only about 35 gallons per minute. The Birmingham Water Committee pumped from the water-bearing rocks of the neighbourhood, when all their completed wells were in full and simultaneous operation, the following quantities per day: King's Vale, 380,000 gallons; Witton, 2,000,000 gallons; Perry, 1,600,000 gallons; Aston, 3,000,000 gallons; Selly Oak, 880,000 gallons—total, 7,860,000 gallons. If to these was added the proved yield of the unfinished Longbridge well—viz., 600,000 gallons—there was produced a total daily yield of 8,460,000 gallons, or, in round numbers, 8,500,000 gallons. In addition to the water drawn from these rocks, a large quantity was pumped from the same water-bearing strata within and around Birmingham by owners of various public and private wells and manufactories, &c. The average quantity of water pumped daily from the 35 square miles of water-bearing rocks within the limits of control of the Corporation Water Committee might be estimated at 12 million gallons. The average annual rainfall for the whole neighbourhood was, in round numbers, about 30 inches. The usual amount of percolation theoretically allowed for sandstone rocks was 10 inches per annum (answering to 400,000 gallons per day per square mile). At this rate, the total supply from the 35 square miles of water-bearing rock in and around Birmingham would be 14 million gallons daily. But of the 35 square miles, some 7½ lie within a radius of two miles of the centre of the city, and must be deducted from the future water-yielding area at the service of the Corporation, for the following reasons: (1) This area is insufficient for the present supply of the local baths, breweries, manufactories, &c., within the city. (2) The actual supply can be but small, and will grow smaller, owing to the extension of paving, drainage, and sewage courses. (3) The water must be already more or less contaminated by the presence of a large population; and this contamination will increase. In this way, therefore, the total deep water-bearing area became reduced from 35 to 27½ square miles; and the estimate of a permanent and available yield from ordinary percolation into the water-bearing rocks sank from 14 to about 11 million gallons. It might be felt that, as Birmingham already possessed a proved supply of 8½ million gallons from this restricted area, and that this supply was furnished by a few wells, some at no great distance from each other, therefore, if additional wells were sunk at fresh and more scattered spots, the present supply would be increased in proportion. This anticipation, fortunately, was tested by information already at command. The trial bore-holes demonstrated that, outside the river valleys, the quantity of water percolating into the Birmingham sandstones was comparatively small—so small, indeed, as to be practically valueless. He was, therefore, distinctly of opinion that by no possible increase in the number of wells within the 27½ miles of water-bearing sandstone at their command to the north, west, and south of the city, would the Corporation be able to add more than about 2½ or 3 million gallons to their present supply, and keep the water at the same time free from surface contamination.

Mr. Copley, F.R.S., F.G.S., Assoc.M.Inst.C.E., a Past-President of the Geologists' Association, gave corroborative evidence; adding that the sites chosen for the reservoirs in the Elan and Claerwen valley were such as to afford firm foundations for embankments, and were in every other respect excellent.

Professor Boyd Dawkins, F.R.S., Assoc.M.Inst.C.E., expressed himself as agreeing absolutely with what Professor Lapworth had said as to the draught on the existing wells having very nearly reached the quantity of water they were capable of supplying. Indeed, he would not like to pin himself to the opinion that there was even the slightest marginal possibility of increase of which that witness had spoken. It

seemed to him that some of the existing wells drew from the surface water; and he did not think there was within 20 miles of Birmingham any area available for the supply of well water.

Mr. BALFOUR BROWNE said he would call Professor Green also, if the Committee thought it desirable that he should do so.

The CHAIRMAN: The Committee have observed that there has been no cross-examination on this evidence. I do not know whether any evidence is to be offered on the other side.

Mr. DYSON: Oh, we have evidence.

Mr. BALFOUR BROWNE: Very well, then; I will avail myself of the weight of Professor Green's name.

Dr. A. H. Green, Professor of Geology to the University of Oxford, said that he was in perfect accord with the conclusions arrived at by Professor Lapworth.

Dr. E. Frankland, F.R.S., said he was formerly a member of the Royal Commission appointed to inquire into the pollution of rivers and the domestic water supply of the country. He received from Dr. Bostock Hill monthly the results of an analysis of Birmingham water, in the blended form in which it was supplied to the inhabitants. These results showed the water to vary a good deal in quality from time to time, and to be polluted with organic elements. The hardness of the water during the past four years had also largely increased. It varied between 12° and 17·5° in 1888, and between 17·5° and 25·2° in 1891. Thus there had not only been serious fluctuation of late in the quality of the water, but continuous deterioration. He had taken samples of the Elan and Claerwen water both in flood time and in normal weather. The former he had allowed to settle, and had filtered through 3 feet of sand, so as to anticipate the conditions to which it would be exposed in the reservoirs. Both yielded an excellent analysis. They did not contain any ammonia, while nitrogen in the form of nitrates, which would have revealed pollution by manure, was either absent or present only as the merest trace. He knew of no better water for the purpose to which it was to be applied. It was fully equal to the celebrated Loch Katrine water. On the other hand, the samples he had collected of the Birmingham river waters now consumed in the city were very seriously impure. The Blythe contained 35·12 parts in 100,000 of solid matters in solution; the Bourne, 34·4 parts; the Witton stream, 34·83 parts; and Plant's Brook, 33·52 parts. Organic carbon and nitrogen were present in such quantities as to indicate pollution by sewage or manure. Not one of these waters was fit for the supply of Birmingham.

The CHAIRMAN: Would you say that these wells and brooks are worse than sources of water supply usually are in large towns?

Witness: Oh, emphatically. I wish to say that I do not know a large manufacturing town in the United Kingdom so badly supplied with water as Birmingham at the present time.

Wednesday, April 6.

On the resumption of the proceedings this morning.

Mr. Moon intimated that, as representing the Wye Fishery Board, he should not have reason to appear again before the Committee until they had discussed the preamble. The promoters had largely increased the compensation water proposed under the Bill. It was true they had not given the Board as much as, in principle, they thought they were entitled to have; and he did not wish the quantity conceded to be regarded as that which Parliament had allowed them in satisfaction of the rights of the case. In regard to spawning-beds, the Corporation had very properly met them by saying that they were prepared to accept the principle of compensation in money—the amount to be discussed later on.

Dr. Frankland was then further examined. He said that, on the whole, it was his opinion that nothing was to be apprehended as to the action of the Birmingham water upon lead, if it had been filtered.

Cross-examined by Mr. EDWARDS: By the time the Welsh water found its way to the Birmingham pipes, it would probably have about 2° of hardness. Professor Dewar and he had made a large number of experiments on the effect of soft water on lead, and had found that filtration was in itself, apart from the hardness it gave, a preventive. He had also passed the water in its natural condition through the Birmingham pipes, and had found that it did not affect them.

Re-examined: There were some very soft waters which did not affect lead at all. In his opinion, this scheme for a new supply of water to Birmingham was not brought forward a moment too soon. On the contrary, he had been surprised that Birmingham should have waited so long. He said this even more especially in view of the quality than of the quantity of the water.

The CHAIRMAN: I understand you to say this water is not, among soft waters, one which, in its natural state, much affects lead.

Witness: I think I should rather say that it stands among those which act considerably, and rather more than the average, upon bright lead, but that its action upon tarnished lead is very slight. All new service-pipes are bright lead; but they acquire the coating of tarnish in two or three months. Water which has this effect on lead at first, loses it after awhile.

At this point Mr. PEMBER, Q.C., interposed to announce another settlement. He said Mr. Lloyd (whose house was to be submerged), had withdrawn his opposition; the Corporation having come to a satisfactory arrangement with him.

Professor Dewar, F.R.S., was next called. He said he was formerly a member on the Commission appointed to investigate the lead poisoning at Sheffield. He did not think that, after the ordinary filtration, there would be the slightest fear of any action by the Elan and Claerwen water upon lead. This view was the more certain, because it would have travelled through many miles of cut-and-cover-work. In Glasgow, the water of Loch Katrine, though it acted rather violently upon lead at the lake itself, was used without filtering after passing along the aqueduct, being found then to have little effect upon lead. He agreed that the waters at present consumed in Birmingham were rapidly deteriorating. As to the saving in soap, Mr. Mansergh's estimate of £60,000 was a very small one. Every 1000 gallons of the present Birmingham water required 200 lbs. of soap to soften it completely—i.e., to produce a permanent lather. Taking the population at 460,000 only, and the quantity of water used per head per day for

the purpose of washing and personal cleansing at half a gallon only, he found that 46,200 lbs. of soap were used daily to soften it. At 1d. per pound, which was much less than the cost, this would amount to £192 per day; whereas with the Welsh water the cost would be £10 per day. It would be seen, therefore, that £60,000 per annum, as the amount of the saving, was a ridiculously low figure. From his experience of water-works, he thought the present scheme would be an immense boon to the population of Birmingham, as regarded economy, cleanliness, and health, and especially to the poor and to manufacturers.

Mr. J. W. Gray, M.Inst.C.E., the Engineer to the Corporation, said that his connection with the Water Department had lasted for 26 years, during which time he had designed and carried out all the works connected with the water supply. In several reports he had made to his Committee during the last few years, he had drawn attention to the fact that, as the demand for water increased, the additional supply would have to come from the present river sources, and therefore the quality of the water would be deteriorated as time went on. This had turned out to be the case; and complaints of bad water had increased. In 1888 there were 43; in 1889, 56; in 1890, 145; and in 1891, 279. This state of affairs caused him great anxiety. From what he had observed in the last few years, he believed the chief cause of the deterioration to be the water of the Blythe. All the water was raised by steam power; and the cost of the water in pumping alone, exclusive of the interest on the cost of works, was a very heavy annual charge on the Department, and had necessitated a large expenditure on capital account. He estimated, owing to the adoption of the water-closet system in Birmingham (the number, in 1886 only 7614, was now 27,620), and to the great addition of baths to houses of from £25 per annum upwards, that the average demand in 1900 would be 4½ million gallons per day in excess of the yield; and the maximum 9½ millions. This would mean a water famine. Consumption for trade purposes and street watering would have to be curtailed, in order that the domestic demand should obtain a part of its needs. Indeed, as the case at present stood, before works of any magnitude could be constructed, the Department would be compelled, unless Birmingham was to go short of water, to adopt measures to secure a further supply, either by extending drifts or tunnels from the present wells, or by sinking another well, which might tide over the difficulty for perhaps two or three years. But he was of opinion that one or two more wells would completely exhaust the water to be obtained from the sandstone formation within the district; and these might diminish the supply procured from the present wells. It had been suggested that two systems of supply might be adopted—one of well water for drinking purposes, and another of surface water for other uses. This would not be the means of reducing the supply per head of the population; and therefore more water would still be required. This scheme would necessitate the construction of special reservoirs, the laying of two lines of pipes, the erection of duplicate engine power for the whole district, the opening up of all the streets, and in each house the provision of additional lead pipes, taps, and cisterns. There were no natural sites on any of the streams in the neighbourhood of Birmingham where large storage reservoirs were capable of being constructed; and therefore fresh sources of supply would still have to be found, as in the present case. He agreed with the evidence given by Mr. Mansergh and Sir Thomas Martineau. He would be very sorry for Birmingham during the next five years if he could not find more water; and as regarded ten years ahead, Birmingham people must assist the Department as far as they could, by being careful, for he was perfectly certain that the supply would have to be curtailed.

The CHAIRMAN: You heard the evidence of the geologists. Does that accord with your general impression and experience of the neighbourhood—that no new sources can be found underground?

Witness: That is so. I may find one that may give me 1½ million gallons a day; but, in fact, I believe some of the water we get now is what has sunk into the sandstone from streams.

Mr. BALFOUR BROWNE: Taken as a whole, do you think that is practically the only scheme for Birmingham?

Witness: Not only that, but it is the best scheme possible.

What is your view of the dual system?—Well, nobody would care to wash clothes in dirty water, or to use it for baths. They would merely flush water-closets with it; and the water-closets of Birmingham would not use 2 million gallons a day. What was this against the expense of a duplicate system? Besides, there were a large number of trades who would require the clean, and reject the dirty water.

Cross-examined by Mr. FREEMAN: In a report which he presented to his Committee in 1891, he said that additional reservoirs might be erected on the Bourne, and good water obtained from that stream. The reservoirs he spoke of were to contain 1131 million gallons, and were to supply what was required for 20 years to come; but that was assuming Parliament would grant the Corporation the whole of the waters from that side. Since Birmingham was last in Parliament, however, it had become customary to give compensation water; and though Birmingham did not give any at present, it was probable that, if they approached Parliament in the matter, they would have to do so. He did not think 20 years was the period commonly looked forward to. No doubt it would be, for a small country place; but for a city like Birmingham, increasing by leaps and bounds, 50 years was not at all too long. As to the dual system, it would be dangerous to have two taps in a house, lest people should drink water drawn from the wrong one.

In answer to Mr. STANHOPE, witness said he had no doubt that some of the objections which had been made to the Birmingham well water were good also in regard to the South Staffordshire well water. Therefore the small towns between Birmingham and Wolverhampton would be glad of the alternative supply which Birmingham would be able to offer them. As a matter of fact, he believed they were asking Parliament for special terms.

In re-examination, witness said the Bourne scheme would have cost a million sterling. Having considered Mr. Mansergh's scheme alongside it, he had at once approved of that scheme, especially as the Committee had desired him to say whether or not temporary provision could be made for 25 years; and he had found it could not.

The inquiry was adjourned till the following day.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Tuesday, May 3.

(Before Mr. Justice KEKEWICH.)

Gadd v. Mayor, &c., of Manchester—The Gasholder Guiding Patents.

The hearing of this action, which involves the validity of Mr. Gadd's patent for the construction of gasholders without guide-framing, was resumed this morning. The previous proceedings are reported on pp. 628, 668.

Mr. *Edward Lloyd Pease* said he was Managing-Director of Ashmore, Benson, Pease, and Co., Limited, of Stockton-on-Tees. The firm were large manufacturers of gasholders. In the beginning of 1889, his Company first came into communication with the Manchester Corporation, with regard to constructing a gasholder. He had previously obtained a patent for improvements in gasholders—the provisional specification being dated Dec. 14, 1888; and the final, Sept. 13, 1889. The original contract with the Manchester Corporation was in May, 1889, and there was a supplemental contract on July 19. He produced the original drawings, which were in accordance with his own patent. The diameter of the holder was 100 feet. On May 24, 1889, he wrote to the Gas Committee suggesting that the new holder should be guided on the wire-rope system, which would enable a saving of £500 to be effected on the one holder. While this matter was under the consideration of the Committee, he sent a model to Manchester; and it was shown in the Secretary's office at the Town Hall. It was not a public exhibition; that was at the end of May, 1889. Two or three members of the Gas Committee were there that day; and the model was put in operation. Some further correspondence ensued, and the work, so far as it applied to his invention, commenced in July—before the date of the supplemental contract. Further drawings were made in connection with this contract, under witness's superintendence, including the descriptive notes. The special fittings for the ropes were sent from the factory in November, 1889; and shortly afterwards the ropes themselves. The gasholder was completed and used at the end of December, 1889. It was in accordance with the supplemental contract and working drawings, with the exception that the whole of the rope used was of the same section, whereas in the working drawings some was of larger section. During all this time, he had no knowledge of Mr. Gadd's patent now sued upon—but only of his spiral guide patent. His Company had erected other gasholders on the same principle—one at Haslingden, near Manchester, the contract for which was taken in July, 1889, and it was finished in September.

Cross-examined: He had taken an interest in gasholder construction since about the year 1885. He first heard of Malam's patent last year; and Wild's at the same time. The same with regard to Standfield's. His firm had been manufacturing gasholders for many years. There were no models of holders which had been constructed; but there were, of course, the working drawings. He did not examine those drawings before making his own. Prior to Mr. Gadd's patent of 1887, he was not acquainted with any method of guiding gasholders without guide-framing. He knew of the 1887 patent when working out his own invention. He read the *JOURNAL OF GAS LIGHTING*, but not regularly; and he did not remember an article referred to in August, 1888, alluding to Gadd's 1887 patent. In his patent, the wire ropes did not perform two offices—one to guide, the other to control. The provisional specification said the invention related to "guiding and controlling." The part of his invention which guided the holder up and down was the rope arrangement and nothing else. The rope controlled the holder by preventing it moving out of a horizontal position. He called the ropes check-ropes. The effect of them was that when one part rose, every other part rose also. The apparatus could be used with guide-framing, as well as without, if desired. That did not necessarily refer to adding a new lift to an old gasholder; but if he were putting up a new holder, he should not use external guide-frames.

Mr. WARMINGTON, Q.C., said that closed the defendants' case. He did not propose, in addressing his Lordship, to travel over the same ground which Sir Horace Davey had covered in opening, but mainly to bring out those points which his friend could not bring into strong relief until the evidence had been given. He would consider first, Mr. James Terrace's invention, as to which the evidence was quite plain, that Mr. Terrace, working quite independently of Mr. Gadd, had arrived at the same conclusion. Then the question was whether there had been any publication of this invention. There were he believed nine persons to whom it was communicated; and, of course, the suggestion on the other side was that in each case the communication was of such a confidential character as to make it not a publication in a legal sense. He submitted that the real question was, whether the person to whom the communication was made stood in such a relation to the inventor as to take him out of the category of one of the public. In several cases, there had been no attempt to place the seal of confidence on the communication; and even in the case of Mr. George Livesey, which he did not consider the strongest case, the suggestion that the matter should be kept private seemed to have come from Mr. Livesey himself. In one instance, the communication was said to have been made "as a mere matter of news." On the whole, he submitted there had been prior publication; and on this point he referred to the case of *Blank v. Footman* (5 Patent Cases, 653.), which was a case where the registration of a design was nullified because samples had been shown to several persons, and orders obtained, before registration. Learned Counsel then proceeded to make a few observations on the question of non-conformity or disconformity between plaintiffs' provisional and complete specification. All previous patents, whether they were anticipations or not, must be taken to be common knowledge, and were of importance in showing what part of the problem remained uncovered in dealing with the stability of a gasholder. The purpose here aimed at had been in view for many years; and therefore an inventor was not entitled to claim the benefit of the doctrine of mechanical equivalents. He

could only claim protection for a particular method of achieving a well-known and desired result. The Court always wished to protect the rights of an inventor; and to ensure him the reward of his exertions. But, on the other hand, it had to protect the rights of the public, and not allow their freedom of action, as the result of prior knowledge, to be interfered with. Mr. Gadd, in his evidence, said that the peculiar character of his invention was guiding a gasholder by means of gearing at the base, in such a manner that every point should be raised together; and that it included any known device for this purpose. Dr. Hopkinson's evidence was to the same effect; it admitted that an engineer reading the provisional specification would not be led to make the arrangements shown in the complete specification. Mr. Davy's evidence was much to the same effect; it showed they were trying to introduce into a patent of this kind that which could not be introduced into it, and to include in the patent all possible means of obtaining the same result. On the other side, Sir Frederick Bramwell's evidence was that the invention described in the complete specification was quite distinct from that shown in the provisional; and there was nothing to show that the patentee had even in his mind at the time this so-called tensional mode of carrying out his object. He did not propose to deal at length with the alleged anticipations, which had been commented on by Sir Horace Davey; but there was one point with regard to Malam and the Grantham holder to which he wished to draw attention in connection with one passage in the complete specification of the plaintiffs, which said that the wheels might be arranged either radially or tangentially, or at any angle desired. That passage seemed to be directly anticipated by Malam. On the whole, he submitted that the defendants had made out their case. The anticipations, alleged served a double purpose—first, to show what was the state of public knowledge, and how narrow was the field left for invention; and secondly, as direct anticipations of what the plaintiffs had claimed in their complete specification.

Justice KEKEWICH said one question occurred to him on which much evidence had not been given—what was the meaning of the term "floating structure," which occurred in Standfield's specification? He should probably hear from the Attorney-General that the term could not be applied to a gasholder.

Mr. WARMINGTON said, on this point, Sir Frederick Bramwell's evidence was distinct, that a gasholder was a floating structure.

The case was then adjourned.

Wednesday, May 4.

The ATTORNEY-GENERAL, replying upon the whole case, said there were three important issues raised—the first being whether or not there was a prior publication of a part of Mr. Gadd's invention by what he would call the Terrace incident. This would be fatal to the plaintiffs' case, unless it could be shown that the publication, whatever it was, was not such as ought to anticipate Mr. Gadd's patent. The second question was whether or not there was good subject-matter, having regard to Malam's and other anticipations. The third question would be whether or not there was such want of conformity between the complete and the provisional specifications as to invalidate the patent. The second issue involved the consideration of the question whether or not the problem was the same when dealing with a pontoon (taking this as a type) and with an inverted vessel like a gasholder. In reference to the first question—whether the Terrace incident invalidated the plaintiffs' patent—it was proved beyond all question, and not disputed by the defendants, that Mr. Gadd never had any notice of what Mr. Terrace had done until the morning of the 13th of December, when he received Mr. Terrace's letter with the one design in it which was undoubtedly identical with that which Mr. Gadd had previously sent in. It was not disputed that this design was in Mr. Gadd's original specification written out two or three days before. No doubt Mr. Terrace had also thought of it contemporaneously, and had shown it to somebody seven or eight days before. In *Newball v. Elliott*, which related to a machine for paying out a cable, a trial of the apparatus had taken place on a ship in the presence of the crew and a considerable number of other persons; but the Court found, as a fact, that it could not be tried experimentally in any other way, and that because it was an experimental trial it did not anticipate the invention. In Mr. Hindmarsh's book on patents, the proposition was stated very clearly that whenever it appeared that an act done before the date of the patent was not intended to be a publication of the invention, it would not be presumed to have amounted to a publication, unless it was clearly shown that the effect of the act was to publish to the world a knowledge of the invention. It could not be denied that the question was identically the same upon the point as to whether Mr. Gadd or Mr. Terrace was the original patentee. The first thing to be observed on this point was that it was clear Mr. Terrace did not at the time mean to prevent himself from taking out a patent. Of course, he might have done it as a matter of fact.

Justice KEKEWICH remarked that he did not think the Attorney-General need trouble himself about that.

The ATTORNEY-GENERAL said this being so, the next point to be discussed was: Had it the effect of preventing Mr. Terrace from taking out a patent? With reference to the list of names which had been mentioned by Mr. Warmington, it was to be observed that in every single case there was either a misunderstanding—that was to say, a dealing with the matter on such terms that the parties understood that they were being consulted confidentially—or they were in fact being so consulted. Mr. Livesey considered that he was being consulted by Mr. Terrace with reference to a possible invention; and he wrote back saying that he thought the thing ought to be patented. Therefore it could not be suggested that either the receiver or the sender considered there was any publication to the world. The learned Counsel then referred to the evidence and correspondence between the brothers Terrace and various gentlemen whom they consulted with reference to their invention, and submitted that the communications were made with a desire to obtain their opinion, and not with the intention of communicating the matter in question to the general public. This being so, the first branch of the proposition to which Mr. Hindmarsh referred must be answered in plaintiffs' favour. Next, the

second part of the proposition must also be answered in Mr. Gadd's favour, because the communications did not have the effect of publishing Mr. Terrace's invention. The only effect resulting from the communication was that persons were asked their opinion as to the merit of an invention which Mr. J. B. Terrace proposed to patent. Supposing his Lordship was satisfied, in all the cases in which it had been proved, by people who knew of it, either that they were being consulted in such a way that they were aware the thing was being confidentially communicated to them, or that they knew it was intended to be patented, and their opinion was being asked upon it, could it be said that, taking the propositions laid down by the Master of the Rolls (*Plumpton v. Malcolmson*) as to the test of whether it had become part of common knowledge, as a fact it had so become? Then there was the question whether Mr. Terrace did in fact publish his invention. Unless his Lordship came to the conclusion that, before the 11th of December, 1888, one or other of the individuals with whom Mr. Terrace consulted would have been justified in making a machine of his own, on the ground that Mr. James Terrace had not communicated the thing to him in such a way that he was merely asking his opinion upon the invention, but was telling him what he meant to use, the answer must be in the plaintiffs' favour. There was no case in which, where the publication was not intended by the man who published it to be communicated to the public, it had even been found to invalidate a subsequent patent. Dealing with the second point—as to whether or not there was good subject-matter having regard to Malam's and other anticipations—it must be remembered that the only evidence for the defendants was given by two gentlemen of great ability and experience, who were simply called in as experts to advise against the validity of the patent. The defendants had not ventured to put into the box a single person of experience in gas engineering, or in the making of gasholders, to indicate that the plaintiffs' invention was obvious, that it was common knowledge, or that it was a mere application of well-known mechanical principles. Sir F. Bramwell admitted that he had not had any practical experience in constructing gasholders, and had never, except in a single instance, designed one; and that he appeared in the case as a scientific witness, and nothing else. Although the defendants had called Mr. George Livesey, whose position was a unique one in the gas world, as their witness, they did not put to him a single question with regard to the arrangement by Mr. Terrace or Mr. Pease—that was to say, the two modifications which Mr. Gadd said he had invented and developed—being an application of common knowledge. Seeing that the anticipations relied upon in the defence were from thirty to sixty years old, and that they had never had the slightest relation to gas engineering, to the construction of gasholders, or of a single vessel coming into the same category, he (the Attorney-General) submitted that it not only did not form part of the stock of common knowledge in relation to gasholders, but that no person other than a scientific witness in a patent case could have seriously suggested that the anticipations were to be regarded as things to be compared with the alleged invention. With the exception of Staindrop and Malam, the whole of the alleged anticipations, and the models illustrating them, had been made, for the purpose of the present case, from the specifications; and it was justifiable to say that, unless people could be found who had been directed to the problem, and the solution of the problem, in those earlier specifications, they ought not to be treated as anticipations. The alleged anticipations, apart from Malam and Staindrop, were in connection with pontoons, or a similar kind of structure; and the elements of the problem were admitted by Sir F. Bramwell to be different when dealing with a pontoon to what they were when dealing with a gasholder. The learned Counsel then dealt at length with the evidence on this point, and proceeded to argue that a vessel analogous to a gasholder—viz., a pontoon—never rose out of its guides; but whether it did so or not, the guides were not dispensed with. Every single anticipation prior to this arrangement, except Mr. Gadd's own—that was to say, the spiral—was in connection with a machine which always had guides that operated on the side, right up to the top of it; and it never left those guides. The great merit of this invention was that, while there was a regulated vertical motion without any screw or sideway motion round the axes, the guides and guide-columns, which were a great source of expense, involving repairs, &c., could be dispensed with. As to Wild's patent, though it was some 37 years old, not only was there no proof of its ever having been made, but there was not the slightest evidence of its ever having been applied to anything but a pontoon. The first observation to be made with reference to Malam was sufficient to dispose of it as an anticipation—viz., that, as described in the specification, it would not dispense with side posts at all. Sir Frederick Bramwell admitted that both Malam and Staindrop intended to use side posts. In concluding his observations, on the second point, the Attorney-General submitted that there was ample subject-matter in Messrs. Gadd and Mason's patent, and that not one of the anticipations, which had been searched out with extreme ingenuity, prevented it from being good subject-matter. With regard to the third point—the alleged discrepancy between the provisional and complete specifications—there was only one case in which a patent had been upset for this reason. It was admitted that, if the language of the plaintiffs' provisional specification did not fairly include the subsequent development, the complete specification could not be read, and ought not to be read, so as to include what had subsequently been put into it. But it was not correct to say that Mr. Gadd must have had in his mind what might be called the particular device which appeared in his complete specification, and which came within the language used. The case stood thus—that, in fact, Mr. Gadd had invented his arrangement before December, 1888, and did not steal it, or take it from anybody else, and insert it in his complete specification. He had sworn that he never saw anywhere a description of what he put into his complete specification; but the whole of it was the result of his own thought and development. The learned Counsel then referred to the case of *Woodward v. Sansum*, and contended that the plaintiffs' complete specification was less outside the letterpress of the provisional specification than it was in that case, where the Court of Appeal decided against the defendant's contention of discrepancy. Without fear of adverse criticism, he (the Attorney-General) would say that the invention in the present case was most unquestionably the vertical

raising of the gasholder, so that all parts must be equally raised and lowered alike; and this was absolutely new. The torsional raising had been Mr. Gadd's own invention. The vertical raising and lowering of the holder, so that all parts were equally raised and lowered alike without torsion, was absolutely new; and this was done without guides and weights, and was applicable to the top, the middle, or the lower lift, or to any number of lifts, of the holder. The Attorney-General then dealt at considerable length with the evidence given with reference to the alleged discrepancy between the provisional and complete specifications. He said it was most important to remember that it was not suggested by Mr. Pease on behalf of the defendants, that they did anything more than the plaintiffs did. The circular motion had disappeared; and everybody agreed that it was not a material difference. Vertical motion without twisting round was the same—the amount of give-and-take of the one being replaced by corresponding take-or-give, as the case might be, of the other; and this by a gasholder which dispensed altogether with outside posts, weights, or anything of the kind. There was not a single thing done by the defendants that was not done by Mr. Gadd.

Justice KEKEWICH remarked that he did not think this was seriously in question.

The ATTORNEY-GENERAL said the whole question was: Had Mr. Gadd, by the terms of his provisional specification, prevented himself from performing his duty—not his right only—of describing other mechanical equivalents? He took his stand very boldly upon this ground, even if there was nothing in the provisional specification which included pulleys and guide-ropes, as they were simply mechanical equivalents. For the first time, vertical motion in a gasholder without guides, standards, or wheels running against them, applicable to all the lifts of a gasholder, had been described; and if there was nothing in the provisional specification to include this, unless fraud was alleged—unless it were said that Mr. Gadd stole this invention—he would be entitled to stop the infringement complained of. It was true to say that he did describe and did intend to describe, by language which was only applicable to the class of connection they were discussing, chain and link gearing, having the functions which had been proved to be their functions, and which had not been disputed by the witnesses on the other side. Under these circumstances, he (the Attorney-General) submitted that the complete specification was no more than the proper amplification of the provisional specification; and that the former was good, and the patent had been infringed. The learned Counsel then took his Lordship through the plaintiffs' drawing; and he concluded by contending that, applying to the plaintiffs' specification no lenient construction, but the ordinary principles of the duty of the provisional and that of the complete specification, it was a development of the invention which unquestionably had been first thought of by Mr. Gadd. There was no discrepancy, and no departure from the fair ambit of the invention; and he submitted that his Lordship's judgment upon this point, as upon the other two, ought to be for the plaintiffs.

His Lordship reserved his judgment.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Monday, May 2.

(Before Mr. Justice GRANTHAM and a Common Jury.)

Lumley v. New River Company.

This was an action in which the plaintiff, the proprietress of an oyster bar in the Euston Road, claimed damages for injuries and loss sustained by the leakage of water from the defendants' main (laid within a few feet of her shop) into her premises, which had happened, it was alleged, by the defendants' negligence.

Mr. WILLIS, Q.C., and Mr. G. A. VENNELL appeared for the plaintiff Mr. MURPHY, Q.C., and Mr. LYON represented the defendants.

The plaintiff's case, as stated by her in examination, was that she had owned the shop in question for several years, and had been carrying on a fairly good business, when, about two years ago, she found that water was coming into her house from below. She had the boards taken up and there found water to the depth of several inches. After all this had been got rid of, the place was still very damp; and the plaintiff said she had had rheumatic fever, which she attributed to the damp. In addition to the damage to clothes, carpets, bedding, &c., estimated at from £20 to £30, she had been obliged to get a new stove, new boards and papers, and have the rooms whitewashed. The plaintiff said her servant was also taken ill, owing to the damp state of the house, and had to go to the hospital. When the sum of £3 was offered to her for the purpose of getting coals, by someone representing the defendants, she told him that £500 would not compensate her for the loss of health alone, not to mention her damaged house and custom.

Mr. Saville, an architect and surveyor, deposed to having taken up the boards in the plaintiff's shop, beneath which he found water several inches deep.

Mr. MURPHY submitted that there was nothing to go to the jury, as there was no evidence that the water came from the main of the New River Company.

His LORDSHIP held that there was no liability unless negligence was shown on the defendants' part; but he declined to stop the case from going to the jury, thinking there was sufficient evidence.

No witnesses were called for the defendants.

Mr. WILLIS, in reply, asked whence came the water they had heard of; and he told the jury that when direct evidence could not be given in a case, they must draw their own inferences. The defendants had suggested that there were underground springs which had caused the damage; but there was no evidence of this.

Mr. MURPHY submitted that the Company had conducted their business in accordance with the obligations and powers imposed and conferred upon them by the 15 & 16 Vict., c. 160; and he denied that plaintiff had proved any negligence, omission, or default on their part.

His LORDSHIP having summed up,

The jury, after a short consultation, found a verdict for the plaintiff or £200.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Guildhall, Friday, May 6.

(Before Mr. Justice LAWRENCE.)

Walford and Co. and Others v. Buenos Ayres (New) Gas Company.

This case had its origin in the same proceedings which formed the subject of the action reported in last week's JOURNAL (p. 806). It will be remembered that Messrs. Walford and Co., were jointly interested with Messrs. Pope and Pearson in two cargoes of Silkstone coal—amounting together to 1259 tons—which they shipped to Buenos Ayres on speculation. Negotiations with the defendant Company resulted in a contract being entered into for the purchase of the coal at \$51½ paper. Two days afterwards the defendants learned that a mistake had been made in a cablegram, transmitted to them by their Manager, which contained his valuation of the coal, and on which they had based their offer. They immediately telegraphed to Messrs. Pope and Pearson cancelling the contract; and this led to that firm commencing the proceedings to recover £3226, the price of the coal. Before the trial of that action, the coal was put up for sale under an order of the Court. Plaintiffs received an offer of \$7 per ton for it; and defendants thereupon said they would give \$7 10. (amounting on the whole quantity of coal to £1812), and at this price a contract was made. After becoming possessed of coal, defendants alleged that it was damaged, and useless for gas making, and deducted 10 per cent. from the contract price; and the present action was brought to recover the full amount.

Mr. BIGHAM, Q.C., and Mr. LECK appeared for the plaintiffs; Mr. BOWYER represented the defendants.

It was contended on behalf of the plaintiffs that the coal was such as was known as Silkstone gas coal; and it was denied that it had deteriorated. For the defendants, it was submitted that there was an implied warranty—it having been described as Silkstone gas coal; and that, although some months ago it might have properly been called gas coal, at the time of the contract it had been damaged by water, and had deteriorated to such an extent that it was not suitable for gas making. Further, defendants had had no opportunity of inspecting the coal, as it was stored at Buenos Ayres, and the contract was made in London.

His LORDSHIP held that this was a sale of a specific article, and that there was no warranty; and he therefore gave judgment for the plaintiffs. [The difference between the sum paid and the amount of the contract was £181 12s. 9d.]

HIGH COURT OF JUSTICE, IRELAND—QUEEN'S BENCH DIVISION.

Thursday, April 28.

(Before Mr. Justice GIBSON and a Special Jury.)

Gordon v. The Belfast Corporation—Damages for Injuries Caused by and Explosion of Gas.

In this case Mr. Samuel Gordon, a stationer and grocer, of Ballymacarrett, Belfast, sought to recover damages for injuries to his premises and himself caused by an explosion of gas, owing to the alleged negligence of the Corporation of Belfast.

Mr. O'SHAUGHNESSY, Q.C., Mr. CRAIG, Q.C., and Mr. KEIGHTLEY appeared for the plaintiff; Mr. OVEREND, Q.C., Mr. BATES, and Mr. HARRISON for the defendants.

Mr. CRAIG, in opening the case, said that plaintiff carried on a trade in stationery and newspapers, and he was also engaged in the grocery business in a small way. On Dec. 24 last, he noticed a smell of gas in his shop; and he at once communicated with the Corporation. Soon afterwards a person named Watson came from the Corporation; and after he had worked in the shop and at the meter for a considerable time, he entered the kitchen, where the plaintiff and a man named Fagar were sitting, and said the gas was all right then. When plaintiff afterwards went into the shop, Watson asked him for some matches, and went towards a gas-jet close by the meter. Almost at the same moment a person came in to purchase a paper; and plaintiff was going round to supply him as an explosion occurred. The whole shop was thrown into confusion, and the windows were blown out into the street. The plaintiff's house was a corner one; and the gable end was in a place called Young's Row, where there was a gas-main belonging to the Corporation. Within an hour after the explosion, Watson became alive to the actual state of things. He went out, and examined the main in Young's Row; and it was found that it had been broken right through. The subsoil of the street was soft; and the gas percolated through it underneath the foundations of the house. Plaintiff was suffering from varicose veins in one of his legs, and had, in consequence of the explosion, sustained severe injuries; having been four months under medical care.

Mr. Gordon was then examined. He stated that his stock had been made unsaleable by the explosion; its value being £165. After the explosion, he was flung on his head and shoulders. He had had the house built at a cost of £400; and he made a profit of £3 a week.

Mr. OVEREND, on behalf of the defendants, said that on Dec. 24 last a message from the plaintiff was received at the gas office to the effect that gas was escaping at his premises. This was reported by one of the clerks to the inspector of mains; and he despatched a competent man to make an examination of the premises, to find the source of escape. They had done everything they thought necessary.

A number of witnesses were called as to the injury to the premises.

James Watson, who was sent to search for the escape, was examined, and said so far as the service-pipe and the connection with the meter were concerned, they were all right. He could tell whether gas was escaping by the smell.

In cross-examination, witness stated that he was a pipe-fitter, and not a gas-fitter.

Mr. Munce, Assistant City Surveyor, described the condition of the premises; and said he estimated the damage to the building itself at about £40.

The jury returned a verdict for the plaintiff, and awarded him £300 damages.

SUNDERLAND POLICE COURT.—Friday, May 6.

(Before Alderman POTTS, Chairman, and Messrs. SANDERSON and SIMEY.)

The Liability of Sulphate of Ammonia Stills for Excise Duty.

To-day an action brought by the Inland Revenue against the Sunderland Gas Company, to test the question of their liability for the payment of Excise duty on their stills employed in the manufacture of sulphate of ammonia, came before the Court.

Mr. ALPE appeared for the prosecutors; Mr. EVANS represented the Company.

On the case being called,

Mr. EVANS said he declined to plead, as he took objection at the very outset. The summons was issued against the Sunderland Gas Company, by the Excise authorities at Somerset House, on the information of a Sunderland officer. It was a prosecution under an Act passed in 1846 (9 and 10 Vict., cap. 90), which made it compulsory for a licence to be taken out by any person who kept a still, and imposed a duty of 10s. on the still, and in default a penalty not exceeding £50. He pointed out that the Company were constituted by a private Act of Parliament, and therefore became a body corporate. He held that they were incapable of pleading to a criminal information—that a body corporate, being an artificial person, could neither be indicted nor brought before a criminal court; and supposing the Bench were to make the order to pay the penalty (£50), they could not imprison an artificial person.

Mr. ALPE replied that this question had only recently been settled in a case in which the St. Helen's Tramway Company were concerned; and it had been held that the Company were amenable.

Mr. EVANS: It is quite a different case. The old law holds good that "a company has neither a body to be kicked nor a soul to be saved."

The Bench decided that the case should go on.

Mr. EVANS: Then I decline to plead.

Mr. SIMEY: If you decline to plead, you should decline to appear.

Mr. EVANS: If I appear, I do so under protest.

Mr. ALPE: I must ask that my learned friend plead.

Mr. EVANS, after seeing a note taken of his objection, stated that he appeared under protest, and pleaded "Not guilty."

Mr. ALPE then proceeded to detail the circumstances of the case. He said defendants were charged with keeping a still without a licence on the 19th of February last. The still was kept at their works at Hendon, in the borough of Sunderland, and it was part of their sulphate of ammonia plant. After explaining the Act under which the prosecution was being conducted, he stated that, if the Company had applied to the Inland Revenue, they would have been granted a certificate which would have relieved them from supervision. He urged that the Company, by not taking out the necessary licence, must be regarded as a Company who kept a still without having taken out a licence. It was a plant for the distillation of gas liquor; and it consisted of two stills, one upon the other. These were used for transforming the liquor into sulphate of ammonia, and they could, if convenient, be used for the distillation of alcohol. He would now simply call the evidence.

Mr. W. H. Young, Supervisor of the Inland Revenue at Sunderland, gave evidence as to visiting the gas-works, and inspecting the plant, which he fully described, with the object of proving that the Company kept a still.

Mr. J. Steel, Superintendent Inspector of the Inland Revenue, London, gave evidence as to examining the plant in question. He said that, in his opinion, it was a still.

Cross-examined by Mr. EVANS: That which a still commonly produced was a liquid. The ultimate production in the present instance was a salt.

Mr. EVANS: Is there anything in the present plant which you can describe as corresponding to the worm of a still?

Witness: No; the actual worm is not there.

Mr. Lewin, Senior Analyst at Somerset House, gave evidence as to the definition of a still. He said he had seen the plant at the Hendon Gas-Works, and was decidedly of opinion that it was a still. A still was simply an apparatus to produce a vapour; what the ultimate use of that vapour was, did not change the still. The apparatus was a still, whether the ultimate product was a liquid or a solid.

This closed the case for the prosecution.

Mr. EVANS, for the defence, said that, although he appeared nominally for the Sunderland Gas Company, he in reality represented the Association of Sulphate of Ammonia Manufacturers of Great Britain, who considered that an attempt was being made to foist upon them an unjust tax. The apparatus in dispute had been known for upwards of 30 years; and since that time no attempt whatever had been made to tax it. The officials of Somerset House had evidently, up to quite recently, considered that it did not come within the Inland Revenue Act, which was for the prevention of the manufacture of spirits by unlicensed persons. The Association were determined to resist what they thought to be an idea of the officials at Somerset House to introduce, in an unconstitutional manner, a tax which was never intended by Government to be imposed. If they had wished to put a tax upon an apparatus such as that in question, they should have gone about it in a constitutional manner, and introduced into Parliament a Bill for the purpose, instead of raking up an old Act which was never intended to be applied to cases like the present. In the apparatus at the gas-works, there was no condenser; and the Act clearly pointed out that a still must consist of three parts—a body, a head, and a worm. In the present case there was neither worm nor head. If the officials defined a boiler as a still, then, to carry the thing to its legitimate conclusion, an ordinary kettle was one. The use of a still was to produce a liquid; and in this case the ultimate product was a solid. They could draw no comparison between the two.

Mr. Achroyd stated that he was a Consulting Chemist, and he practised in Halifax. He was the County Analyst, and had had considerable experience in chemistry. In his opinion, taking the apparatus as it stood, it could not be used as a still. It had no worm, and was without several essential parts necessary for distillation.

Cross-examined by Mr. ALPE: It could not be used economically

for the purposes of the distillation of alcohol; but alcohol could be produced by it.

After a short private consultation, the Bench dismissed the case; an application for the costs of the defendants being refused.

It is understood that the decision will be appealed against.

MARYLEBONE COUNTY COURT.—Wednesday, May 4.

(Before Mr. H. J. STONOR, Judge.)

Bradley v. The Gaslight and Coke Company—An Important Decision under the Employers' Liability Act.

To-day his Honour gave a considered judgment in an important case heard by him at the March Court; the facts being as follows:—

On the 6th of August last, the plaintiff was in the employ of the defendant Company, working in the erection of certain machinery in the retort-house in their works at Kensal Green. He was engaged in pinning up with brick a cast-iron retort, which was held in position temporarily by a wooden strut, part of the Company's plant. This strut was displaced by some bricks falling upon it, and, in consequence, the retort fell on the plaintiff, inflicting serious injuries, in respect of which the action was brought. The plaintiff asserted that the accident happened through the strut being placed against the opposite iron retort instead of against a flat piece of wood, as the other struts were fixed. The defendants denied this, and also that the accident was occasioned in this way. They further alleged that it would have equally happened whether the strut were placed against the iron or the timber. At the conclusion of the plaintiff's case, it was submitted, on behalf of the defendants, that he ought to be non-suited, on the ground that the machinery in question was incomplete, and not then "connected with or used in the business" of the Company within section 1, sub-section 1, of the Employers' Liability Act. His Honour declined to stop the case; and it was arranged that the questions of fact, as to the defect in the condition of the machinery and the damages, should be left to the jury, and that the question of non-suit should be reserved. The jury found in favour of the plaintiff, and assessed the damages at £150. Upon the question of non-suit, the defendants' Counsel relied upon the decision and *dicta* of the Judges of the Divisional Court in the case of *Howe v. Finch* (L.R. 17; Q.B.D. 187), where the defendants were constructing an external wall of a building intended to be used as a warehouse, but which had not been used at the time the accident occurred through the wall falling upon the plaintiff. The Court held that the facts did not show "a defect in the condition of the works connected with or used in the business" of the defendants within the sub-section in question; and Mr. Justice Mathew said "he did not think it was intended to apply to a case where machinery was brought into a place, intended to be used, and left so insecure that it fell"—a *dictum* which very nearly met the present case, but appeared to have been unnecessary to the decision of the matter then before the Court. Mr. Justice Mathew concluded his judgment with the observation that "the damage by the fall of a wall in course of erection cannot be spoken of as arising from defective works actually occupied or actually used for the purpose of business," as to which his Honour observed that the Act does not require that works should be actually occupied or actually used, but only that they should be "connected" with the business of the defendants. Mr. Justice A. L. Smith gave judgment to the same effect; concluding as follows: "'Ways' means the ways used in the business, not partly made ways not used. If that be so as to 'ways,' it is as to 'works.' I do not agree that, if a whole structure fell or caused damage to a workman, he would not have a right of action, for I think he would. But here it was partly finished. I think 'ways, works,' &c., mean the existing and completed works." His Honour said he could not, in the present case, come to this conclusion, although some of these *dicta* certainly appeared to apply; but he thought the case might be distinguished from that of *Howe v. Finch*. The circumstances under which the plaintiff in the latter case was injured scarcely appeared in the report, and might have been very material to the decision arrived at, apart from the construction of the Act. It did not appear in the report whether the defendants were themselves building, or engaged contractors or builders for the purpose, nor whether the building was upon the same premises as those on which the defendants actually carried on business, or upon other premises, nor whether the plaintiff was engaged in the defendants' business, and necessarily passing the wall in question, at the time of the accident. This rendered comparison of that case with the present difficult and unsatisfactory. It was, however, clear that the wall in *Howe v. Finch* was part of a building which not only had not been used, but might never have been used, for the purposes of the defendants' business; while in the present case the machinery the plaintiff was employed in erecting was intended as an addition to machinery actually in use, and was not only intended for the defendants' business, but could not be otherwise employed. His Honour could not see how it could be said that such machinery was not "connected with" the defendants' business. The question as to the completion or use of this machinery appeared to him to have nothing to do with its "connection" with the defendants' business. Under these circumstances, he considered the plaintiff had made out a case to go to the jury, and that he was entitled to judgment under sub-sections 1 and 2 of section 1 of the Act. His Honour concluded as follows: Since preparing this judgment, I have seen the case of *Brannigan v. Robinson* (1892, 1 Q. B., 344), in which Mr. Justice Wright, referring to the case of *Howe v. Finch*, seems to have felt the same difficulty as to the facts of the case which I have, and to have assumed that the building in that case was erected by a builder and not by the defendants themselves, and was in the possession of the builder at the time of the accident; and this, perhaps, was the true ground of that decision. If so, it presents an additional marked distinction between the case of *Howe v. Finch* and the present.

Slough Gas Company.—The ordinary general meeting of this Company was held on the 2nd inst.—Mr. R. Martin in the chair. The profit on the working in the six months ending Dec. 31 last was £602, which with the balance allowed of the usual dividends.

MISCELLANEOUS NEWS.

THE DANGER TO GAS AND WATER PIPES AND FITTINGS FROM THE PROXIMITY OF ELECTRIC LIGHT WIRES.

Early last month, the Secretary and General Manager of The Gas-light and Coke Company (Mr. J. Orwell Phillips) forwarded to the Board of Trade two reports made to him in reference to the destruction of a gas-meter by electricity in Piccadilly. The matter was promptly investigated by the Electrical Adviser to the Board (Major Cardew, R.E.); and a copy of his report thereon was transmitted to the Company. We have been favoured by Mr. Phillips with a copy of the document; and as the subject dealt with therein is of special interest to owners of gas and water pipes and fittings, we reproduce the principal portions.

Major Cardew opens his report by stating that his attention had been called to the accident to the gas-meter, as well as to two very similar cases of damage to water-pipes, by the Clerk to the St. James's Vestry (Mr. H. Wilkins). It appears that a lead water-pipe, supplying the premises of a Mr. Barker, a pastrycook, whose shop is closely adjacent to the building wherein the meter was destroyed (occupied by Mr. Peat, a saddler), had been eaten through on two occasions within a few months. Major Cardew examined a piece of the damaged pipe; and its appearance suggested electric action. This was supported by the statement of Mr. Barker's employees, who averred that they had sustained electric shocks from touching the handle of a water-tap on a boiler in metallic connection with the lead pipe. As the possibility of electric shocks was a very serious matter, Major Cardew lost no time in having the main of the London Electric Supply Corporation exposed. This main terminates in a dead-end nearly opposite Mr. Barker's shop; and it was thought possible that there might be serious leakage from this. But it turned out to be in very good order; and no shock whatever could be obtained from the outer casing of the main. The action on the water-pipes also was much more likely to be occasioned by a main supplying continuous current. On the 29th of March, Major Cardew examined the gas-meter; and its appearance was thoroughly in accordance with the theory of galvanic or electrolytic action as the cause of the damage. Two holes had been eaten through the back, where it had been in contact with a damp wall; but the rest of the meter did not show any signs of corrosion. On the 30th of March, Major Cardew received an intimation from Mr. Wilkins that Mr. Barker's water-pipe had again failed. The ground was opened to remove the defective pipe, exposing a portion of the culvert of the St. James's and Pall Mall Electric Light Company, which was laid just above the water-pipe; and by means of a few tests with a galvanometer, proof was afforded that there was a steady difference of potential of about 6 volts between the iron culvert and the pipe—the culvert being negatively charged as regards the pipe. This appeared to Major Cardew sufficient to account for the mischief; and he communicated to the Chief Engineer of the Electric Light Company the results of his test, and requested that notice might be given when the culvert was opened, in order that he might be present. He was informed that this would be done on the morning of the 5th ult.; but on account of some very important experiments with the new standard ampère balance, he was unable to make the inspection until the afternoon, by which time the culvert had been partially opened. There was a good deal of water in it, and in some places this had evidently touched the positive main. There were also three lead-covered wires, which had been used as "pilot wires," lying loosely at the bottom. Two of these wires had been fused (evidently by a considerable current), and a good deal of the insulation burnt, as was evidenced by a sooty deposit on the main conductors and the culvert at the spot. This had occurred at two separate places—one being near Mr. Barker's shop, and the other opposite Mr. Peat's. Major Cardew has little doubt that a connection between the negative conductor and the iron of the culvert was effected by the fused and stripped ends of these pilot wires. This is confirmed by the following facts: At the time of his inquiry into the explosions which occurred on the Company's mains, he found that the insulation of the negative side of their system from earth was very defective. This fault was very persistent; but until the culvert was opened it had not been localized and removed. Immediately, however, this section was disconnected, to enable the culvert to be opened, the fault disappeared; and the potential of the positive main from earth, which had been persistently about 190 volts, fell to about 110 volts.

Major Cardew considers the explanation of the action to be this: The negative *main* has for some months been in metallic connection with the culvert in one or perhaps two places in this part of Piccadilly. If the insulation of the positive *side* had been perfect, no electric action would have resulted. But this was not, and in fact practically could not be, the case. Consequently, a leakage current was continually passing to earth from the negative at this place, and an equal current in the aggregate from the positive side through many small leaks. The lines of flow of the current would be to absolute earth or zero potential in all directions. Any water or gas pipes in the vicinity would be practically at zero potential throughout, on account of their metallic connection with the whole mass of the water or gas mains of London. Consequently, the lines of flow of the current would, to a large extent, converge on any such pipes in the immediate vicinity, if only separated from the charged conduit by damp earth. In other words, there would necessarily be a flow of positive electricity from such pipes to the surrounding earth, and thence to the charged culvert. But the flow of positive electricity from a metal into a damp medium, or water, is always necessarily accompanied by the generation of oxygen at the surface of the metal, which, if oxidizable, is thereby corroded. This is the action which has destroyed the water-pipes. The gas-pipe happened to be laid in bitumen, and was thereby protected; but the gas-meter, touching a damp wall within the influence of the leakage, was affected.

The state of the system of the St. James's and Pall Mall Electric Supply Company, so far as it has been brought to Major Cardew's

notice, may be briefly summed up as follows: In September last, two explosions occurred, due to accumulations of gas and water respectively—a faulty pilot wire causing the explosion of gas. On the 3rd of November, he held an inquiry into these explosions; and, from information given by the Engineer to the Company, he proposed a test, which was carried out shortly afterwards, and revealed the existence of a very serious earth connection on the negative main. This the Company were unable to localize and remove, and it continued in existence until the 5th of April, when it was removed by disconnecting the section of main opposite Mr. Peat's. The local effect of this fault has been the damage now reported upon. But it is certain that an equivalent oxidation of metal must have occurred on the positive main, or the house wires and apparatus connected with it; and it is not yet proved that this destruction has been so distributed as not to amount to material damage at any one point. On examination, it is again discovered that the fault originated in the pilot wires. In his report on the inquiry, he recommended that the Company should at once remove all pilot wires from the interior of their conduits. The Company stated, in answer to this, that they would, as far as possible, be removed; but that they found the wires had in many cases adhered firmly to the bottom of the culvert, and could with difficulty be detached. In the portion of culvert which was opened on the 5th ult., these wires did not, however, appear to be adherent to it in any part.

Major Cardew considers that the steps to be taken by the Board of Trade to provide against the recurrence of similar faults and their consequences will require very mature consideration; but he says that he has no hesitation in recommending that the Company should, without further delay, remove every portion of the pilot wires from their culverts, and should test throughout their system for the existence of any appreciable difference of potential between the iron culverts and the gas and water pipes.

Since Major Cardew's report was made, Mr. G. F. L. Foulger, the Distributing Engineer of The Gaslight and Coke Company, has reported to the Secretary and General Manager another case of damage by electric current to a meter and fittings at No. 56, Pall Mall. He states that the Company have a 10-light check meter fixed at the top of a water-closet in the bath-room on the second floor, near to a small cistern, the water-supply pipe of which touches the back of the meter, near which are electric fittings. The gas is used for heating purposes only, and is now, by request of the consumer, temporarily dispensed with. On the 25th ult., the occupier was startled by the noise of an explosion. The housekeeper saw smoke in the passage; and, perceiving a smell of gas, at once turned the tap off at the meter. The meter and fittings were damaged, and also the cornice and ceiling. Apparently there was a small escape of gas from the consumer's fittings; and this was evidently ignited by the electric current. The Company's inspector informed his chief that he subsequently saw electricity issuing, in the form of a blue spark an inch long, from the electrical fittings at the point in question. The ignited gas melted the solder on the top of the meter, as well as the lead inlet-pipe. Mr. Foulger adds: "I cannot too forcibly call attention to the dangers these electric wires present to our fittings; they arise in such a variety of ways hitherto unsuspected by electrical engineers, and also, I apprehend, by insurance companies. The risk of fire being attributed to us, when all evidence of the real cause may be effaced, is, to my mind, a very grave one."

THE BIDEFORD TOWN COUNCIL AND THE GAS COMPANY.

Further discussion on the question of the purchase of the gas-works and the adoption of electric lighting took place at the meeting of the Bideford Town Council yesterday week. The Gas Committee reported that the Gas Company had offered to sell their works to the Town Council for £16,000, plus the value of stock, residual products, &c.; and that they had made a counter-offer of £13,000, and the stock at a valuation. The Committee had, however, received no reply to their offer. Mr. Ascott expressed his conviction that the Directors of the Company were simply keeping the Council "dilly-dallying" about until it was too late to oppose their Provisional Order. It was decided that a meeting to specially consider the situation should be held on Wednesday. This meeting was accordingly held; and, at its commencement, Mr. Squire said, as no communication had been received from the Gas Company, he proposed that the estimate from Messrs. Tardrew and Son for the supply of electric lighting be opened. This was agreed to. The estimate stated that plant for the electric light would cost about £4680, and the annual cost of maintenance something like £620. Mr. Squire observed that the cost of maintenance was rather more than he expected. It appeared to him, however, that, if the Council erected an electric lighting plant of their own, they could supply private consumers, and make a profit. In answer to Mr. Restarick, the Mayor said the Council last year paid the Gas Company £490 for lighting the town lamps. The question of electric lighting was referred to a Committee. Mr. Narraway then proposed that the Council offer the Gas Company £14,000 for their works. This would be at the rate of £20 per share, plus 10 per cent. for compulsory purchase. He thought that opposing the Provisional Order in Parliament would be unwise, and a waste of public money. The Council should, however, see that a clause was inserted giving them power to acquire the Company's works at a future date, if they did not do so shortly. Mr. Squire, in seconding the proposition, said if the Company would not meet them, the best course would be to put up an electric lighting plant of their own. Mr. Braund believed that, however much the Council tried, they would not get the Company to take less than £16,000. This was clearly their price; and to offer less was, in his opinion, a waste of time. Mr. Pollard maintained that the Council, by expending £7000, could erect better and more modern works than those owned by the Company. He favoured the suggestion to oppose the Provisional Order in Parliament. The resolution was carried by eight votes to three. On the suggestion of the Mayor, it was resolved that the members should meet in Committee, and consider the clauses of the Company's Order *seriatim*.

IMPERIAL CONTINENTAL GAS ASSOCIATION.

The Half-Yearly General Meeting of this Association was held last Tuesday, at the City Terminus Hotel, Cannon Street, E.C.—Sir JULIAN GOLDSMID, M.P., in the chair.

The SECRETARY (Mr. R. S. Gardiner) read the notice calling the meeting, and subsequently the following report of the Directors:—

The present half-yearly ordinary general meeting of the proprietors has been convened in conformity with the Association's Acts of Parliament, for the purpose of receiving a report from the Directors upon the affairs of the Company, and of declaring a dividend for the half year ended the 31st of December last.

The following summary shows the results of the Association's operations during that period:—

The quantity of gas made in the half year ended the 31st of December last was 4261 million cubic feet; and the quantity made in the corresponding half year of 1890 was 4163 million cubic feet—being an increase of 98 million cubic feet, or at the rate of 2·36 per cent.

The total number of lights on the 31st of December last amounted to 1,975,039; there being at that date 136,452 consumers on the books of the Association. At the close of the corresponding half year of 1890, the number of lights was 1,901,253, which gives an increase of 73,786, or at the rate of 3·88 per cent.

The entire length of mains on the 31st of December last was 1605 miles; and the length of mains laid on the 31st of December, 1890, was 1546 miles—an increase of 59.

The gas-rental also shows an increase on the corresponding half year; but the profit earned has been somewhat less, owing chiefly to the excessive cost of coal; the value of coke and other residual products having remained about the same.

The plant and mains at all the stations were maintained in a due state of efficiency; and the new gasholder on the Association's Tabor Works at Vienna was successfully brought into action.

The Directors have to report that they have obtained a prolongation of the concessions for the lighting of Berchem and Borgerhout—suburban Communes of Antwerp—until the year 1927. They have also obtained concessions for the lighting of Haaren—a suburban Commune of Aix-la-Chapelle—and of Zehlendorf and Friedenau, suburban Communes of Berlin.

The Directors have sold land for which there was no further use at Aix-la-Chapelle, Berlin, Ghent, and Rotterdam, and have purchased land at Frankfurt.

The Directors have to record with regret the retirement from the Board, on account of ill-health, of Mr. George Simpson, who had given them useful assistance for thirteen years. They have filled the vacancy thus created on the Board by electing Sir James Carmichael, Bart., a Director of the Association.

They have further only to draw the attention of the proprietors to the accounts for the half year ended the 31st of December last. These have been duly audited; and from them, the Directors have, in accordance with the provisions of the Companies Clauses Consolidation Act, prepared a scheme showing the profit of the Association for the half year, and the portion thereof applicable to the purposes of dividend, which they recommend now to be declared—namely, a dividend of 5 per cent. for the half year ended the 31st of December last, and a bonus of 1 per cent., both payable, free of income-tax, on and after the 1st day of June next.

The Directors who go out of office by rotation are: Clarence Pigou, Esq., the Hon. E. C. Leigh, John Horsley Palmer, Esq. These gentlemen are eligible for re-election, and offer themselves accordingly. The Auditor who goes out of office by rotation is Montague Somes Pilcher, Esq., who is eligible for re-election, and offers himself accordingly.

The CHAIRMAN said that it would not be necessary for him to detain the proprietors at any length on this occasion, though he would pursue the usual course at their meetings, and make a few observations upon the working of the half year, after which he would tell them anything which he considered of interest that had occurred since the accounts closed on Dec. 31. It would probably have been observed that the balance of profit was less than that of the previous half year, and considerably less than that of the corresponding period of the previous year. He informed them upon the last occasion—and he remembered it with regret—that he entertained some hopes that the balance of profit would be larger than it was last half year; but there were two reasons why this had not proved to be the case. The balance of profit for the six months ended the 30th of June last was something above £243,000; and during the half year under review, it was £233,000—showing a diminution of £10,000. The reason for this was very simple when they came to consider the matter and go into the figures carefully, as he had considered it his duty to do. Eighteen months ago, there were strikes and threatenings of strikes all over the Continent; and the result was that their engineers, in common with many others, thought they might have great difficulty in observing the strict regulations of their contracts, supposing that they were prevented from obtaining the necessary supplies of coal; and with the consent—the mistaken consent—of the Directors, they ordered at that time more coal than was then really required. Unfortunately, the coal was very dear; and the strike did not take place. If it had, they would all have been abundantly justified. But it did not; and therefore they had had rather more coal in stock than had turned out to be necessary. The result was that dear coal had extended over a somewhat longer period than would otherwise have been the case, and had come into the present accounts; whereas—this he could tell them with confidence—they knew that during the current half year coal would be obtainable at lower prices, and therefore a larger profit could be expected. It was owing, therefore, to the abundant caution of the officers and Directors that the diminution mentioned in the balance of profit had occurred; but this did not account for the whole of the decrease. He believed that, in spite of what he had said, there would not have been anything like the difference mentioned but for the exaggerated view which had been taken in the Accountants' office in London. Those gentlemen had thought that certain figures—which it would be too complicated to consider, amounting in all to £8000—ought to be written off the half year. He was away at the time through illness in his family; but he was satisfied (as he believed all the Directors were now) that it would have been fair to spread the amount in question over a much longer period. The result, therefore, would have been, with the figures he would have presented, that the difference in the balance of profit would have been only £2000. Be that as it might,

however, he could assure the proprietors that, under the circumstances, the results shown were, in his opinion, by no means unsatisfactory. Their working exhibited as little loss of gas by leakage as, he believed, any other company on the Continent or in England. He had been frequently asked what the result of the extension of electric lighting was upon the business of the Association. He had told the inquirers that he had hoped—that they all hoped—that other forms of extension in the use of gas would compensate for the disadvantage of the electric light being used in many great establishments instead of gas. He was examining, upon this head, only a few days ago, the accounts prepared with respect to the use of cooking-stoves at their different stations. There was no doubt that in some towns cooking-stoves were much more popular than in others; but he was convinced—and he had figures which showed it—that the loss in gas consumption at night would be very largely replaced by the consumption in the cooking-stoves. This was a large business, which he believed was being extended by many other companies besides their own; and he looked forward still to a considerable increase under this head. Of course, in a great city like Berlin—for instance, in the splendid thoroughfare known as Unter den Linden—they must expect that the modern taste for the electric light would be considerably developed. But this affected the town gas-works at least as largely as their own; and they did all they could fairly to combat it. He still believed there was plenty of work for gas to do; and that the proprietors ought not to be disheartened because of the competition of the electric light. There was no other special matter concerning the business of the half year, excepting the fact that they had made some extended contracts with the suburbs of some of the big towns which they lighted. He had always told the proprietors—and he thought it his duty to repeat it—that it was in very rare cases only that gas companies on the Continent were freeholders; and therefore they had always the possibility of negotiations for the extension or entry into any particular town not being successful. He could honestly say that this question of negotiation was the most arduous part of their work; and the one which showed the least to the general public, and also to the shareholders. But he could assure them that all the Directors were only too anxious to extend contracts, and that they always did all they possibly could to meet the reasonable views (they were not always reasonable) of the authorities with whom they had to deal. So much for the business of the half year. It was, he thought, the ordinary record of industry on the part of their officers. They had endeavoured in every possible way, he believed, to meet the legitimate requirements of the public; and he thought that, on the whole, their efforts had not been unsuccessful. During the half year they had lost, by resignation, the services of Mr. George Simpson. Years ago now, he (the Chairman) being—excepting the Deputy-Chairman, Mr. Newton—the senior member of the Board, invited Mr. Simpson to join the Board. That gentleman had special knowledge of the uses to which tar might be applied; and he had large business experience. He considered Mr. Simpson's special knowledge would be useful to the Board; and he had the pleasure of inviting him to become a member of it. Failing health had compelled him—he believed to his own regret, and certainly to the regret of the Directors—to leave them; and it became their duty to supply his place with someone whom they considered competent to assist in managing the affairs of the Association. He had no difficulty in recommending the Directors to elect his friend Sir James Carmichael, who had seen public and private service, and who was a man of good judgment and large business experience. The Directors, therefore, had had much pleasure in adding him to their ranks; and they trusted that his devotion to their service would prove their judgment to be well justified. With regard to what had occurred since the 31st of December, he did not know that much had happened. One of their oldest officers (Mr. L. G. Drory), their Chief Engineer at Berlin, who had acted as Inspecting Engineer for a few years, had found the latter part of his duties too arduous, and had therefore given it up, remaining as Chief Engineer at Berlin only. They had consulted—he thought to the advantage of the Association, and therefore of the shareholders—a most distinguished outside Engineer, Mr. Corbet Woodall, who had given them the benefit of his experience, which was not confined to the Continent or to England only, but extended, he believed, to many parts of the world. He believed they had exercised sound judgment in this respect, and that Mr. Woodall's knowledge would be of great use to the Association. Then came an even more important matter to them than this. For many years their offices in London had been in Clement's Lane. He had told them before that, in consequence of the extension of their business, the number of clerks crowded into those comparatively small premises was extremely large; and that, for the purpose of doing their business well, and as regarded the health of their employees, the place was very badly arranged and ill-adapted to their requirements now. Some time ago, therefore, they purchased a site in Austin Friars, upon which new buildings had been erected for them; and in the course of two or three weeks, they hoped to transfer their offices there, when they would be well housed. These matters were about all that had occurred since the close of the year. They were discussing various questions still at the Board which might be of benefit hereafter to the Association; but whether their sittings were long or short, he was quite certain of this—that they all acted with the single-minded desire to promote the interests of the proprietors, and to produce the best result they could at their half-yearly meetings. He concluded by moving the adoption of the report.

Mr. NEWTON seconded the motion, which was at once unanimously adopted, without discussion.

The CHAIRMAN then proposed the payment, free of income-tax, on and after the 1st prox., of a dividend of 5 per cent. for the half year ended Dec. 31, and a bonus of 1 per cent., upon the £3,800,000 stock of the Association.

Mr. BASSETT seconded the motion, which was put to the meeting, and adopted.

The retiring Directors and Auditor were then re-elected; and the proceedings terminated with votes of thanks to the Chairman and Directors and the staff.

BOMBAY GAS COMPANY, LIMITED.

The Ordinary Meeting of this Company was held last Thursday, at the London Offices, No. 6, Drapers Gardens, Throgmorton Street, E.C.—Mr. R. DAVIDSON in the chair.

The SECRETARY (Mr. J. H. Perrins) read the notice convening the meeting; and it was agreed to take as read the Directors' report and the statement of accounts, which were referred to in the JOURNAL for the 26th ult.

The CHAIRMAN said the statement of accounts which had been sent to the shareholders represented the period of twelve months ending Dec. 31 last, instead of only six months to that date as heretofore; the half-yearly balance, as the shareholders were aware, having been abandoned, in accordance with the resolution passed at the interim meeting of Nov. 6, 1890. He thought they would agree with him that the result of the year's business was matter for congratulation. The gross revenue amounted to £70,088, and compared with £68,962 received in the previous year, showed an increase to the extent of £1126. Although this might not appear at first sight a large difference, he wished to draw attention to the remarkable increase which had taken place in the item of gas-rental from private consumers; the sale of gas having been 46 million cubic feet, as against 41 million feet; showing an advance on the year of yearly 10½ per cent. and producing an increased rental of close upon £3000. Bearing in mind the prejudices of the country and other difficulties which their Manager (Mr. Louis Penny) had to contend with in pushing business, this result was most gratifying; and it was worthy of notice that during his ten years' management of the Company's affairs, the receipts from private consumption alone had risen from £15,000 to not far short of double that amount. The number of public lamps in use at the close of the year was 3640—being an increase of 111, and producing a rental of £27,681; but owing to the discounts they had to allow the Municipality under agreement, this was some £480 less. With regard to the sale of residuals, cheaper coal and the fact that the local demand had not kept pace with the increased production, had combined to diminish the receipts for coke, and the like observation applied to tar. This, however, was counterbalanced to some extent by the saving effected in the cost per ton of coal carbonized. The profit on the sale of fittings was also smaller; but this was not altogether an unfavourable feature, as, of course, their object was to promote as much as possible the use of gas among shopkeepers and the like, who necessarily required a cheaper class of goods. Turning to the debit side of the profit and loss account, the shareholders would notice several increases in the items, most of which were a necessary sequence of the expansion of business—such as coal, wages, trade charges, &c. They had carbonized 12,587 tons of coal, as against 10,872 tons, or 1715 tons more, but at a reduction of 4s. 3d. per ton (due chiefly to the prevailing low freights), so that the difference of 1700 tons only cost £286. They would doubtless have noticed the very heavy item for exchange, amounting to £18,812 which was £4424 in excess of the loss made in 1890. This matter had occasioned the Directors considerable anxiety—the average rate for the year being the very low one of 1s. 4½d. per rupee; and, as they were aware, it had fallen still further during the past few months. As previously mentioned, the continued growth in the consumption of gas had rendered an enlargement of plant necessary; and the Directors had sent out a new gasholder, with a storage capacity of nearly half a million feet, also new boilers, an additional exhauster, and a set of purifiers; new benches of retorts would also be necessary. This would entail considerable expense; but fortunately they had ample capital in hand to meet such a contingency. As most, if not all, the shareholders were aware, the present agreement for lighting the public lamps expired in July next year. The Directors were in negotiation with the Municipality for a renewal, although nothing could be said about the matter at present; but they were hopeful of concluding an arrangement that would be mutually satisfactory. He had only one more matter to refer to, and that was the retirement from the Board of their valued colleague, Mr. Lysley, who had been a Director from the inception of the Company. He was sure his familiar presence would be greatly missed by all at their annual meetings. His place had been filled by Mr. H. E. Jones, a gentleman well known in the gas world, and whose acceptance of the office would doubtless be appreciated by the proprietors. In consequence of this appointment, a vacancy was created in the auditorship. This had been temporarily filled by Mr. Magnus Ohren—a gentleman thoroughly qualified for the position by his knowledge of gas accounts; and he would solicit the shareholders' confirmation of the appointment later on, which of course was entirely in their hands. Proceeding, the Chairman said he should like to say a few words further on the subject of exchange, which was so large an element in their future prosperity. During the last ten years from 1880, they had got their money home at the following rates: 1881, 1s. 7 15-16d.; 1882, 1s. 8½d.; 1883, 1s. 8d.; 1884, 1s. 8d.; 1885, 1s. 7 15-32d.; 1886, 1s. 6 1-16d.; 1887, 1s. 5 3-16d.; 1888, 1s. 4 9-16d.; 1889, 1s. 4½d.; 1890, 1s. 5 11-16d.; and 1891, 1s. 4 3-32d. Since the date of the accounts now presented, the exchange had fallen 1d. in the rupee, or about 6 per cent., or (as the amount of money they had to remit in a year was about double their profits) about 12 per cent. on the net revenue. This was a somewhat serious outlook, as if exchange did not improve, they might be compelled to reduce the dividend, although every other feature in the business is most satisfactory. About the future of silver, with which the interests of the Company were so closely identified, he was afraid no opinion of any value could be given. No doubt supply and demand would have much to do with it; and on this head he saw by a newspaper that the attempt of the American Government to artificially support the price of silver had led to an increase in the world's production since 1887 of 44 million ounces—viz., from 96 to 140 millions. On the other hand, as the price went down, the production would decrease, and the exports from silver countries—such as India—would be stimulated and increased, thereby causing a greater demand for silver. They also found that as Indian exports increased, outward freights became lower; and the Company were thus able to lay down their coal cheaper. In these respects he saw some hope. As to bi-metallism, much as it would benefit the Company, he could not say he had the least belief in it. He

concluded by moving—"That the report and statement of accounts be now received and adopted, and that a dividend of 4 per cent. be declared, making with the interim dividend already paid, $7\frac{1}{2}$ per cent. for the year, payable on and after Dec. 1 next."

Mr. F. LANE LINGING seconded the motion.

Mr. CUFF said the accounts which they had before them were very satisfactory, and gave them evidence of the great care with which the Directors managed the business. The question of the renewal of the concession was a very important one; and he suggested that, when it was actually decided, the Board should let the shareholders have some information in regard to it. Twelve months would be a long time to wait; and he understood that the matter was to be settled during the coming summer. He also asked whether, supposing there should be a still further depreciation in the value of the rupee, the Directors would think it desirable to raise the price of gas to the private consumers.

Mr. BEARD, referring to the question of exchange, said he recollected on a former occasion suggesting that, if the rate of exchange continued to fall, the price of gas should be raised, as he did not think the shareholders' dividend should be reduced. The report, which altogether was a very satisfactory one, referred to the retirement from the Board of Mr. Lysley; and he should be glad if the Chairman would let the shareholders know why he took that step.

The CHAIRMAN, in reply, said that, when the contract was completed, he did not see how they could intimate it to the shareholders. The mere fact that they had obtained the contract would not be of pressing importance; and all information in regard to it would be at the disposal of any shareholder who called at the office. As to the charge for gas, perhaps they were aware that in India it was 6 rupees, which was about equal to 12s. per 1000 cubic feet, or, at present exchange, it would be about 8s. This compared with 2s. 6d. and 3s. in England; so that it would be a very serious matter to contemplate the raising of the price. Besides, there was the electric light, which, however, except in some private buildings, had made no progress whatever, and for the moment it seemed to have dropped out of sight. As to their late colleague, Mr. Lysley, he retired from the Board for purely private reasons, which had nothing whatever to do with the Company's affairs.

The motion was then carried unanimously.

On the proposition of Mr. C. GANDON, seconded by Mr. LINGING, Mr. Davidson was re-elected to his seat at the Board; as was also Mr. H. E. Jones, on the motion of the CHAIRMAN, seconded by Major W. F. GORDON.

Mr. SUART next proposed, and Mr. W. PARKINSON seconded, the re-appointment of the Auditors (Mr. E. A. Flinders and Mr. Magnus Ohren); and it was agreed to.

The usual complimentary votes were passed to the Chairman and Directors, the Engineer and Manager, the Secretary, and the other officers of the Company, and the proceedings then terminated.

WEST MIDDLESEX WATER-WORKS COMPANY.

The Half-Yearly General Assembly of this Company was held last Tuesday, at the Offices, No. 19, Marylebone Road—Sir W. H. WYATT presiding.

The SECRETARY (Mr. F. H. Wybroo) read the notice calling the meeting; and the report and statement of accounts were taken as read. He afterwards read the Auditors' report, which stated that the cash balance at the bankers amounted to £4673, or, deducting outstanding cheques, to £3788. The investments of the reserve fund were as reported last half year; and the repairs and renewal fund remained as before. The Company had also the sum of £135,000 on deposit at interest with the London and Westminster Bank, the Union Bank of London, the London Joint-Stock Bank, and the London and County Bank. The capital of the Company was the same as in the previous half year—namely £1,372,136; and the total expenditure on works (including £13,479 expended in the past half year) amounted to £1,333,372. The revenue for the six months ended Lady-day last had been £118,708, or an increase of £3957 on that of the corresponding period of 1891. The balance to the credit of the dividend and interest account was £147,324.

The CHAIRMAN, in moving the adoption of the report and accounts, said he thought the shareholders would agree with him that the accounts submitted on this occasion were very satisfactory. It was quite evident, however, that, in allowing the consumers $7\frac{1}{2}$ per cent. discount, they were going as far as they could; for they did not increase, but rather diminished, their reserve fund. On the other hand, they had spent liberally in the half year on repairs and renewals; and he could assure them, from his own observation as well as from the Engineer's reports, that every portion of the works was in first-rate condition, which, of course, was very important. They had also done a good deal of new work in the six months. They had completed the filter-bed at Barnes; new mains had been laid; and the Worthington engines at Hampton and Hammersmith were nearly erected, and would shortly commence working. A constant supply had been extended to two new districts; and the number of houses now so supplied by them was 34,503. He was not sure that this was much advantage to anyone; but sentiment said that they must do it, and they had had to. The next subject referred to in the report was one which must be a matter of anxiety. He alluded to the Royal Commission which had been appointed to inquire and report whether "the present sources of supply of the Metropolitan Water Companies are adequate in quantity and quality." He maintained it was far better for them to have a Royal Commission than a Committee in the House of Commons. He thought they were now in the hands of gentlemen who understood their business; and he was sure they would endeavour to deal, and would probably deal fairly with them. What their report might be, he could not tell the shareholders. All the Water Companies had prepared a full statement as to what their powers and capabilities were. The Commission rather wanted them to show that they could supply the coming wants for the next 40 years. This was "a stiff order;" but they had met it (and, no doubt, the other Companies had done the same) in the very

best way they could. The death of Dr. Tidy at the present moment was very unfortunate, as he had been so long one of their Analysts, and, probably, he could have given the Commission better evidence than almost any other scientific man. They had had to supply the vacancy; and he hoped they had done so successfully. It was a matter of great regret to the Directors that their excellent friend, Mr. Hall, after 48 years' service, had felt it necessary to have more quiet; and he had therefore retired. He knew, however, that Mr. Hall, under all circumstances, and at all times, would render the Company every advice and assistance when required. He thought they had acted very wisely in appointing Mr. Wybroo to succeed Mr. Hall. One of their collectors, Mr. Christie, having died, after some years' service, they had made certain alterations in the collecting districts, and had increased the number of collectors from fifteen to sixteen. Mr. Voysey having resigned his appointment as inspector of the Kensington district, Mr. W. B. Hack, formerly an assistant inspector, had been appointed in his place. A Christmas gratuity of 5 per cent. had been given to the staff; and, as he had already said, a rebate of $7\frac{1}{2}$ per cent., amounting to more than £17,000 per annum, had been allowed to their consumers. These were heavy "pulls" upon them; but as long as they were able to do so, they were very glad to let everyone share in the prosperity of the Company. The accounts for the half year enabled them to recommend the usual dividend.

The DEPUTY-CHAIRMAN (Mr. J. Meyer) seconded the motion, which was carried unanimously.

The CHAIRMAN proposed the payment of a dividend on the consolidated stock at the rate of 10 per cent. per annum; and, in answer to a question, he said it was impossible to pay the dividend free of income-tax, as 10 per cent. was their maximum distribution.

The DEPUTY-CHAIRMAN seconded the motion, which was adopted.

The retiring Directors (Mr. J. Pomeroy, the Hon. Baron Dimsdale, M.P., Mr. H. W. Prescott, and Mr. E. Cumberlege) were afterwards re-elected, as were also the Auditors.

On the motion of Sir RICHARD WYATT, seconded by Mr. BLUNDELL, a vote of thanks was passed to the Chairman and Directors for their diligent attention to the business of the Company, and their able and satisfactory management of its affairs.

The CHAIRMAN, in acknowledging the compliment, said there was no doubt that Directors of Water Companies had an anxious time before them, and probably no one knew this better than the mover of the resolution, who was himself a Director of a Water Company. However, he (the Chairman) had great confidence that everything would come out well in the long run; and that, if their undertakings were acquired, the Companies would receive fair and reasonable terms. They would rather not be taken over, but would prefer to go on as they were at present. They must, however, submit to circumstances; but he could not believe that the proprietors would be deprived of what was their fair and just due. There had been a great panic, as they knew, in the stocks of most of the Water Companies—no doubt led on by unscrupulous remarks which had been made elsewhere, and the evident desire on the part of some persons to depreciate their property; but he did not think these efforts would have any effect on the Companies in the long run.

The proceedings then terminated.

The Proposed Augmentation of the Water Supply of Gloucester

—Having regard to the various and difficult questions involved in coming to a decision as to the best means of obtaining an increased water supply, the Gloucester City Council have just resolved, on the recommendation of the Water Committee, to lay all the reports on the subject before Mr. James Mansergh, C.E.

New Joint-Stock Companies.—Among the new joint-stock undertakings lately started is the Smokeless Boiler and Engineering Company, Limited, with a capital of £100,000, in £5 shares. It proposes to acquire certain inventions and letters patent in the United Kingdom and the Isle of Man relating to improvements in gas-fired steam generators, in accordance with an agreement made between the Jackson (British Patents) Company, Limited, of the one part, and the Company of the other part, and generally to carry on business as boiler and furnace makers, mechanical engineers, &c.

Fire at the Old Kent Road Gas-Works.—About half-past nine o'clock last Friday night, information was received at the South London fire station that a serious fire was raging on the property of the South Metropolitan Gas Company in the Old Kent Road. The first intimation received was the ringing of the Canal Bridge Road fire alarm into the Old Kent Road fire-station; and in a short time the manual which was turned out came back with the news that a building of two floors, about 60 feet by 30 feet, belonging to the Company, was well alight. The Fire Brigade authorities instantly despatched steamers and men to the scene; and it was found that the building, which was used as a recreation room and stores, was alight from end to end. The Company's men had first brought to work one of the manual engines kept on the premises; and, the firemen promptly aiding with other deliveries, the flames were prevented spreading. The fire was overcome soon after ten o'clock; but the structure in which the mischief had originated was entirely destroyed.

Nottingham and Derby Water Gas Company, Limited.—A meeting of the shareholders in the Nottingham and Derby Water Gas Company, Limited, was held last Thursday at the Cannon Street Hotel (by order of Mr. Justice Stirling), for the purpose of considering a scheme of compromise in relation to the Company's claim against the British Water Gas Company for a return of the purchase-money. Mr. Weston (the Liquidator) presided, and explained that, under the scheme, £15,000 would be paid to the parent Company, which would allow of a return of £1 15s. per share to the shareholders. The balance would be retained until the liquidation accounts were presented, and then there would be a further distribution. Several shareholders expressed their approval of the scheme, and the voting-papers were then deposited. There were present at the meeting, in person and by proxy, 181 shareholders, representing 9225 shares, who voted for the payment of the £15,000 in full settlement of the claim against the Company. Those who voted against the arrangement numbered only five, representing 170 shares.

PARIS GAS COMPANY.

The Report and Accounts for the Year 1891.

The following is an abstract translation of the report of the Directors of the Paris Gas Company for the past year (presented at the recent annual general meeting of shareholders), with the accounts for this period in our usual condensed form.

Commencing with consumption, the report states that in the past twelve months there were sent from the works 311,929,550 cubic metres, or about 11,013 million cubic feet, of gas; being an increase of 4,067,670 cubic metres, or about 142 million cubic feet, on the output in the preceding year. These figures are only 328,500 cubic metres lower than those of the exceptional consumption in the Exhibition year of 1889. Of the entire quantity of gas sent out, 84,459,525 cubic metres, or 26.45 per cent., was consumed in the daytime, for industrial and domestic purposes. The use of gas for culinary operations is daily making further progress; something like 125,000 cooking-stoves having been placed by the Company at the disposal of their customers during the past few years. Heating by gas is also being more widely adopted in Paris, owing to the elegance of the stoves which makers of these appliances are now showing. The receipts from the sale of gas last year amounted to 79,606,950 frs. (£3,184,278), as compared with 79,069,443 frs. (£3,162,778) in 1890. Of the former amount, 73,141,065 frs. came from the city, and 6,465,885 frs. from the surrounding districts. The number of consumers on Dec. 31 last was 242,339; surpassing by 9329 the total at the corresponding date in 1890, in which year the increase was 8891. The number of public lamps in use at the close of the past year was 77,076, of which 66,573 were employed in lighting the city. In this total are included 2127 recuperative burners; and to these must be added 2298 similar appliances in use by consumers—making altogether 4425 high-power burners, corresponding to 31,100 jets of the ordinary type. The fixing of large service-pipes up buildings, to supply the occupants of the various "flats," was continued briskly last year; no less than 2250 being put in. Deducting 30 of these pipes thrown out of use, the total at the close of the year was 32,450, distributed over 25,326 houses. Only 293 of the pipes fixed in 1891 were put into new houses; the rest were for the service of apartments already occupied by people who were willing to employ at once a sufficient quantity of gas to compensate the Company for their outlay. At the end of the year there were no less than 118,786 consumers taking gas from these pipes; being 8290 more than the number at the corresponding period of 1890. As a matter of fact, the consumers served in this way now represent nearly half the total number of the Company's customers; whereas 15 years ago the proportion was only 23 per cent. With regard to the works, as they were found equal to requirements, no very important additions were made thereto. The distributing plant, however, was increased to the extent of 39,913 metres, or 44,000 yards, divided pretty equally between Paris and the suburbs. This brought up the total length of mains at the close of the year to 2,269,594 metres, or rather more than 1400 miles, of which 940 miles are beneath the streets of the city.

Turning to the financial part of the report, we find that the expenditure on capital account last year amounted to 3,776,707 frs. (£151,068), of which 1,497,073 frs. were spent on house service-pipes, 1,185,361 frs. on ordinary service-pipes and meters, and 570,067 frs. on the works at Le Landy. The capital account stood as follows on Dec. 31, 1891:—

	Francs.	Sterling.
Amount expended to Dec. 31, 1890 . . .	282,649,582	£11,305,983
Do. do. during 1891 . . .	3,776,707	151,068
	286,426,289	£11,457,051
To meet which there has been raised—		
By shares 84,000,000 frs.		
By bonds 221,550,639 "		
	305,550,639	12,222,025
Showing an unexpended balance of .	19,124,350	£764,974

The following is the working account for the past year:—

Expenditure.	Francs.	Sterling.
Value of gas in store on Jan. 1, 1891 .	52,210	£2,088
Manufacture of gas—		
Coals carbonized	22,282,069	891,283
Coke and tar for heating purposes .	4,731,551	189,262
Salaries and wages	4,868,459	194,738
Maintenance of works and plant .	2,119,281	84,771
Incidental expenses of carbonization	1,702,191	68,088
Purifying materials	513,647	20,546
Distribution—		
Salaries of engineers and officers .	1,719,177	68,767
Repairs, &c., mains and services .	1,171,418	46,857
Miscellaneous expenses, stamps, &c.	388,099	15,524
General management—		
Directors and Executive Committee	300,000	12,000
Salaries	1,111,656	44,466
Office and other expenses	348,896	13,956
Service, accidents, relief, &c. . .	319,825	12,793
Law and other charges	31,887	1,275
Bad debts	8,597	344
Rents and insurances	217,320	8,693
Interest on loans	8,370,050	334,802
Loan redemption fund	7,874,400	314,976
Share redemption fund	2,495,250	99,810
Cost of experiments, &c.	91,899	3,676
Pension and provident funds . . .	267,790	10,711
Municipal charges—		
Tax of 2 c. per cub. met. of gas sold.	5,397,317	215,893
Rent of subsoil occupied by mains, &c.	200,000	8,000
Lighting, extinguishing, and maintenance of public lamps (less amount paid by Municipality) . .	1,073,427	42,937
State charges—		
Official gas testing, stamps, &c. .	1,117,118	44,685
Total expenditure	68,773,533	£2,750,94

Revenue.

	Francs.	Sterling.
Value of gas in store on Dec. 31, 1891	53,760	£2,150
Sale of gas	79,606,950	3,184,278
Residual products—		
Coke	17,693,605	707,744
Tar	2,366,558	94,662
Ammoniacal liquor	1,314,226	52,569
Rental of meters and fittings on hire	3,169,169	126,767
Fire-bricks, &c.	155,633	6,225
Interest and discount	1,194,090	47,764
Miscellaneous	40,816	1,633
Total revenue	105,594,807	£4,223,792
Deduct expenditure	68,773,533	2,750,941
Balance, profit for 1891	36,821,274	£1,472,851
Deduct balance of 1890 liquidation .	7,606	304
Deduct to meet outstanding claims .	213,668	8,547
Balance available for distribution . .	36,600,000	£1,464,000
Deduct for share dividend	11,200,000	448,000
Balance, divisible equally between the Company and the Municipality . .	25,400,000	£1,016,000

The total amount available for distribution among the shareholders is therefore as follows:—

	Francs.	Sterling.
Dividend as above	11,200,000	£448,000
Half of divisible balance	12,700,000	508,000
Portion of annuity (now compounded) payable by Municipality	50,000	2,000
Balance of undivided profits	66,965	2,678
Total	24,016,965	£960,678
Deduct 1 fr. per share for reserve fund.	336,000	13,440
Balance	23,680,965	£947,238
Deduct interim dividend of 12 frs. 50 c. per share paid in October last . .	2,692,213	107,688
Balance available for final dividend .	20,988,752	£839,550

The balance allowed of a further payment of 62 frs.; making in all 74 frs. 50c. per share of 250 frs., or at the rate of 29.8 per cent., and leaving 156,752 frs. (£6270) to be carried forward. The dividend is 50 c. per share lower than that for 1890, notwithstanding the increase in the consumption of gas. The difference is explained by a slight rise in the price of coal, the extra cost of labour, and the additional charges occasioned by the last loan.

With regard to residuals, the latter months of the past year were not favourable for the sale of coke. Stocks, however, were not augmented. The advance in the price of coal naturally raised the value of coke; and the returns from the sales were 1,941,720 frs. more than in 1890—viz., 17,693,605 frs. against 15,751,885 frs. Tar and ammoniacal liquor were affected by the over-stocked market; and the amount realized by the sale of these products was only 3,680,784 frs., as compared with 3,890,170 frs. in 1890—a drop of 209,386 frs., or 5.38 per cent. The consumption of gas for motive power and culinary and heating purposes does not show any signs of falling off in Paris. Last year, 3,800,000 cubic metres of gas were used in gas-engines of various powers. The Company have always made a point of encouraging the consumers to use gas-stoves; and lately they have had under consideration the best types of these appliances, suitable for heating purposes, by French and foreign makers. They have themselves patented several models, which, alike for elegance, calorific power, and economy, they believe will commend themselves to the Parisians. With the special object of directing public attention to the variety of applications, both domestic and industrial, of which gas is susceptible, and to afford as much information on these matters as possible, the Company have opened a show-room in one of the principal thoroughfares of the city—the Rue du Quatre Septembre, where, in the early days of the introduction of electric lighting, they made so successful a display of gas by means of improved burners and lanterns which have since borne the name of that street.

The usual particulars are given in the report in regard to the various provident and other funds connected with the Company; and the statistical portion of the document closes with a short reference to the perennial question of the suggested reduction in the price of gas. This matter has been under discussion, in one form or another, for something like ten years. After being dropped, taken up again, and then abandoned, it was seriously considered by the Municipal Council at the beginning of the year 1890. The problem before them was how to reduce the price from 30 c. to 25 c. per cubic metre for lighting and heating gas, and from 30 c. to 20 c. per cubic metre for that employed in the production of motive power. The diminution in the receipts which would result from the change was estimated at from 10 to 11 million francs per annum. To compensate for this drop, it was proposed to spread the capital charges over a greater period; and it was hoped that, by prolonging the concession by 25 years from 1905, a means would be found of conciliating the consumers, the Municipality, and the Company. This combination, which at the outset appeared to be acceptable, was in the end discarded. It was considered that, instead of resorting to an extension of the concession, it would be preferable to suspend the amortization of the bonds until Dec. 31, 1905, and leave to the City the responsibility of indemnifying the bondholders by charging the working after the termination of the existing concession with the restitution of the capital not paid off at the latter date. Upon these new bases the Company have lately been invited to enter upon fresh negotiations. The Directors state that, in the conferences which have taken place, the Municipality and the Company have manifested an equal desire to come to an understanding. But the proposed combination, although to all appearance so simple, gives rise to legal difficulties which need careful examination; and therefore no information can be afforded to the shareholders as to when the question is likely to be settled.

In the section of the report devoted to the changes in the administration, fitting reference is made to the loss the Company have sustained

by the death of the Chairman—M. Fernand Raoul-Duval—who, after filling various offices, became Vice-Chairman in the year 1884, and succeeded M. Eugène Preschez as Chairman in 1887. He attended or presided at all the negotiations between the Company and the Municipality on the question of the price of gas; and it did not rest with him that these were not brought to a satisfactory conclusion. His successor on the Board is his son, M. René Raoul-Duval, who, as a Director of the Neapolitan Gas Company, has already had experience in the administration of a gas undertaking.

THE ELECTRIC LIGHTING QUESTION AT TAUNTON.

Report of Mr. Gisbert Kapp.

Our readers are aware that some weeks ago the Taunton Town Council held a special meeting to consider the question of purchasing the plant of the local Electric Lighting Company, as to the advisability of which opinion seems to be very much divided—the undertaking being in a rather low condition. On the eve of the Council meeting, the rate-payers decided, by a small majority, against the proposal to purchase the Company's works; but the councillors showed themselves to be more hesitating, and they adjourned the question for a month—an expert to be employed in the meantime to report upon the suitability of the present buildings and plant for the electric lighting of the town. They had already had two reports—one by the Joint Committee entrusted with the matter, and the other from the Borough Surveyor—but they wanted a third; and this they now have. The expert called in, on the suggestion of the Board of Trade, to assist the Council with his advice was Mr. Gisbert Kapp, M.Inst.C.E.; and his report, dated the 26th ult., came before the Council at a special meeting held on Tuesday last. As the two previous reports have been summarized in the JOURNAL (see ante, p. 589), we give a few particulars from the one last submitted.

Mr. Kapp visited the works on the 14th and 15th ult.; and he opens his report with a full description of them. They comprise a central station, a complete system of overhead wires now supplying about 30 arc lamps for street lighting, and 40 arc lamps for private lighting, a number of incandescent lamps of various capacities, equivalent to 500 lamps of 16-candle power, and three sets of storage batteries. The central station stands on a piece of land 14,570 square feet in area. He next describes in detail the generating and distributing plant, and states that, with a few exceptions, the whole of it is in good, and some even in excellent condition. Dealing with the methods of working, Mr. Kapp explains that the supply of electrical energy from the station is at present intermittent; the machinery being started in the afternoon, and kept going till one or two o'clock in the morning only. Although such a manner of working is, generally speaking, conducive to economy, it has not, he says, been so in the present case. He has estimated approximately the number of units supplied for private and public lighting, and the amount of coal consumed; and he finds that for the delivery of 80,000 units during the year 1891, 870 tons of coal were burned—being at the rate of about 24 lbs. of coal per unit delivered. Had the Company been working under a Provisional Order and been compelled to keep the pressure on the mains for private lamps continuously, the consumption of coal per unit supplied would have been still greater. Under the favourable conditions of intermittent supply, Mr. Kapp says the consumption of 24 lbs. per unit delivered is far too large. Modern and well-designed stations giving uninterrupted direct-current supply at low pressure, require from 9 to 15 lbs. of coal per unit; and alternating-current stations affording uninterrupted supply, require from 12 to 24 lbs. of coal per unit. There are, he says, chiefly two reasons why the coal consumption in the Taunton station is so large. In the first place, the average load on the alternators is very small in comparison with the rated power of the engines; and in the second place, the efficiency of the arc lighting plant is low, owing to the interposition of a heavy countershaft between the engines and dynamos. This defect cannot be remedied with the existing plant; but the efficiency of the alternating plant would be materially improved if, instead of 500 lamps, three or four times the number were connected, and the supply were still carried on intermittently as now. Should it, however, be necessary to give an uninterrupted supply (as is generally the case when the undertakers work under a Provisional Order), he says it would only be possible to attain a fair efficiency by the addition to the present plant of a small engine and alternator for daylight work, and the establishment of sub-stations with large and small transformers. Passing on to consider the commercial results, profit, &c., Mr. Kapp says that the station has been worked in a manner as economical as the nature of the plant permitted; and he does not think that in future it will be possible to reduce expenses. The commercial results can therefore only be improved by increasing the receipts. The receipts were, in round numbers, about £1110 from arc lighting, and £410 from incandescent lighting; the latter being charged at an average of 1s. per candle power per annum, while each private arc lamp produced £10 per annum. The 41 private lamps consumed during 1891 about 17,000 units; and the income from them was £410, which comprised the payment for the rent of the lamp, the carbons consumed, and the current supplied. Deducting £80 for the rent of lamps and carbons, the 17,000 units were supplied for £330, which is at the rate of 4.65d. per unit. Since the cost of producing a unit was during 1891 about 5.7d., it is clear that the private arc lighting was a loss to the Company. If the current for these lamps had been charged by meter at 8d. per unit, there would have been a small profit on the private arc lighting—each lamp earning about £14 per annum. Provided the consumers would submit to the additional charge as determined by the meter, the adoption of meters would increase the income; but he does not think it would affect that derivable from incandescent lamps. If the current were charged at 8d. per unit for private lamps, the income would be £2900; but as, in order to earn this, extra plant would be required, bringing up the total working expenses to £2450, there would be left only a gross profit of £450. This would not be obtainable supposing the station had to be worked continuously instead of intermittently. If the former, the profit

would be converted into a loss. Coming to the existing system of supply, Mr. Kapp thinks it is not suitable to local conditions. The central station lies within a comparatively small district, and the whole of the lighting is comprised within a radius of 800 yards. As distances up to 1200 yards are well within the reach of the three-wire system with uninterrupted direct-current supply, and as the whole profitable lighting area of the town lies well within this limit, there is, he thinks, no need for the alternating-current system. Taunton could, he says, be very efficiently lighted on the direct-current system; the generating plant including storage batteries, so that an uninterrupted service could be given without the necessity for working the machinery for more than ten hours daily. After dealing with the Board of Trade requirements in regard to electric lighting, Mr. Kapp comes to the important question of purchase. On this point he says: "The price suggested for the purchase in the report of your Joint Committee is £10,000; and if the design of the station had been such as to fully meet the conditions indispensable for economical and efficient working, as well as the requirements of the Board of Trade, I should consider this price a fair and reasonable one to pay for the land, buildings, machinery, and distributing plant. Unfortunately, however, the design of the station, and the whole system under which the light is at present supplied, is not such as will allow of economical working, if the supply is to be continuous, such as the consumers would have a right to demand; and therefore I cannot advise you to buy up the works as a going concern, or in any such manner as would compel you to carry on the present system of supply." He then proceeds to show how, if the Council determine to undertake the supply of electrical energy, this may be done—viz. (1), by erecting and working an entirely independent station; or (2), without buying up the whole of the present plant, by purchasing so much of it as can be profitably employed in the reconstruction of an improved central station and distributing system—leaving the Company free to sell the rest of their plant in the open market. As the former plan did not come within his instructions, Mr. Kapp confines himself to the latter. This he discusses at some length—going fully into all details. Assuming that the total requirements of Taunton for the next four or five years will not exceed 44 street arc lamps, and 2000 16-candle power glow lamps, or their equivalent in arc lamps and glow lamps of other candle power for indoor lighting (of which not more than 1400 will ever be required to burn at the same time), he finds the cost to be as follows: Price to be paid to the present Company for their central station and material, £5250; cost of additional plant at central station, £3700; feeders, mains, house connections, and meters, £5300; 44 arc lamps and mains, £1650—total, £15,900. To this he says £1000 should be added for working capital; so that the total sum the Corporation would have to borrow would be £17,000. The annual payments on this sum would be £880, which added to the working expenses (£1780) brings up the total annual outlay to £2660. The total revenue he estimates at £2900; showing the small profit of £240 on the working of the station, which would be increased with the use of the current for motive power, and the further employment of the light up to the ultimate capacity of the station. Mr. Kapp's general conclusions are as follows: (1) The present electric lighting system is not suitable for small areas, and cannot be worked at a profit if the supply must be continuous. For this reason I cannot advise you to buy the undertaking as a going concern. (2) Taunton can be lighted most economically on the direct-current low-pressure three-wire system, with batteries to take the day load. (3) If you determine to start an entirely new station, it should be placed close to the river. (4) If you determine to utilize the existing station, you can take over the buildings, boilers, engines and accessories, and 44 iron posts; paying the Company £5250. (5) The existing countershafting, dynamos, alternators, transformers, batteries, overhead mains, and arc lamps not to be taken over, but to be removed by the Company. (6) The total cost of complete works suitable for the supply of 2000 16-candle private glow lamps, and 44 street arc lamps, is £15,900. The annual working expenses will amount to £2660, including repayment of loan; and the annual revenue will amount to £2900.

At the same meeting, the Joint Committee reported that, having considered the report of the expert, they could not recommend the Council to purchase the undertaking at the sum of £10,000. The Mayor, as Chairman of the Joint Committee, moved the adoption of their report. In doing so, he said that, in making the simple recommendation that the works should not be purchased for £10,000, they did not intend that negotiations should be stopped. He could call their attention to the small matters of defect pointed out by the expert; but the favourable points included the fact that the whole of the plant was in good and excellent condition, had been well cared for, the installation was remarkably good, and if the Council decided to purchase the undertaking as a going concern the sum of £10,000 was a reasonable one. With regard to the system; of lighting, the report condemned the Thomson-Houston system; but he thought the residents of Taunton had reason to be proud of it. Alderman Van Trump seconded the motion, so far as it recommended the Council not to purchase the works for £10,000. Alderman Farrant moved, as an amendment—"That the consideration of Mr. Kapp's report be postponed until the next meeting of the Council; and in the meantime that the Committee obtain information as to the successful working of the Thomson-Houston system, and also whether Mr. Kapp is in any way interested in any other system or patents in connection with electric light." This was carried with one dissentient. The Mayor then moved a resolution to the effect that steps should be taken at once to obtain from the Board of Trade their view on the subject of overhead wires, uninterrupted supply, and of having arc lamps at high pressure in shops and houses; and it was adopted.

The Water Question at Mansfield.—The Water Committee of the Mansfield Town Council have decided to engage an expert to consider the question of the water supply of the town and the report of Mr. W. H. Dalton, F.G.S., to which reference was made in our issue of the 12th ult. (p. 678). Professor Green, of Oxford, Professor Lapworth, of Mason's College, Birmingham, and Mr. T. Hawksley, are to be communicated with.

GAS AND ELECTRIC LIGHTING AFFAIRS AT SALFORD.

At last Wednesday's Meeting of the Salford Town Council, two or three interesting matters relating to gas and electric lighting came before the members.

The first subject to engage attention had reference to certain statements recently made in the Committee-room of the House of Commons, during the proceedings on the Swinton and Pendlebury Gas Bill, with regard to the quality of the Salford gas. Mr. Phillips, the Acting Chairman of the Gas Committee, stated that surprise visits had been paid to the gas-works by Mr. J. Hepworth, of Carlisle, and Mr. Thomas Newbigging, of Manchester; and both these gentlemen reported that they had found the gas pure, and that it was of more than the illuminating power required by the Act of Parliament. Mr. F. Jones, the Consulting Chemist, reported that the average illuminating power at the Bloom Street station during the past year had been equal to 18·86 standard candles, and at the Regent Road works, to 18·71. The Committee were doing all they could to supply gas that was pure and of high illuminating power; and he was glad to say there were never fewer complaints from consumers than at the present time.

Subsequently, the Council approved of a resolution of the Gas Committee to the effect that the tender of Messrs. Ashmore, Benson, Pease, and Co., Limited, of Stockton-on-Tees, for cast and wrought ironwork required for the construction of a new four-lift gasholder and guide-framing, for the Liverpool Street gas-works, for the sum of £12,000, and also for old wrought iron at 30s. per ton, and cast iron at 20s. per ton, be accepted.

A report was also submitted by the Committee on the subject of the proposed scheme of electric lighting. It stated that, in view of the replies to the circulars issued throughout the borough, it had become evident that the scheduled area proposed originally, and included in the Provisional Order, would not meet the ascertained requirements, and consequently the contemplated expenditure in lighting the area was not advisable. They, therefore, deemed it their duty to seek the instruction of the Council as to an application to the Local Government Board for a modification of the area of supply, and other incidental matters. After due consideration, it appeared that, to meet the demand for the electric light received through the circular referred to, a scheme of a different character, and upon a larger scale, would be necessary; and consequently the sum of £15,000 which was mentioned as the probable cost of a first installation must be increased to £30,000, as any smaller installation would be of very little use to the borough. Mr. Phillips, in moving the adoption of the report, admitted that the electric light at one period of the year would not pay, but that period would be succeeded by another when it would pay its expenses, and before long begin to make some return. He instanced Bradford, where the electric lighting, on which there was at first a loss, now showed a profit of £1000. Mr. Roper seconded the motion, which was carried. Mr. Snape then proposed that the Gas Committee proceed with the preparation of a scheme, and get out a specification and present the same, with tenders, to the Council for an installation amounting to not more than £30,000. The Town Clerk pointed out that the Council had the power at the present time to supply the whole of the borough; but they were doing it piecemeal. Alderman Mottram seconded the proposition, which was carried by 33 votes to 12.

EXHIBITIONS OF GAS APPLIANCES.

The exhibition of gas-stoves and other appliances which was held at Sheffield last January was so successful that another has been organized, and was opened yesterday week by Mr. E. W. T. Richmond, of the firm of Messrs. Richmond and Co., Limited, of London and Warrington. In addition to the gas-stoves, there is shown by the Sheffield Gas Company a large collection of chandeliers, brackets, globes, and other fittings, together with many novelties in gas-burners. The exhibition will continue during the present week; and, as during the past week, Miss Golding will deliver lectures twice daily on the advantages of cooking by gas. A gas exhibition, under the auspices of the Hexham Gas Company, was held in the Corn Exchange in that town from the 25th to the 30th ult., when a good display of cooking-ranges, gas-fires, stoves, &c., was provided by the above-named firm. The lighting exhibits were of a varied character, and included some powerful "Vincent" lamps by Messrs. W. Sugg and Co., Limited, which were much admired. The exhibition was opened by R. Wallis, Esq., J.P. (President of the North of England Gas Managers' Association), who dwelt at some length on the advancement made by the gas industry as a result of similar exhibitions. A series of lectures on cookery were given by Miss Owen to large and appreciative audiences. The arrangements were carried out by Mr. Herbert Lees, the Secretary and Manager of the Company; and the exhibition proved a great success. Messrs. Richmond and Co. also supplied the stoves, &c., at the exhibition at Ramsay (Isle of Man), mentioned in the JOURNAL last week. In the Town Hall, Wycombe, from the 27th to the 29th ult., a successful exhibition was held under the auspices of the High Wycombe Gas Company; the general superintendence being entrusted to the Manager (Mr. W. F. Thurlow). The stoves shown were supplied by the Davis Gas-Stove Company, Limited, whose representative (Mr. Goatley) fully explained their capabilities, which were amply demonstrated by Miss Cameron in a series of cookery lectures. Last week the Davis Stove Company exhibited at Bristol, where Miss Ellen Johnston lectured; at Worcester, where Mr. J. Young, M.P.S., discharged a similar duty; and at Ramsgate, where Miss Rotherham officiated. Under the auspices of the Ascot Gas Company, an exhibition of gas cooking stoves and appliances, manufactured by Messrs. Fletcher, Russell, and Co., of Warrington and London, was held in the Sunninghill Reading Room from Tuesday to Friday last week. Lectures illustrative of the advantages of cooking by gas were delivered each day by Miss Edden. In the Town Hall, Haverhill, the same firm held a gas exhibition, under the auspices of the Local Board, from Tuesday to Friday last week.

They had on view a number of their indestructible cooking-ranges and other appliances. The Local Board showed Cowan's wet meters, Peebles's governor burners, and the Wenham, Deimel, and Sugg lamps, by which the hall was lighted. The arrangements were efficiently carried out by Mr. B. Gibson, the Gas Manager to the Board. The exhibition was opened by Alderman Gurteen; and lectures on cookery were given by Miss Rotherham. The exhibition which Messrs. W. Parkinson and Co. held in the Drill Hall, Nuneaton, from Monday to Friday last week, was in every way successful. It was opened by Mr. J. E. Iliffe, Chairman of the Gas Committee; and Miss Woods gave demonstrations in cookery each afternoon and evening, which were well attended. The result was the placing of a large number of gas cooking-stoves on hire among the consumers. At the Albert Institute, Windsor, Messrs. J. Wright and Co., Limited, have lately been holding an exhibition under the auspices of the Gas Company. Lectures were delivered by Miss Page.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The "sensation" which I mentioned last week as being attempted to be created by a writer in the *Scotsman*, with reference to the Edinburgh gas-works, was taken notice of by no one during the week; but to-day the writer himself returns to it. He writes in the *Scotsman*: "The 'authorities' of the gas-works have not seen fit to take up the challenge to deny or explain away the statements contained in my letter to you last Saturday. The truth cannot be denied. There are now seven of the English bricklayers there; and they are likely to be for some time to come, as I understand the whole of the inside of the bench will have to be not repaired but renewed. I would invite the Gas Commissioners to make some inquiry into this matter, and scrutinize the bill closely; and see if this be the best way to keep down the expense." To this the editor of the *Scotsman* adds: "The rate-payers no doubt will be interested whether there is or is not foundation for these statements—Are men at work on the removal or renewal of a bench of retorts recently erected; and, if so, what justification is there for this course? Assuredly, silence on this subject is not the part which the Commissioners ought to play." I am puzzled to know what they are driving at. Last week I thought it was the builder who was aimed at; now it would appear to be someone else. The whole affair is mysterious; but I now incline to the opinion that the author of these communications is a Gas Commissioner, who has taken this method of divulging what was intended to be kept private. The Committees of the Commission have not met since last Saturday, I may point out; and it was therefore not possible either to "challenge or deny" his statements. When they meet, there may or may not be something heard of this subject. From the temper of one of the Commissioners whom I met this week, I presume that it will.

The dream which has floated before the eyes of some southern engineers, and notably of Mr. V. Wyatt, of London, of seeing a number of gas-works combine to carry on a works for the treatment of residuals, is placed within reasonable possibility of accomplishment by the failure of Messrs. John Dobbie, Sons, and Co., of Leith and Elliot. Mr. J. S. Tait, C.A., of Edinburgh, the trustee of the estate, has issued a circular in the following terms: In terms of the instructions given at the first meeting of creditors, I have carried on the works at Elliot and at Leith with the view of these being disposed of on advantageous terms. I have sold the Waverley Chemical Works at Leith; and before closing the sale of the North British Chemical Works at Elliot, it has been suggested to me, by parties having a strong interest in the beneficial outcome of the estate, that the Gas Companies in the district should have an opportunity of considering as to the advisability of taking over the works for the purpose of manufacturing the whole residual products from the gas-works in the district. In these circumstances, I have thought it right to call a meeting of the Gas Corporations and Companies, along with their Treasurers, to be held in Dundee." The meeting took place yesterday, Provost Keith, of Arbroath, presiding. Most of the parties invited attended; but the Dundee Gas Commission at their meeting on Wednesday, resolved to take no action in the matter. Mr. Scott stated that, should the company resolve to acquire the works at Elliot, he proposed that the price of them should be fixed by a neutral party. The gentlemen composing the meeting pointed out that they did not represent their Corporations or Companies officially; and that all they could do was to communicate what they had heard. The proposal was thus not advanced very much; but it is put in shape for consideration by the local bodies, on whose decision will rest the determination of whether or not this interesting experiment is to be carried out.

The cheering news from Dundee, of which I spoke last week, has developed into an actuality. The financial year of the Gas Commission ends on April 30; and with a promptitude which is as commendable as it is rare, they have already announced that their output of gas during the year was 504,778,600 cubic feet. In the previous year, the output was 470,381,700 feet; so there is this year an increase of 34,396,900 cubic feet. This is a remarkable growth; but it is the more so when it is taken into account that a year ago the increase upon the previous twelve months was as much as 40,381,700 cubic feet above the estimated quantity. For the year just closed, the estimate has been exceeded by 14,778,600 cubic feet. Such a growth of business almost deserves the name of phenomenal, and is worthy of being put on record as an indication of the vitality of the gas industry when it is well managed—as everyone must admit the undertaking at Dundee is. The revenue from sales of gas during the year amounted to £81,084; which, though there was no increase in the price, was £4854 higher than in the previous year. This news is in itself sufficiently cheering, but more follows. The Committee to which was entrusted the selecting of the coal for the year which is now current, having about 70 offers before them, went diligently to work; and on Wednesday, they came before the Commission with a recommendation that 16 of the offers be accepted, which was agreed to. These offers were for 35,000 tons, which is estimated to last for between seven and eight months. It is expected that the price of coal will fall, which is the explanation that

a whole year's supply has not been contracted for. In this I believe the Commissioners are right. Every indication is in the direction of a fall in prices; and—this is worth noting—I have it on the authority of the manager of a comparatively small gas-works, that he is securing coal of high quality at prices from 20 to 25 per cent. under last year's rates. The price at which the Dundee Commissioners have secured their contracts for rather more than half of the year, is 15s. 8d. per ton, which, as compared with last year, means a reduction in price of 1s. 5½d. per ton, or nearly 2d. per 1000 cubic feet of gas. The coal contracted for is intended to yield gas of 25½-candle power. No mention was made of requiring the contractors to give a guarantee that a certain illuminating power would be derived. Judging from the remarks of ex-Provost Brownlee, in moving approval of the contracts, it would appear that, although the form of requiring a guarantee may be gone through, little reliance is to be placed upon it. The analysis of the coals, he said, showed that they should have gas of 27-candle power; but he expected they would only yield 25½ candles. If this means anything, it is that coal sold to the Commissioners to yield 27-candle power gas is not expected to give that return; but that if it does not fall below 25½ candles, no complaint is made. This is stated with reference to the coal as a whole, but of course each individual coal will have to stand its own analysis; and the true meaning is that in the case of any coal, no action will be taken unless the gas yielded falls more than 1½ candles below the guaranteed power. The difficulty of the Commissioners would be to prove which of the coals in the mixture was responsible for the drop, if they should find that they were not getting the illuminating power they expected. That the Dundee Gas Commissioners have done well cannot be denied; because the probability is that, notwithstanding the fall in the price of residuals, they will be able to continue the price of gas at its present figure. It is just possible, however, that they might have done better if they had trusted their contractors more, and did not practise the rigid system of analysis which they pursue.

The Edinburgh Merchants' Association, who started some months ago on a war crusade against the Edinburgh and Leith Gas Commissioners, ended their antics on Wednesday night by a tame discussion in which the hard words, formerly so conspicuous, gave place to mild expressions of an opposite nature, and a resolution was adopted requesting the Gas Commissioners to consider and give effect to the report by Mr. J. M. Turnbull, to which I referred four weeks ago. Mr. Turnbull's report is accountable for this change of front. It is the old story; it is easy to condemn in a general sort of way, but it is far more difficult to provide a remedy. That 4s. 6d. per 1000 cubic feet of gas is a long price to pay, goes without saying; but how to reduce the price, when all the circumstances are taken into account, is a problem which puzzles everyone. No one, I am sure, regrets the high price more than the Gas Commissioners themselves; and no suggestion which is of value will be thrown away by them. Mr. Turnbull's recommendations were chiefly that coal contracts should be abolished or shortened; the adoption of the oxygen method of purification; and the lowering of the illuminating power of the gas. These are all suggestions which are quite reasonable. The Commissioners may or may not adopt them; though I think the probability is that they will not, unless, it may be, the last-mentioned, which, according to all indications at present, is a step they will be obliged to take in a few years whether they choose or not. The proposal with reference to coal contracts derives its greatest force from the fact, as mentioned by Mr. Turnbull, that while household coal has only advanced by 10 per cent. since 1889, the coal contracted for by the Gas Commissioners advanced by 66 per cent. Of course, the rise in the higher classes of cannel accounted for the greater part of this; and the question of whether these can be done without, is thus very sharply raised. Still the advance in the inferior classes of coal must have been more than 10 per cent.; and the conclusion must be arrived at that under the contract system the citizens have been made to pay much more heavily than they should, on account of the troublous times with the miners. If the Commissioners should resolve to work without coal contracts, or with shorter contracts, they would, as pointed out at the meeting, require to establish a coal-buying department; and the labour thrown upon the Commissioners would be very much more than it is at present, when the coal purchase is disposed of once for all for a twelvemonth. The Commissioners would also have difficulty in determining what rate they should sell gas at, seeing that the price of coal might go either up or down very suddenly, and they are obliged to fix the price of gas in advance. The question of oxygen purification is one for the Engineers to determine; and the Commissioners will no doubt be guided by their opinion.

The Hamilton Gas Corporation have completed their financial year; and the outcome is a profit of £1135, which, considering that they sell gas of 27-candle power at about 3s. per 1000 cubic feet, is a very creditable result. The Corporation, however, occupies one of the finest positions in the gas world. They are right in the centre of a coal-producing district, and they have written down their capital by more than half. This year, they have resolved to devote their entire surplus to reduction of liabilities; £1000 going to the depreciation fund, and £135 to the reversion fund. It is interesting to observe that the cost price of gas is only 1s. 4½d. per 1000 cubic feet. In Edinburgh, it is 2s. 4d.; but there, about 1s. per 1000 cubic feet is absorbed in the payment of annuities, of which there are none at Hamilton. The Corporation, at its meeting on Thursday night, resolved to make considerable alterations upon the gas-works, including new arrangements for taking in coal, the formation of a tar tank, and the reconstruction of a portion of the retort-bench. The new retorts are to be built on the system which is employed by Mr. Henderson, the Gas Manager at Saltcoats, which the Corporation resolved to adopt after consultation with Mr. Henderson. It is expected that 30 per cent. more gas will be obtained from the coal in the new bench.

Increased Water Storage for Johannesburg.—The Johannesburg Water Company are about to increase their capital to £200,000 by the issue of 15,000 additional shares at par. The money is required for the construction of two new reservoirs, for which contracts to the extent of £10,000 have already been entered into.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, May 7.

Sulphate of Ammonia.—The market keeps fairly steady, in spite of a limited business, and apparently small requirements for this month. The reason for this probably is that there is really not much offering; and the shipments absorb present production. The declining tendency of nitrate prices does not seem to check the willingness of consumers abroad to contract forward at present low values of sulphate; but, excepting some of the low makes of the Scotch production, very little is to be bought from the manufacturers, beyond spot delivery. This, under existing circumstances, appears to be the wisest plan. Hull and Leith quotations are £10 2s. 6d.; Liverpool, £10. Nitrate is quoted at 8s. 6d. to 8s. 9d.

LONDON, May 7.

Tar Products.—Benzols seem to have about reached the bottom, as nothing lower than 1s. 6d. for 90's and 1s. 3d. for 50's is mentioned; and these are about the lowest figures touched during the past six or seven years. There is not much anthracene changing hands; and the prices are about those of last week. Creosote inquiries are not numerous; but a considerable quantity is being burned as fuel, and stocks are not increasing. There is no improvement to report in carbolic acid or crystals. Pitch for forward supply is quoted lower; but for prompt delivery, 26s. to 27s. is still available. Prices are: Tar, 10s. to 12s. Pitch, 26s. to 27s. Benzol, 90 per cent., 1s. 6d.; 50 per cent., 1s. 3d. Toluol, 1s. 2d. Solvent naphtha, 1s. 1d. Crude benzol naphtha, 30 per cent., 8d. Creosote, ¾d. Naphthalene salts, 20s.; pressed, 45s. Carbolic acid, crude, 60's, 1s. 1d.; 70's, 1s. 4d.; crystals, 5d. Cresol, 8d. Anthracene, 30 per cent., "A" quality, 10½d.; "B," 7d.

Sulphate of Ammonia.—This market is steady at about last week's quotation—viz., £10 to £10 3s. 9d., less 3½ per cent. discount. Gas liquor (10-oz.) fetches 5s. to 6s. 6d.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Only a quiet demand is reported generally throughout the coal trade of this district; and the tendency is in the direction of lower prices. The exceptionally cold weather still helps the demand for the better qualities, suitable for house-fire purposes, and these are mostly moving away without difficulty at about late rates. Best Wigan Arley is still quoted at 12s. 6d.; Pemberton four-feet and second qualities of Arley, 10s. 6d. to 11s.; and common house-fire coals, 9s. to 9s. 6d. per ton at the pit mouth. But sellers in all cases are not quite so firm at the full figures as they have been. The lower descriptions of round coal continue in but indifferent demand for iron making, steam, and other manufacturing purposes, owing to the depressed condition of the principal coal-using industries; and these are becoming more difficult to dispose of, with a weakening tendency in prices. In many cases, there has been a giving way of something like 3d. per ton upon recent quotations; and for inland sales, ordinary steam and forge coal at the pit mouth does not average more than 8s. to 8s. 3d. per ton. The shipping demand for steam coal varies somewhat, but generally is only very moderate; and prices have eased down since the commencement of the month. Ordinary descriptions of steam coal are now readily obtainable at 9s. 3d. to 9s. 6d. per ton, delivered at the Garston Docks, or the High Level, Liverpool. The requirements for engine classes of fuel have necessarily been largely affected by the stoppage of so many of the cotton mills throughout Lancashire; and all descriptions of slack have been accumulating. Thus considerably under current rates are accepted, in many cases, to effect a clearance sales of surplus lots. The result is that prices are very irregular; and quotations can only be given as nominal, at about 6s. 6d. to 6s. 9d. for the better qualities of burgy; 5s. to 5s. 6d. for the best qualities of slack; and 3s. 6d. to 4s. for common sorts. There has been so much underselling in the open market to effect business, that prices, to a large extent, have been governed by special circumstances.

Northern Coal Trade.—There has been an increase in the output of coal in the Durham district during the last week, by the starting of a few of the unassociated collieries whose owners asked for no reduction in wages. Some of these produce household coal, and one or two gas coal. There has thus been an addition, though not a large one, to the supply; and it is possible that in a few days a large increase will take place. Best Northumbrian steam coal has been sold at high prices where an early delivery was needed; but an average quotation now may be from 12s. to 12s. 6d. per ton, f.o.b., though this would, of course, drop with any immediate prospect of a general recommencement of work in Durham county. Steam small coal is steady; and as high as 10s. per ton has been paid for a small quantity. But the large supplies of coal from Scotland and Yorkshire are being utilized for manufacturing purposes. Gas coal has been sold by one of the Durham collieries that have recommenced, for immediate delivery at 12s. 3d. per ton, less discount—a high rate that cannot long endure. In the south of Durham, some of the gas companies are using Yorkshire coal for gas making, with advantage. Manufacturing fuel is cheaper, owing to large importations of Scotch coal, which has been delivered in the Tyne at as low as 8s. per ton. There is no alteration in the price of bunker coal, but the supplies are larger; and the production of coke for blast purposes has been increased, the price being still very high. The Durham strike seems now to be nearing a termination, by the exhaustion of the miners.

Scotch Coal Trade.—This week's feature of the coal trade in Scotland has been the notices of reduction in wages. In the West, the reduction, as stated last week, is 10 per cent. Against this there is little show of opposition; the only movement being to continue the practice of working only five days per week. Otherwise, all the men are steadily at work. In Fifeshire, a reduction of 7½ per cent. has been notified; and in the Lothians, a reduction of 10 per cent. In the case of the Lothians, the reduction was fixed after consultation with representatives of the men, which gives more force to the view that the trade is not in a flourishing condition. Shipments continue to be large. There is a scarcity of railway waggons in the

West, which retards despatches by rail. Still, large quantities, including a considerable proportion of gas coal, is being sent to the North of England. Steam coal is dull of sale. The prices quoted in Glasgow are: Main, 7s. 6d. to 7s. 9d.; ell, 8s. 6d.; splint, 8s. 3d. to 8s. 6d.; and steam, 10s. to 10s. 3d. per ton. The shipments for the previous week showed a considerable increase.

Electric Lighting for Portsmouth.—After experimenting with various electric lamps at the Portsmouth Town Hall, the Corporation Electric Lighting Committee have decided to adopt, for the lighting of the streets, Swan-Edison lamps of 200-candle power, which will be placed at distances of about 50 yards. The existing gas columns, which stand about this distance apart, will be used for the new lamps in almost every case. The Clarence Esplanade, from one pier to the other, will be illuminated by powerful arc lights of the Brookie-Pell pattern. It is expected that the Local Government Board will, in about a month's time, give their sanction to the borrowing of the £60,000 for the whole work, which will then be taken in hand forthwith; the Committee being desirous of completing the installation this year.

The Longwood Gas Company and their Consumers.—It will be remembered that, at a recent meeting of ratepayers at Longwood (see *ante*, p. 717), a deputation was appointed to wait upon the Directors of the Gas Company to endeavour to obtain a settlement of the dispute between them and their men; and also some concession with regard to the price of gas and meter-rents. Another meeting has since been held, at which the deputation reported the result of their interview. Respecting the dispute with the men, the Directors stated that they had discharged certain of their workmen, not because they were members of the Gas Workers' Union, but because they were incompetent, and were not doing the right amount of work, and further they expressed their intention of not being dictated to by the Union officials. In reference to the price of gas, the Directors declared that it was impossible to lower it at the present time; but they would consider the advisability of reducing the meter-hire. After hearing this report, the meeting passed the following resolution: "That, in the opinion of this meeting, the Manager and Chairman of the Longwood Gas Company, and Directors, are responsible for the deplorable lock-out now going on at the gas-works, and we hereby enter our strong protest against their conduct in the matter; and, further, that this meeting recommend the consumers to have their gas cut off as early as possible, and return their meters." A number of persons were then appointed to receive the names of consumers who intended cutting off their gas supply, if the dispute was not soon settled.

Georgetown (British Guiana) Gas Company, Limited.—The accounts of this Company for the half year ended Dec. 31 last show a profit of £1122. The amount required to pay the interest on debentures and the usual dividend is £1278, or £156 in excess of the profit earned. As the balance of undivided profit brought forward from the last account was £476, and as there are also reserve funds amounting to £2356, the Directors state that they would, under ordinary circumstances, have felt justified in recommending the payment of the usual dividends; but the public lighting of a considerable portion of Georgetown having been given over to a recently-formed Electric Lighting Company, they consider it undesirable to make use of the accumulated funds until it is seen what effect, temporary or permanent, the electric lighting may have upon the business of the Company. They therefore recommend the declaration of a dividend on the preference share capital at the rate of 8 per cent. per annum, and on the ordinary share capital at the rate of 6 per cent., both less income-tax (except upon those dividends payable to the local shareholders). The Directors announce the resignation through failing health, of their colleague Mr. Joseph Quick, who has been connected with the Company since its formation; and they also report with regret the death of Mr. Charles Newton, who had been a Director since the year 1889. The vacancies thus occasioned have been filled up by the election of Mr. Alfred Lass, who has acted as Secretary to the Company during the last twenty years, and of Mr. Robert Berridge, who succeeded the late Mr. Newton as Auditor. The Directors recommend that the vacant auditorship be filled up by the shareholders; and Mr. J. Manwaring has offered himself as a candidate. The secretaryship has been filled by the appointment of Mr. Samuel Wood, A.C.A.—for many years associated with Mr. Lass.

The Completion of the Vyrnwy Water Scheme.—The approaching completion of the great work for supplying Liverpool with water from Lake Vyrnwy gave rise to a long, and at times rather animated, discussion at last Wednesday's meeting of the City Council. On behalf of the Water Committee, Mr. Alderman Hughes proposed that the Mayor be respectfully requested to make arrangements for publicly inaugurating the supply of water from Lake Vyrnwy; Mr. Deacon having reported that the connection would be finished before July 14 next. In view of the completion of the work, said Alderman Hughes, there was a feeling that there should be some formal ceremony in the city to commemorate the successful carrying out of this noble work. Frequent difficulties and misfortunes had overtaken the scheme during its progress; but they were now assured that the tunnel was completed, and that the permanent line would be finished shortly. They would then have secured to Liverpool 15 million gallons of water per day from Vyrnwy. Inquiries had been made by Mr. Parry, the Water Engineer, as to the supply of water for manufacturing purposes in other towns; and he hoped even before July to be in a position to submit to the Council a proposition by which water could be supplied at a cost that would not only be satisfactory to the manufacturers, but that would compete with any other town in the kingdom. As to the contemplated ceremony, it was suggested that at one time they might have a memorial fountain; but, whatever course was adopted, he (Alderman Hughes) hoped that there would be some record in one of the principal thoroughfares commemorative of so important an event. The cost in all probability would not be more than from £500 to £1000. Alderman Garnett seconded the motion. The discussion which ensued appeared to be carried on mainly by certain members who objected to the ratepayers' money being spent in this way; but, after three amendments had been proposed and rejected, the original motion was agreed to.

Increased Storeage for the Leeds Gas-Works.—The record of the proceedings of the Gas Committee which was submitted, and approved of, at the meeting of the Leeds County Council last Wednesday, included a decision to obtain tenders for the erection of a new gasholder, 240 feet in diameter, on land recently acquired by the Corporation, and adjoining the Meadow Lane works. This, Alderman Gilston explained, would involve considerable expenditure; but if the Committee did not increase their storeage they would have to spend a still larger sum in extending their producing capacity. They had, he thought, adopted the most economical course.

A Secretary Convicted of Embezzlement.—At the Mansion House Police Court, on Monday last week, William David Melville Forrest, Secretary to the Odessa Water Company, was charged on remand before the Lord Mayor with stealing a cheque for £600 2s. 6d., belonging to the Company. The case was reported in the JOURNAL last week. The accused had been 21 years in the service of the Company; and he was in receipt of a salary of £350 per annum. The prosecutors asked that the prisoner might be dealt with summarily; and he pleaded guilty. Sir Albert Rollit, M.P., was called, and gave him an excellent character. The Lord Mayor sentenced the prisoner to six months' hard labour.

Proposed Reduction in the Price of Gas at Manchester.—On the minutes of the Gas Committee being presented for adoption at the monthly meeting of the Manchester City Council last Wednesday, Mr. J. Brooks suggested that the following motion on the agenda paper should be considered with the report: "That the price of gas be reduced within the city from 2s. 6d. to 2s. 3d. per 1000 cubic feet; beyond the city, from 3s. to 2s. 9d.; beyond the River Mersey, from 3s. 6d. to 3s. 3d." After some conversation, it was resolved to approve of the minutes, with the exception of the recommendation relating to the price of gas, the consideration of which it was agreed to defer until the estimates of the Committee came before the Council.

Goring and Streatley District Gas and Water Company, Limited.—The term of the lease under which the contractors for the works of the above Company (Messrs. J. and H. Robus, of Bucklersbury) have carried them on, having expired on the 25th of March, they have, we learn, been taken over by the Directors in excellent condition. They were designed by Mr. Jabez Church, M.Inst.C.E., F.G.S., of Westminster, and erected under the personal supervision of Mr. H. J. Robus, who has now been elected a member of the Board. In the notice of the visit of the Directors to the works in July last, which appeared in the JOURNAL at the time, reference was made to the excellent character of the district served by the Company, and the scope it afforded for an extension of both branches of their business. The opinion then expressed has been verified; as the gas-rental has increased to the extent of 31 per cent., and the water-rental is advancing in a most satisfactory manner. In the erection of the plant, provision was, of course, made for adding to it as required; and the first addition is now being made in the shape of a second bench of retorts.

Southampton Gas Company.—The half-yearly general meeting of this Company was held last Wednesday.—Mr. R. C. Hankinson in the chair. The report presented by the Directors showed that the amount available for division was £14,094. From this sum the Directors recommended the payment of maximum dividends, amounting to £7360, on all classes of shares, less income tax; leaving a balance of £6374 to be carried forward. The increased expenditure for coals during the half year, as compared with the corresponding period of 1890, came to £2360; and, owing to the Durham strike, the cost in the next half-year's accounts would, the Directors stated, be considerably higher. The Chairman, in moving the adoption of the report, said it did not contain much, but what was there was highly satisfactory. He was glad to be able to state that the works (under Mr. Durkin's direction) had been carried on successfully, and were in good condition; and that the progress of the Company was satisfactory. The sale of gas was increasing; and this fact would necessitate a considerable enlargement of the works at an early date. Indeed, plans had been already prepared for the consideration of the Board. Since the last meeting, the works for the manufacture of sulphate of ammonia had been completed; and they were in operation night and day. There was a fair sale for the product; and the Directors were satisfied with the result, which was far better than that attained by the sale of the ammoniacal liquor at the low price obtainable for it. Dr. Trend seconded the motion, and it was carried. The maximum dividends were then declared; and after the re-election of the retiring Directors and Auditor, the usual votes of thanks were accorded.

The Registration of a Water-Meter.—At the Halifax West Riding Court recently, the Halifax Corporation summoned Mr. M. Bowers, the tenant of stabling and other premises at the Halifax Racecourse, for the non-payment of water-rent, amounting to £5. The case arose out of a dispute as to the quantity of water which had passed through the defendant's meter between Aug. 11 and 18 last. While the consumption averaged between 1000 and 3000 gallons per week, the quantity registered by the meter within the week was 101,400 gallons. The defendant, finding there had been a burst, had the pipe repaired; but he denied that the registration of the meter was correct. He said that it was not possible for 100,000 gallons to pass through the meter in a week. Mr. Waugh (who appeared for the Corporation) said that the meter had been tested; and it had been found that it would pass rather more than that quantity in a week at its full capacity. He took his stand on the 59th section of the Public Health Act, 1875, which provided that where water was supplied by measure by any local authority, the register of the meter should be *prima facie* evidence of the quantity consumed. John Mitchell, a meter inspector in the employ of the Corporation, was called; and, in cross-examination by Mr. Kershaw (for the defendant), admitted that there was an entry in his book in one instance of 100,000 gallons of water more than was consumed, but that had been corrected. Mr. James Robinson, Manager of the firm who made the meter, averred that, in order for the meter to pass 100,000 gallons per week, it would be necessary to have a leak as large as the pipe itself, all the taps being closed. The Chairman (Mr. W. H. Rawson) at this point, announced that the Magistrates had decided to dismiss the claim, with costs for the defendant.

Gas v. Electric Lighting at Northampton.—The Northampton Town Council last year introduced the electric light in the four ornamental lamps in front of the Town Hall, and gave the system a thorough trial during the winter. The result has been so unsatisfactory to the public, that at their last meeting the Council ordered a return to gas. The cost was shown to be about 14d. per hour, as compared with gas at 1d.

Proposed Purchase of the St. Anne's-on-the-Sea Gas-Works by the Local Board.—At the last meeting of the St. Anne's-on-the-Sea Local Board, a resolution was adopted to the effect that the Gas Company should be approached with the view of ascertaining upon what terms their works could be purchased. A Sub-Committee was appointed for the purpose; and it is stated that the Directors are not unwilling to sell, providing a fair price is offered for the concern.

Completion of a Reservoir for the Bolton Corporation Water-Works.—Mr. R. H. Swindlehurst, M.Inst.C.E., the Water Engineer to the Bolton Corporation, reports the completion of the new reservoir at High Rid; the total cost, including the site, being estimated at £28,000. The reservoir is 1435 yards in circumference, and 38 feet deep; and it has a storage capacity of 110 million gallons, equal to a full 28 days' supply for the whole of the borough. The present storage capacity of the reservoirs is as follows: For domestic purposes, 1128½ million gallons; compensation, 1113 million gallons.

The Sevenoaks Local Board and the Water Company.—Last Thursday, a special meeting of the Sevenoaks Local Board was held to receive the report of the Water Committee as to the Sevenoaks Water Order of 1892. The report reviewed the position of affairs from the beginning. Although not opposed to a uniform water-rate of 7 per cent., the Committee expressed themselves in favour of a sliding scale. In conclusion, they recommended the Board to present a petition to Parliament against the confirming Bill, with the view of making clause 74 in the Company's Act of 1878 compulsory to getting the Order amended. The Rev. J. Jackson moved that the report be adopted. He said that, acting on the Board's authority, they had entered into negotiations with the Company as to the purchase of their works. The Board had no power to compel the Company to sell; and the Committee therefore urged the Board to seek parliamentary authority to help them in the matter. Mr. Oldfield, in seconding the motion, said he was of opinion that the works might be purchased at a price satisfactory to all parties, if men of experience and independence were called in to say what the property was worth. The report was adopted.

Extraordinary Theft of Gas.—At the York City Police Court on Thursday last, William Henry Short, a glass-worker, was charged with stealing from the York Gas Company a quantity of gas valued at £25. The accused had been irregular in his payments; and in 1887 his gas was cut off, and the meter removed. He, however, by means of india-rubber tubing, effected a connection between the pipe coming from the main and the service-pipe on the premises, and so obtained a supply of gas for his business and household purposes. This was not detected until the 28th ult. Mr. Charles Sellers, the Company's Secretary and Manager, stated that the prisoner's gas consumption for the eight years prior to 1887 averaged £5 11s. 9d. per annum; but, putting it at £5 only, he had robbed the Company to the amount of £25. The accused pleaded guilty; and the Company's representative (Mr. Cobb) asked the Bench, in the interests of justice, to inflict a heavy sentence. He said they felt that the case was one which could not be dealt with otherwise than by imprisonment. Mr. Wilkinson addressed the Bench at some length on prisoner's behalf; pleading the failing health and declining business of his client, and throwing himself on the mercy of the Court. He asked that the case might be dealt with under the First Offenders Act. The Bench decided that this Act did not in any way affect the case; and the accused was sentenced to six months' imprisonment, with hard labour.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

For Stock Market Intelligence, see ante, p. 838.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon invest-ment.
£			p. c.					£ s. d.
GAS COMPANIES.								
590,000	10	13 Apr.	10½	Allance & Dubln 10 p. c.	10	16½-17½	+1	6 0 0
100,000	10	"	7½	Do. 7 p. c.	10	11-12	..	6 5 0
300,000	100	2 Jan.	5	Australlan (Sydney) 5 % Deb.	100	105-107	..	4 13 5
100,000	20	27 Nov.	8	Bahia, Limited	20	12-14	..	11 8 1
200,000	5	12 Nov.	7½	Bombay, Limited	5	6½-7	..	5 5 9
40,000	5	"	7½	Do. New	4	4½-5½	..	5 14 1
380,000	Stock.	26 Feb.	12½	Brentford Consolidated . . .	100	210-215	..	5 14 1
150,000	"	"	9½	Do. New	100	160-165	..	5 12 2
220,000	20	11 Mar.	11½	Brighton & Hove Original . .	20	40-42	..	5 9 6
888,500	Stock.	11 Mar.	5	Bristol	100	95-100	..	5 0 0
320,000	20	13 Apr.	11½	British	20	12-14	..	5 2 3
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	10	19-20	..	5 15 0
51,510	10	"	8½	Do. 7 p. c.	10	14-15	..	5 13 4
328,750	10	"	—	Buenos Ayres (New) Limited	10	6½-7½	..	—
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	94-97	+1	6 3 9
150,000	20	26 Feb.	8	Cagliari, Limited	20	25-27	..	5 18 0
550,000	Stock.	13 Apr.	13	Commercial, Old Stock . . .	100	230-235	..	5 10 8
165,000	"	"	10	Do. New do.	100	180-190	-2½	5 5 3
130,000	"	30 Dec.	4½	Do. 4½ p. c. Deb. do.	100	118-123	..	3 13 2
800,000	Stock.	30 Dec.	13	Continental Union, Limited .	100	221-226	..	5 15 1
200,000	"	"	10	Do. 7 p. c. Pref.	100	190-195	..	5 2 7
75,000	Stock.	30 Mar.	10	Crystal Palace District . . .	100	185-195	..	5 2 7
486,090	10	29 Jan.	10	European, Limited	10	19-20	..	5 0 0
354,060	10	"	10	Do. Partly paid	7½	13½-14½	..	5 3 11
5,470,820	Stock.	12 Feb.	12	Gaslight & Coke, A, Ordinary	100	204-209	+2	5 15 0
100,000	"	"	4	Do. B, 4 p. c. max.	100	94-97	..	4 2 5
665,000	"	"	10	Do. C, D, & E, 10 p. c. Pf.	100	247-252	+2	3 19 4
30,000	"	"	5	Do. F, 5 p. c. Prt.	100	116-121	..	4 2 9
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	169-174	..	4 6 2
1,300,000	"	"	7	Do. H, 7 p. c. max.	100	153-156	..	4 9 9
463,000	"	"	10	Do. J, 10 p. c. Prt.	100	245-250	+1	4 0 0
476,000	"	"	—	Do. K, 6 p. c. Prt.	100	146-150	..	4 0 0
1,061,150	"	11 Dec.	4	Do. 4 p. c. Deb. Stk.	100	113-116	..	3 9 0
294,850	"	"	4½	Do. 4½ p. c. do.	100	118-123	..	3 13 2
908,000	"	"	6	Do. 6 p. c. do.	100	163-168	..	3 11 5
3,800,000	Stock.	12 Nov.	12	Imperial Continental	100	224-228	..	5 5 3
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4-4½	..	6 13 4
560,000	100	1 Apr.	5	Met. of Melbourne, 5p. c. Deb.	100	106-108	..	4 12 7
541,920	20	27 Nov.	6½	Monte Video, Limited. . . .	20	14½-15½	..	8 7 8
150,000	5	27 Nov.	10	Oriental, Limited	5	8-8½	..	5 17 8
60,000	5	30 Mar.	7	Ottoman, Limited	5	4-5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited	10	2-3	..	—
People's Gas of Chicago—								
420,000	100	3 May	6	1st Mtg. Bds.	100	102-105*	..	5 14 3
500,000	100	1 Dec.	6	2nd Do.	100	103-106	-2	5 13 2
150,000	10	15 Oct.	10	San Paulo, Limited	10	8½-9½	..	—
500,000	Stock.	26 Feb.	15½	South Metropolitan, A Stock	100	275-280	+5	5 10 8
1,350,000	"	"	12	B do.	100	217-222	-3	5 8 1
200,000	"	"	13	C do.	100	235-240	..	5 8 4
725,000	"	30 Dec.	5	5 p. c. Deb. Stk.	100	140-145	..	3 9 0
60,000	Stock.	11 Mar.	11½	Totten. & Edm'nton, " A "	100	225-230	..	5 0 0
WATER COMPANIES.								
729,331	Stock.	30 Dec.	10	Chelsea, Ordinary	100	252-257	+2	3 17 9
1,720,252	Stock.	13 Apr.	8	East London, Ordinary . . .	100	193-198	..	4 0 10
544,440	"	30 Dec.	4½	Do. 4½ p. c. Deb. Stk. . . .	100	136-140	..	3 4 3
700,000	50	11 Dec.	8	Grand Junction	50	96-99	..	4 0 10
708,000	Stock.	12 Feb.	10½	Kent	100	252-257	+2	4 1 8
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max. . . .	100	220-225	+2	4 4 5
406,200	100	"	7½	Do. 7½ p. c. max.	100	185-190	+1	3 19 0
260,000	Stock.	30 Mar.	4	Do. 4 p. c. Deb. Stk.	100	120-123	..	3 5 0
500,000	100	12 Feb.	12½	New River, New Shares . . .	100	320-330	..	3 13 6
1,000,000	Stock.	29 Jan.	4	Do. 4 p. c. Deb. Stk.	100	126-129	..	3 2 0
902,300	Stock.	30 Dec.	6½	S'th'wk & V'hall, 10p. c. max.	100	145-150	..	4 6 8
126,500	100	"	6½	Do. D 7½ p. c. do.	100	133-138	+3	4 14 3
1,155,066	Stock.	11 Dec.	10	West Middlesex.	100	242-247	+2	4 1 0
Ex div.								

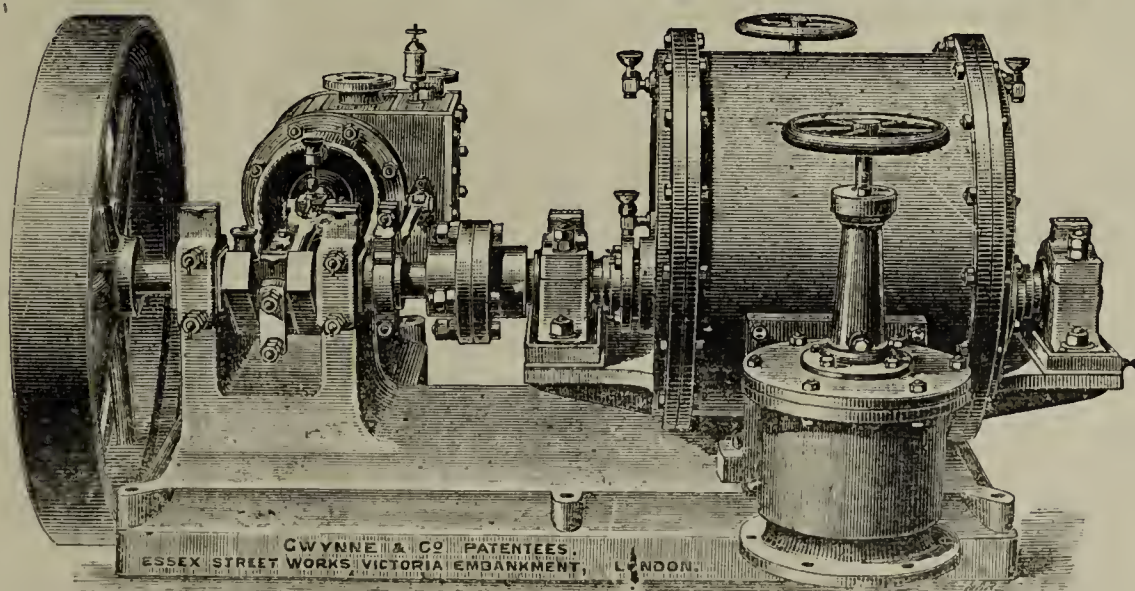
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May 7, 1892.

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COAL AND CANNEL.

THE Lymm Local Board are prepared to

receive TENDERS for the supply of COAL and CANNEL, to be delivered at their Gas-Works, in Lymm, for a term of One year from the 1st day of July, 1892.

The probable quantities required are about 1200 tons of Coal and 250 tons of Cannel, which must be well screened, and free as possible from Bats, Sulphurous Pyrites, or other objectionable matter; but the Board reserve the right of increasing or decreasing the quantities named.

The person whose tender is accepted will be required to enter into a contract, form of which can be seen at the Board Office any Tuesday or Friday between the hours of Ten and Twelve a.m. and Two and Five p.m.

Tenders, stating price per ton, delivered alongside the Works, to be sent to the undersigned on or before the 28th day of May, 1892, endorsed "Coal and Cannel."

Further particulars can be had of the Gas Manager, Mr. W. Severs.

The Board do not bind themselves to accept the lowest or any tender.

The Board have no special form of tender.

W. MULLARD,
Clerk to the Board.

Local Board Offices, Lymm,
May 7, 1892.

TAR AND AMMONIACAL LIQUOR.

THE Lymm Local Board are prepared to

receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR made at their Gas-Works, for a term of One year from the 1st day of July, 1892 (or for such longer term as may be contracted for, with the consent of the Board).

The Tar and Liquor will be delivered free in Contractor's Boat on the Bridgewater Canal.

Tenders to be sent to the undersigned on or before the 28th day of May, 1892, endorsed "Tar."

The purchaser will have to enter into a contract, form of which can be seen at the Board Office any Tuesday or Friday, between the hours of Ten and Twelve a.m. and Two and Five p.m.

The Board do not bind themselves to accept the highest or any tender.

The Board have no special form of tender.

Further particulars can be had of the Gas Manager, Mr. W. Severs.

W. MULLARD,
Clerk to the Board.

Local Board Offices, Lymm,
May 7, 1892.

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THE

JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MAY 17, 1892.

The Institution Meeting.

THE members of the Incorporated Institution of Gas Engineers met on Wednesday and Thursday last, under the presidency of Mr. Charles Hunt, of Birmingham; and the gathering is fully deserving of first mention as the event of the week in the annals of the British gas industry. The meeting was completely successful in every way. It was well attended; and the varied items of a

time-table which was almost too well filled, were all followed up with a zeal which only just fell short of enthusiasm. It is not possible to doubt now that the Institution does fill a real want. It brings together men from whom their professional colleagues are at all times ready to hear, and who are apparently not to be reached in any other way. And its papers are truly authoritative, in the sense that they emanate from most competent sources of information. The meetings of the Institution are pervaded by the most severely practical spirit. The authors of the papers give one the impression that their chief desire is to air their subjects rather than themselves; and the same candid sinking of the personal in the material characterizes the discussions. The two first Presidents of the Institution have set their followers a bright example of strict attention to business; and to them and to the Council must be ascribed the gratifying result that the meetings of the Institution are already taking rank with gatherings where something is to be learnt.

This year the meeting, by accident or design, or by a combination of both, was largely devoted to threshing out the questions of oil gas and carburetted water gas, as these affect British gas undertakings. The result was really good; for whether the various authors of papers and the speakers agreed or differed, the effect was to throw a strong light upon the subjects under notice. This class of gas engineering topics is quite a novelty in British gas managers' meetings; and it is possible to sympathize with the perplexity of those who discovered a difficulty, after perusal of the programme, in deciding whether the "gas" mentioned in the title of the Institution should be understood to be coal, oil, or water gas. It is idle to protest, however, that the trade of the members of the Institution is the manufacture of coal gas, and of this alone. For it is a general truth that hitherto the coal-gas works of all parts of the United Kingdom have depended upon more than one class of raw material. A store of cannel has always occupied a more or less prominent place in every works, even where the output of gas has not been of particularly high quality, judged merely from its illuminating power. Scotch gas makers, as is known, have been great sticklers for using only the best class of cannel, and have even gone so far as to stigmatize as "dross" the coal with which their southern brethren have to deal. But whether they used much or little of it, cannel has always been the gas managers' "friend in need." Now, however, this friend is failing them on all hands. District after district from which cannel coal has been drawn during the last hundred years, is being worked out; and the owners of the yet available pits are stiffening their terms accordingly. Thus, therefore, the gas manager has no choice in the matter. Whether he will or no, he must think more about oil than he used to do; and the Institution has laid itself out to present in one view the actual state of knowledge of the various ways in which oil may be employed for the purposes of British gas makers.

If it did no more than this, the recent meeting would have deserved to be called successful in the technical sense; but the attention of the members was not confined to oil. They had the opportunity of hearing about, and of talking over, other matters of contemporary interest; and their trip to East Greenwich must have been deeply instructive to most of them. For whatever can or can not be said of Mr. George Livesey and his brother and their aids, they are at least progressive. They are men of ideas, with whom it is good to confer. They make every completed work a stepping-stone to something still better; and they would regard an achievement in construction as almost a failure if it did not suggest an improvement upon itself. Conversely, when viewed in this light, a failure that illustrates the way to better things is never a total loss. This is the real secret of progress in gas engineering as in other things; and it is the possession of this power in such an eminent degree that renders the works of the Liveseys so irresistibly attractive in the eyes of their professional colleagues. Moreover, nobody—not even himself—can ever say what Mr. Livesey will do next; and so to his other interesting qualities he adds that of surprising on-lookers, which is sure to rivet attention.

There is no sound at present of the Institution quitting London; nor does there appear any urgent reason why the locality of the meetings should be changed. All roads lead to London; and if there is in existence a gas manager East, West, North, or South who objects to the spending of a few days in town during May, we have yet to discover him.

It is purely a question of the convenience of the majority; but there is no difficulty in perceiving which way this consideration points. It only remains now to recognize the excellent way in which the Council must have worked to bring the Institution into its existing satisfactory condition. One or two little matters require further looking into, of course; but, on the whole, the arrangements work remarkably well, considering all things. The Institution has good and powerful friends; but nothing can compensate for lack of experience in administration. Great credit is also due to the painstaking Secretary, Mr. T. Cole, Assoc.M.Inst.C.E., who is an efficient officer. It is undeniable that the position and prospects of the Institution have greatly improved from the conditions of this time twelve months; and there is no reason why the improvement should not continue during the year of Mr. Hunt's presidency.

Gas Workers before the Labour Commission.

THE case of the gas workers has at length been reached by the Labour Commission; the evidence of several prominent unionists occupying Mr. Mundella's Section during two days of last week. We commence in another column our special report of these proceedings. The best witness for the cause of Unionism was Mr. William Thorne, the General Secretary of the Gas Workers' Union, who stated his views with a candour and sincerity that gained him respect, as an earnest partisan, even from those who deplore the twist his mind has received from the socialistic demagogues with whom he has been thrown into such close contact. There is no beating about the bush with Thorne. He says what he means, and does not hold one tone in the mass meeting and another before the Commission. We have always admitted him to be a totally dissimilar kind of man to Ward and the others, whose un-English adroitness in suiting their policy to their company has gone so far to bring the name of Trade Unionism into contempt. Ward was examined before the Commission, of course; but he was a very different person in the room at Westminster from the Ward who harangues stokers outside the gates of gas-works. The story of the South Metropolitan strike was opened, from the Union side, by Mr. T. Blackburn, the Secretary of the Greenwich Branch of the Gas Workers' Union, who tried to make out that the real cause of the strike was the application of the men for double pay for Sunday work. He was subsequently led to confess, however, that the Executive of the Union wrote to the Directors, "asking them if they would kindly remove" the men who had dared to disobey the orders of the Union by signing the Company's profit-sharing agreement; and he also admitted that there was practically no Sunday work under the South Metropolitan Company. It is significant that this representative Union official, who had so much to do with the proceedings that led to the strike, had only been in the employ of the Company for one year; so that the subsequent locking out of men who had been working for the Company all their lives (which Ward affected so deeply to deplore) was through following the hare-brained counsels of the temporary hands. Both Blackburn and Ward tried to persuade the Commission that the South Metropolitan strike was "made with rose-water," and that the strikers were as lambs beside the brutal police and the still more bloodthirsty new hands. A different aspect was put upon the practical working of Trade Unionism by the evidence of the man Higgins, originally a unionist gas worker (by compulsion) at Salford, and now a stoking-machine tender at East Greenwich, who was so outrageously libelled by Ward. The evidence of the gas workers before the Commission should be read in conjunction with the newspaper reports of the reception, by the Marquis of Salisbury, of the deputation chosen to represent to the Government the feeling of a party of the working classes in favour of a legal Eight-Hours' Day. Mr. Thorne was a member of this deputation; and he told the Premier that the Gas Workers' Union had spent £10,000 upon strikes to secure the eight-hour shift in gas-works; and he asserted that this had been largely lost again through the action of the employers. This statement hardly squares with the evidence on the subject of gas workers' strikes submitted to the Commission; for in not a single case has it been established that a strike has originated for this reason. It would be advantageous if these discrepancies of testimony were removed.

The Gas Supply of Paris.

THE figures relating to the gas supply of Paris which appeared in last week's JOURNAL supply satisfactory evidence of the sustained popularity of gas in the French capital. The output of the Paris Gas Company has increased so largely, that it is now nearly on a par with the exceptional sale which marked the Exhibition year. The growth for the last twelve months reached the high figure of 142 million cubic feet, which, taking all the circumstances into consideration, is a really astonishing result. The proportion of gas consumed in the daytime, and therefore mainly for industrial and domestic purposes, was 26.45 per cent. of the whole. This is ascribable to the intelligent way in which the Directors of the Company have striven of late years to cultivate the popular taste in the matter of cooking and heating stoves. The administration is also entitled to credit for the readiness which they have displayed in facilitating the distribution of gas among the tenement houses of Paris, from which they now draw a very substantial proportion of their revenue. Coal and labour cost the Company rather more last year than they have been accustomed to pay; and the dividend shows the consequence. Fortunately for the Company, they have a capital sale for their coke, the value of which rose with the increased price of coal—thereby differing from the English coal market. The figures which deal with the Company's profits and dividends are as striking as ever. A profit balance of £1,464,000 resulted from the operations of the Company for the past year; and it was distributed in the following manner: A covenanted rate for share dividend, amounting to £448,000, was first deducted; leaving a sum of £1,016,000 equally divisible between the shareholders and the Municipality. Thus the latter get, as their share of the profits, £508,000, in addition to the proceeds of the tax of 2c. per cubic metre of gas sold, amounting to £210,893, and £8000 for rent of the subsoil occupied by the mains, and £42,937 towards the cost of lighting, &c., the public lamps. Thus the Municipality benefit directly from the gas undertaking (which does not belong to the city) to the extent of £774,830, while the proprietors get altogether £956,000, or after the rate of nearly 30 per cent. on their investment. The State charges, it should also be recorded, amount to a burden on the undertaking of £44,685 in the year. All this is rendered possible by the terms of the concession, which maintain the price of gas at 30c. per cubic metre, at which it has now stood for 36 years. Certainly, the high figure does not seem to stop the Company's growth. Yet it is felt in Paris as a grievance, if not as an absolute scandal; and the Municipality are continually being moved to devise some method of reducing it without injury to vested interests, which is a very difficult matter indeed. It was a year or so ago that a basis for a satisfactory rearrangement of the affairs of the Company was in sight, whereby a reduction in price might have been rendered possible at the cost of a prolongation of the concession. But the negotiations fell through, for some reason; and now, although a renewal of the interminable *pourparlers* upon the subject is spoken of, there is no real prospect of anything being done in the matter. It is in order for both the Municipality and the Company to express a desire to come to a better understanding; but while talking thus, both parties keep a firm grip upon the preposterous profits which the short-sighted framers of the Company's concession enable them to share. And so, as there is no making of omelettes, even in France, without breaking eggs, and it is not evident how the price of gas is to be lowered without diminishing the profit on its sale, things remain as they were, year after year.

Gas Profits and Rating in the Manchester District.

THE Manchester City Council have refused to accept the recommendation of their Gas Committee to reduce the price of gas by 3d. per 1000 cubic feet; thus endorsing once more the traditional policy of the aldermen and councillors identified with the spending departments of the Corporation, and denying to the doubly-rated gas consumers the relief which the circumstances of the undertaking fully justify. There is no attempt to disguise the motive of those who have defeated the efforts of the Committee to further popularize the gas supplied from the Corporation works—it is simply and solely the disinclination to cut off an indirect source of revenue which can be made useful in covering up the losses, waste, and financial

blundering of the Corporation. Having finished hotel building, it might have been thought that the Corporation would have shown more willingness to go directly to the ratepayers for the money required for carrying on the city government; but when was a local authority other than impecunious? Mr. Alderman King says that the School Board precepts are high, and the Council have a deal of work in hand; and therefore he cannot agree to relinquish £36,000 a year from the gas profits. Alderman Sir John Harwood points out that coal is dear, and tar falling in value. But these are minor considerations; and it would be something new for the administration of the Manchester Corporation gas undertaking to frame the selling price with sole reference to considerations of internal economy. Far more to the purpose was Sir J. Harwood's reminder that the Corporation are about to spend £100,000 upon an electric lighting installation which could hardly be expected to pay its way for a long time to come; and, of course, it would be the height of impolicy to do anything calculated not only to deprive the electric lighting venture of the support of gas funds, but also to increase the disparity between the cost to the user of the two systems of lighting. These and similar arguments have proved irresistible; and, accordingly, the gas consumers of Manchester, and the ratepayers who desire, in the interests of good administration, to put a stop to the vicious system of bolstering up one corporation department by another, must possess their souls in patience for another election or two. But how strange it would read if the preamble of all Bills for transferring gas undertakings from companies to local authorities were to rehearse the true reason why corporations like that of Manchester desire this class of property: "Whereas it is expedient that the corporation should have an indirect source of revenue, whereby the party in power may be to a corresponding extent independent of the ratepayers." As will be seen from our reports, Bolton, Rochdale, and Wigan agree with Manchester in acting upon the principle that rates paid through gas bills are not felt. Wigan, indeed, "goes better" than its big neighbour; for, in order that the municipal coffers shall not suffer, the Gas Committee actually pay over in relief of rates 25 per cent. more than their net profits—taking the rest out of their brand-new reserve fund, only established last year. At Rochdale, it is true, Alderman Petrie, speaking as Chairman of the Gas Committee, has awakened to the truth that a wrong and foolish thing has been done in the past in "coddling" the rates at the expense of the gas consumers; but municipal consciences in general are apt to be dull when an apparent lowness of rates can be purchased at the price of a piece of injustice which has "use and wont" to excuse it.

Death of Professor James Thomson.—The death, after a brief illness, of Dr. James Thomson, Emeritus Professor of Civil Engineering in Glasgow University, was announced early last week. He was born in 1822 in Belfast, where his father was Professor of Mathematics in the Royal Academical Institution, and subsequently filled a similar position in Glasgow University. The two sons—James and William—passed through all the classes of that institution with considerable distinction. The former chose the profession of a civil engineer; and, on the completion of his apprenticeship with Sir W. Fairbairn, he commenced business on his own account in Belfast. While resident there, he was appointed Engineer to the Water Commissioners; and in 1857 he became Professor of Civil Engineering in Queen's College. In 1872 he was elected to the professorship at Glasgow which he held at his death. His brother William is now Lord Kelvin.

Electric Light Statistics for Massachusetts.—We have received a copy of the seventh annual report of the Board of Gas and Electric Light Commissioners of Massachusetts, embracing statistics for the year ending June 30, 1891. We learn therefrom that there are 131 companies under the Board's supervision; 26 of them supplying gas and electric light, and 58 electric light only. The receipts last year amounted to \$2,440,350, and the expenses to \$1,735,206; as compared with \$1,920,702 and \$1,340,815 in 1889-90. The balance in that year was \$579,897; whereas last year it was \$705,144. The gas companies supplying electric light earned \$110,871 in 1889-90, and \$143,241 in 1890-91. The net earnings of the electric lighting companies in 1889-90 were \$469,016; in 1890-91, they were \$561,903. The Edison Electric Illuminating Company of Boston has the largest capital—\$1,263,500. The dividends paid ranged from 10 down to 1 per cent. There were five accidents (one fatal) caused by electricity.

WATER AND SANITARY AFFAIRS.

It is somewhat singular that the London County Council, in sending its statement respecting the Metropolitan Water Supply to the Royal Commission, thought fit for the document to take the form of a letter to the Secretary of the Commission, signed by the Parliamentary Agent of the Council. Why this gentleman should appear in the exercise of a function more naturally appertaining to Lord Rosebery or Mr. De la Hooke, is not very clear, especially as the statement is the result of a consultation in which the Chairman, the Medical Officer, and the Engineer, as well as the Parliamentary Agent, were concerned. Perhaps the County Council look upon the Royal Commission as engaged in an inquiry which falls very far short of the Progressive "program." The inquiry is purely scientific, and has nothing whatever to do with the question as to the right parties to possess the water supply. Neither are the Commissioners authorized to extend their inquiry beyond the watersheds of the Thames and the Lea. If they find that sufficient water for a greatly increased population, such as may be calculated upon for a distant period, can be obtained within the watersheds appertaining to London, the inquiry will terminate with that conclusion. So also if it be considered that the supply thus obtainable is insufficient, the Commission will have fulfilled its instructions. But another inquiry will then have to follow, to ascertain the best source of supply. We may infer, from all the reports and manifestoes issued from the County Hall, that the expectation existing in that quarter is a verdict hostile to the present supply. As the Commissioners have to consider the question of quality as well as quantity, there is the hope on the side of the Council that, if the water is sufficient in volume, it will be objected to as impure. In any case, the Council is doubtless looking for a second and further inquiry; and it is then that the grand opportunity will arise for attacking the Water Companies, and seeking to obtain the command of the situation. The present fight is looked upon rather as a kind of preliminary skirmish. But it may prove to be something more; and the Water Companies must not fail to deal thoroughly with the question. Yesterday the Commissioners examined witnesses appearing on behalf of the New River Company. Mr. Francis, the Company's Engineer, gave evidence as to the large additional supply to be obtained from the wells. The water that goes down the Lea in winter could, he said, also be stored, so as to yield 10 million gallons per diem throughout the year to the New River Company, and a like quantity to the East London Company. To-day the case of the latter Company will be gone into.

Some interesting particulars concerning the "Amines" process, invented by Mr. Hugo Wollheim, for the treatment of sewage, appear in a report which has just been issued, descriptive of experiments conducted last summer at Salford, in which this particular system is said to have proved eminently satisfactory. In the JOURNAL for Sept. 24, 1889, we gave an account of the first experimental demonstration of the process, as applied to the sewage of Wimbledon. The system met with the approval of the Wimbledon Local Board; and it has been in operation there down to the present time, with the result, it is alleged, of being an "unqualified and unvarying success as regards both efficacy and cheapness." It is claimed for this process that, by the action of lime on certain organic bases belonging to the group of "Amines," a highly soluble gas is evolved, which spreads through every part of the liquid treated, and is held in solution with great tenacity. It is said that this gaseous reagent, which is designated "Aminol," has been found antagonistic to the existence and propagation of every species of bacteria occurring in sewage and other similar waters; these creatures being utterly extirpated in a remarkably short space of time. The absence of offensive smell in connection with the process was mentioned in our report of the Wimbledon demonstration. At the same time, the quantity of lime then in use appeared to be startling—being at the rate of 47 grains per gallon of sewage, coupled with 3 grains of herring-brine. At Salford, only 22½ grains of lime were used per gallon of sewage; the herring-brine being 4 grains. The experiment lasted two weeks, during hot and dry weather; the treatment being continuous, and the total quantity of sewage rather more than 84½ million gallons. The cost of the chemicals was ½d. per 1200 gallons of sewage; and

the entire charge, including all items, is calculated at £807 per annum for a million gallons per day. It is accordingly asserted that the entire cost of the process ranges from $\frac{1}{2}$ d. to $\frac{3}{4}$ d. per 1000 gallons treated. Dr. Klein's report on the process as tested at Salford shows that the effluent was practically sterile; and Mr. Charles E. Cassal repeats what he has said on a former occasion, "that clarification and the removal of a substantial part of the organic matter has been satisfactorily effected." Also "that no objection can possibly be taken to the alkalinity of the effluent." The final decision of the Salford Corporation, as to the adoption of the process or otherwise, has yet to be declared. Mr. Webster's electrical process is also under consideration; having been exhaustively tried in application to the Salford sewage. Continuously working, day and night, this process has yielded, if possible, even better results than when it is only worked intermittently.

Presentation to Mr. W. T. Batten.—An interesting meeting was held at the Singapore Gas-Works on the 12th ult. The men employed on the works, to the number of a hundred, consisting of Chinese, Malays, and Tamils, clad in the picturesque Eastern garments peculiar to their races, assembled in front of the Manager's house, to present a silver tray to Mr. W. T. Batten, on the occasion of his leaving Singapore for England. Mr. H. Willis Smith, the newly-appointed Manager, was asked by the men to present the tray, and also an address printed on white satin and ornamented with bows of ribbon in the Chinese style. This duty he discharged in felicitous terms; concluding by expressing his hearty concurrence with the sentiments contained in the last paragraph of the address, and wishing Mr. and Mrs. Batten long life and prosperity. Mr. Batten feelingly acknowledged the gifts. He congratulated the Company on having obtained good native servants, many of whom had, he said, been with them for 30 years. He assured these old employees, and also those who had joined the Company later, that not only he, but also the Directors had appreciated their services; and he was sure that their interests would be as well looked after in the future by his successor (Mr. Smith) as they had been by himself.

The Glasgow Water-Works Extension.—There are several interesting features in connection with the new service reservoir now in course of construction by the Corporation of Glasgow at Milngavie, forming an important section of the extension scheme devised by Mr. J. M. Gale, M.Inst.C.E., their Water Engineer, which is being rapidly pushed forward. A special point is the depth to which, at one side, it has been necessary to carry down the puddle trench; the excavation at one spot being no less than some 180 feet in depth, the strata traversed being greenstone (known locally as "whin"), soft sandstone, and shale. The minimum width of the trench is 6 or 7 feet at the bottom, gradually widening out as the surface is reached. The reservoir is formed of banks with internal and external slopes, 3 to 1 and 2 to 1 respectively; that on the inside being protected by beaching 2 feet in thickness, terminating in pitching 1 foot thick, running up to the top of the bank. The reservoir covers an area of 92 acres, and will have a water surface of no less than 86 acres, while it will hold 548 million gallons, or, taking the daily consumption of Glasgow at 50 million gallons, about eleven days' supply. It was commenced in the summer of 1886, and completion is estimated in some two or three years from now. It is lined with 5 to 1 concrete, worked in 12 feet lengths. It has been hand-mixed; being turned over twice dry and twice wet.

The Stability of Endothermic Compounds at High Temperatures.

—Recognition of the nature of the processes attending chemical combinations and transformations is being gradually forced upon technicians by the otherwise unaccountable results of experiments devised with practical objects. Thus, as Professor Ostwald said, in the course of his address at the last meeting, in Halle, of the German Scientific and Physical Society, it is necessary to reconsider the dogma that high heats are competent to break up all compounds into their elements. This view is now seen to lack justification. What we do know about the stability of compounds is, on the contrary, that all which are formed with absorption of heat—endothermic compounds, in short—actually become more stable with rise of temperature, and *vice versa*. It so happens that the majority of the compounds with which we are acquainted are formed from their elements with evolution of heat—are exothermic, in effect—and these become more unstable with rising temperature; and so we have fallen into the opinion that this is always the case. Two most important compounds, however, cyanogen and acetylene, are formed from their elements with great absorption of energy; and these can be readily produced in quantity at the highest temperatures of the blast-furnace and the electric arc. It is obvious that this consideration operates very powerfully in respect of the practical dealings with cyanogen and acetylene, which are concerned with the recovery of the nitrogen of coal and the carburetting of coal and water gas, and even with the construction of illuminating gas-burners,

THE INCORPORATED INSTITUTION OF GAS ENGINEERS.

PROCEEDINGS AT THE GENERAL MEETING,

HELD AT THE

INSTITUTION OF CIVIL ENGINEERS, MAY 11 & 12, 1892.

Mr. CHARLES HUNT, M.Inst.C.E., President.

REVIEW OF PROCEEDINGS.

The Incorporated Institution of Gas Engineers was last week favoured by the first burst of real summer weather which has been experienced in London this season; and it was doubtless owing in part to this good fortune in the important matter of climate that the members flocked in such a cheerful throng to Great George Street last Wednesday morning. The winter, with its prolonged fogs and dear coal and occasionally recalcitrant labour, had evidently not seriously depressed the spirits, or damped the powers for taking an interest in technical discussions, of the very business-like assembly which welcomed the retiring President of the Institution—Mr. G. C. Trewby—to the chair, which he only occupied for the time necessary for the disposal of the formal matters remaining over from the first year's existence of the young organization. So speedily were these votes taken, that Mr. Trewby was enabled to induct his successor—Mr. Charles Hunt—into the Presidential seat, and the new President had risen for the purpose of delivering his address, within ten minutes from the time that had been fixed for the commencement of the meeting. It is impossible, however, to proceed with a notice of the conduct of the affairs of the Institution by Mr. Hunt without placing upon record the indebtedness of the new association to the first President. It is not too much to say that Mr. Trewby, by his aid and influence exerted on behalf of the Institution, contributed most materially towards giving the organization that "good start" which it has undoubtedly made, and which ought not to be so difficult to follow up with a steady development in usefulness and interest. The Institution has to thank him in particular for marshalling in its support a brilliant group of technicians who had not previously come forward in this way, and whose presence in connection with it is the most effective demonstration of the fact that the young society is something more than a schism from an older organization.

The President has had a unique experience of this kind of office, having twice filled the chair of The Gas Institute—or rather, it should be said, of the British Association of Gas Managers. Among the memories that cling round these incidents of Mr. Hunt's professional career, perhaps the most pleasing is that of the impression created by his address of 1880, which was recognized at the time as one of the most masterly orations that had ever been delivered from the chair of the associated gas engineers of Great Britain.

After briefly paying the usual courtesies of an elective President, Mr. Hunt began his address by reminding his auditory of the Murdoch centenary; passing lightly over Murdoch's single achievement of applying coal gas to illuminating purposes, and pronouncing a few wise words on the subject of the man's peculiar genius. There is nothing concerning which more claptrap is commonly spoken than the respective values of mother-wit and schooling in the production of a great man, or of a man who does great things. Mr. Hunt put the matter very succinctly when he remarked that "the spread of education has no doubt done very much to increase our average working efficiency; but it cannot create a Murdoch or a Stephenson." We shall save ourselves much trouble by remembering that it is not the function of education to create anything, but rather to economize the time and labour of the student, and to train and equip the creative energy where it exists. Nobody more keenly felt the disadvantages of his want of training than Stephenson; and Murdoch must have groaned in spirit over many an hour of labour which a little previous instruction would have shown him to be hopeless.

The President soon left Murdoch and the early troubles of the pioneers of the gas industry, in order to discuss the very tangible legacy which these adventurers left behind

them in the shape of the excessive capitalization of old gas undertakings. Though the gas engineers of the past made many costly blunders, it was well pointed out by Mr. Livesey upon a recent occasion that it is hardly fair to make them bear all the blame for the most glaring cases of over-capitalization, which is a consequence of bad administration that one could wish rather than believe to be characteristic only of the remote past. It is not possible to give the President all he asked for the purpose of his comparison between the treatment of gas undertakings by companies and local authorities respectively. It may be true that the companies pay, on an average, about 7 per cent. for their capital; but the local authorities hardly get off for 4 per cent., as Mr. Hunt suggests. Surely, the extra for the sinking fund should have been added to this charge, because it is actually a present burden, although it is intended to come up again as a credit at some future time. There is an appearance of something like a "bull" in the presidential argument that if the local authorities get for 4d. per 1000 cubic feet of gas sold something which costs the companies 7d., the difference in favour of the former is "probably about 5d. per 1000 cubic feet of gas sold." This may be so; but a little further explanation seems to be wanted of how a threepenny saving becomes a fivepenny profit.

Mr. Hunt did not put forward these figures with a view to claim any superior merit for corporation management; but he did claim for the local authorities, for whom, as a class of gas proprietors, he has a natural partiality, that they are making a substantial provision for future eventualities by clearing off their capital liabilities. He argued that this must be for the better in any case; because if the first object of the provision should turn out to be an illusion, they will be all the freer to do many things—"supply gas at the cost of manufacture," or spend the money "in any other way that may appear advantageous." When one remembers the class of purposes for the application of gas revenues that have appeared to be "advantageous" in the estimation of the Corporation of Birmingham, and when one remarks how Birmingham is going to encumber itself with a big water-supply project, and bears in mind the example of Manchester and the appropriation of gas profits to the Thirlmere scheme, it is with a smile for the enthusiast who believes that if gas-works sinking funds should ever be found superfluous, the consumers of gas are even remotely likely to benefit by the discovery.

Mr. Hunt propounds the question whether something like amortization—total or partial, we may presume—should not be permitted for gas companies. It is an old query, of course, and is an idle one in the present state of the law of gas supply, except in regard to the voluntary relinquishment of some share of sliding-scale dividends, with the object of piling up a reserve, which might be regarded as a sinking fund in so far as to be held sacred for the last extremity of the concern. With this suggestion we heartily and strenuously agree, and hope the hint will not be lost upon those whom it may concern when the present pinch of dear coal, &c., is past. Statutory gas companies are not allowed to provide themselves with depreciation funds or to amortize their works at the cost of the consumer, as local authorities do. It is quite fair to put it in this way—that the higher burden of capital borne by the companies is, in part, a recognition of the fact that the proprietors are compelled to *stand by their risk*, whatever this may be; and it would not be an over-valuation of this risk to call it equivalent to 1 per cent. of dividend. It will take more than this for some years to build up to anything like a satisfactory figure the reserve funds of some of the gas companies that have been hardest hit by the recent and current troubles. We have never liked this depleting process; and we are inclined to go to the fullest extent with Mr. W. J. Warner, of South Shields, who has urged that the sliding scale should have the fullest play, while the reserve should be kept inviolate for transient needs. This is, however, a difficult question. It is all very well to say in general terms that gas company directors and proprietors should deny themselves of a point or two in the matter of dividend, for the sake of protecting themselves from adversity in the future; but what would you? Might it not be said with equal force that when a local authority acquire a gas undertaking, paying heavily for the goodwill, they ought to wipe this off, and bring the

business down to its bearings before taking a penny out of the revenues in aid of the rates? Yet where has so much foresight been shown?

There is always a "fearful joy" in correcting a President in a matter of reference or quotation. Mr. Hunt brought in a remark about a "decremental rate of increase," which he described as something susceptible of adoption, and ascribed the phrase itself to Mr. George Livesey. Now, it is true that Mr. Livesey has been responsible in his time for some very startling and even terrifying things in connection with gas administration; but this phrase is not one of them, nor does it bear the meaning ascribed to it by Mr. Hunt. It originated in connection with the arbitration respecting the acquisition of the Birmingham gas supply by the Corporation; and as then employed, if we remember rightly, it was coined by an accountant to express a continuously diminishing rate of growth of a gas undertaking when the district approaches the point of saturation. Thus, an increase for the current year of 5 per cent., followed by an increase of $4\frac{1}{2}$ per cent. next year, then by one of 4 per cent., and so on, would be very properly described as a "decremental rate of increase." The phrase did not, however, happen to please Lord Grimthorpe, then Sir Edmund Beckett, who was engaged in the Birmingham arbitration case; and so he contemptuously dismissed it as a sample of "arithmetic gone mad." That the invention of the term should be ascribed to Mr. Livesey, who, as we have understood, was only amused by it, is a striking example of the way in which history comes to be written.

The President next proceeded to comment upon the awkward question of the nominal illuminating value of gas, and ventured upon the generalization that "the richer the gas, the less economically it is used." For such a statement he will draw down upon himself the censure of many North British gas managers; but for this, secure in the appreciation and support of Glasgow, he will probably care little. These remarks led him naturally to the subject of carburetting by oil instead of cannel, which was to be so elaborated by the majority of the papers in the programme of the meeting; and he introduced some statements relating to the results of special experiments with oil gas, which ought to be read in conjunction with these papers. It is to be noticed that Mr. Hunt does not despair of the simple method of injecting oil into ordinary coal-gas retorts, after the charge has been partly carbonized—a plan which has few partisans among skilled technicians; but Mr. Hunt dearly loves a little paradox.

The subjects of labour and coal prices then occupied the attention of the President, who, while admitting, in general terms, the proposition that the stoker and the coal miner should be well paid, was careful to point out the reasons for his conclusion that the wages fund applicable to these employments is not illimitable. In asserting that wages in gas manufacture are now as high as they can be expected to stand for some time to come, Mr. Hunt stated a truth that the workers themselves will scarcely dispute. He rested upon indisputable facts when he declared that "there never has been a time when the reasonable and timely demands of gas workers have been denied;" and he might have gone further, and pointed out that improvements of position accorded to gas workers have never been taken away again during less favourable seasons for workers in general. This section of the address contains some very weighty and well-considered remarks upon the whole question of labour in gas-works, and the cognate subject of the employment—or rather of the very partial use—of labour-saving machinery in gas manufacture.

The President's remarks upon the important subject of gas testing and photometry were looked for with special curiosity, because he is known to hold strong opinions with regard to the Procrustean rule of the standard burner, consuming gas at the uniform rate of 5 cubic feet per hour. Expectation was not disappointed in this instance; for, with all the reserve due to remembrance of the circumstance that a presidential utterance is an *obiter dictum*, Mr. Hunt resolutely propounded his favourite theory that in all cases the height of the gas-flame in the standard burner should correspond with the maximum efficiency of this burner for the quality of gas under test. Whatever it may be worth, this contribution to the controversy of the day must be deemed timely and rational.

Of course, it would be impossible for a gas-works administrator to close a review of the condition of the industry without touching upon the "load factor," which

has of late being elevated into such prominence by the practitioners of a sister technology. It is one of the chief recommendations of this address that it is critical rather than historical or merely enumerative; and if Mr. Hunt had done nothing more with his great opportunity, he would have deserved well of his professional brethren, and those for whom they work, by laying the stress he did upon the "close relationship between economy of manufacture and duly-proportioned plant." There is much more in the remarks upon this head than meets the eye. Reading between the lines, it is easy to see that the speaker's object was to demolish the vulgar and pernicious notion that there is anything admirable in mere bulk, or despicable in smallness. Proportion, he tells his hearers, is all in all; and for those who miss this open secret, there is no redemption. Unfortunately, it by no means follows that the largest responsibilities fall to the most comprehensive minds. A critic was once brought to book for his hardihood in daring to call in question the administration of a gigantic undertaking. "Are you aware," asked his questioner, "that the Directors of this Company all receive £30 a time for their attendance?" It was too true; how could perfect wisdom be missed at such a price?

With a few kindly words relative to the subject of the training of students in gas manufacture, which the speaker's official position in connection with the City and Guilds of London Institute rendered appropriate, and which it is to be hoped will bear good fruit, this really admirable address was brought to a close. It is not an easy thing to justify oneself upon all occasions; but when Mr. Hunt resumed his seat in last week's meeting, he must have felt, doubtless with immense relief, that he had done justice to the Institution and to himself.

As soon as the President had concluded his address, Mr. George Livesey rose for the purpose of moving a vote of thanks to him for it. This proceeding was, by a very thin fiction, supposed to be irregular; but the irregularity, having now been committed twice, may well be converted henceforward into a normal function. A president of a scientific or technical society deserves thanks for having undergone the tribulation of preparing and delivering an address; and the debt may as well be paid off at once as held over to another stage of the proceedings.

An important motion, having the character of a digression from, or rather of an addition to the regular programme of the meeting, was then introduced by Mr. W. Foulis, of Glasgow. It referred to the Committee upon the Standards of Light, and was intended to empower the Institution to make representations to the Committee, in the name of the Institution, and on behalf of the gas industry of the Kingdom, on the subject of the proposed substitution of another standard for the statutory candle. The resolution to take this step was adopted unanimously; as also was another authorizing the Council to carry it into effect. After this matter was thus satisfactorily disposed of, the reading of papers was proceeded with; Mr. George Livesey's being taken first. We do not propose to criticize the papers, or to comment upon the discussions this week. Enough to say that the character of the technical business transacted by the meeting during the day and a half devoted to this work, was particularly good, and such as to well maintain the reputation of the Institution.

The first day's business was wound up by the annual dinner at the Holborn Restaurant, which was a very enjoyable and satisfactory function. The fare and the company were alike good; and if next time the Council can manage to compress the programme a little, their arrangements will be still more admirable. There is an ever-present temptation to essay too much in the way of oratory upon these occasions; but the temptation must be resisted in the interest of humanity. The second day's work showed no abatement of interest. Unfortunately, the time available for discussion was cut rather short by the exigencies of the tide in the river, which had to be consulted with reference to the afternoon excursion. The President had chartered a steamboat which took the members and a few friends from Westminster Bridge to the Tower Bridge works, a free inspection of which was permitted by the contractors, Sir W. Arrol and Co. Luncheon was also provided on board the boat by the hospitality of the President. After leaving the Bridge works, the trip was continued to the East Greenwich station of the South Metropolitan Gas

Company. The party was conducted over this large and fast-growing station by Mr. Robert Morton, as a Director of the Company representing the Chairman (Mr. George Livesey), who was unavoidably prevented from being present by his duties on the Labour Commission. Mr. Frank Livesey, the Chief Engineer, and Mr. Tysoe, the Engineer in charge of the station, also received the visitors, and explained what there was to see. Interest centred in the new six-lift holder now in progress of erection by Messrs. Clayton, Son, and Co., Limited, of Leeds, the contractors; and in the retort-working machinery, which comprised an illustration in action of the wire-rope power machines of Mr. West, and the new hydraulic power system of Mr. Foulis. The latter was only represented by the retort drawer, which is an admirably light, cheap, and efficient machine; but it was understood that the charging apparatus would soon be in place. It is unnecessary to describe the East Greenwich works in detail. They are now so far developed as to show the scale upon which the manufacturing operations will in future be carried on, and furnish a most instructive lesson in the art of filling out a generally uniform and settled scheme of gas works-construction, without excluding such improvements of detail as the progress of engineering science suggests from time to time.

The steamer then returned with the party to the "Ship" at Greenwich, where the Directors of the South Metropolitan Company entertained their visitors to high tea. The usual compliments having been paid and acknowledged by guests and hosts, the return from Greenwich up the river to Westminster brought the second meeting of the Incorporated Institution of Gas Engineers to a satisfactory end; and the members separated with mutual admissions of having spent a pleasant and profitable two days.

REPORT OF PROCEEDINGS.

The General Meeting of the Institution was held last Wednesday and Thursday, at the Institution of Civil Engineers, Great George Street, Westminster.

Mr. G. C. TREWBY, President for the past year, took the chair at the commencement of the proceedings.

ANNUAL REPORT AND ACCOUNTS.

The report of the Council (which had been printed and circulated) was taken as read. The principal portions were as follows:—

In presenting the second annual report, the Council has pleasure in being able to congratulate the members on the continued progress of the Institution. Since the meeting in May last, 45 applications have been received for admission into the Institution. This satisfactory addition to its numbers shows the increasing favour in which it is generally regarded.

The Council regrets to record the loss by death of one member—viz., Mr. Neil Meiklejohn, of Longwood—and one associate, Mr. John Chapman, of Harrow.

The first volume of Transactions is now in the hands of members, and will be found a fitting record of the work done by the Institution. The programme of the forthcoming meeting includes matter of at least equal interest and importance.

The Council would again draw attention to the suggestion contained in the circular letter of Feb. 29, 1892, pointing out the desirability of members contributing papers, not necessarily for reading and discussion, but for incorporation with the annual issue of Transactions.

The proposal to hold an autumn meeting was reluctantly abandoned, in consequence of it being found that the time of year was inconvenient for the attendance of members.

In response to an invitation from the Royal Commission on Labour, the Council offered, on behalf of the Institution, the services of such members as it felt would be of assistance to the Commission in their consideration of matters affecting the gas industry.

Accompanying the report was the balance-sheet, as audited by Messrs. Alfred Lass, Wood, and Co., and Mr. Magnus Ohren.

Mr. C. C. CARPENTER (London) moved the adoption of the report.

Mr. J. METHVEN (Beckton) seconded the motion; and it was carried unanimously.

NEW MEMBERS AND ASSOCIATES.

The Scrutineers reported that the whole of the gentlemen on the following list had been elected:—

MEMBERS.

Ball, T. B., Engineer, Gas-Works, Rochdale.
Belton, W., Engineer, Gas-Works, Shrewsbury.
Darwin, S. B., Engineer, Gas-Works, Portsmouth.

Edwards, A. J., Manager and Secretary, Gas-Works, Taunton.
 Ennis, T. F., Assistant-Engineer, Gas-Works, Nine Elms.
 Eunson, J., Engineer, Gas-Works, Northampton.
 Eunson, G. S., Engineer, Gas-Works, Northampton.
 Gandon, J., Engineer, Gas-Works, Smyrna.
 Helps, J. W., Engineer, Gas-Works, Croydon.
 Holgate, T., Engineer, Gas-Works, Halifax.
 Hulse, W. W., Engineer, Gas-Works, Longton.
 McGregor, W. S., Engineer, Gas-Works, Constantinople.
 Milne, R. V., Resident Engineer, Gas-Works, Adderley Street,
 Morley, H., Engineer, Gas-Works, Cardiff. [Birmingham].
 Symes, W., Engineer, Gas-Works, Rochester.
 Tindall, J., Engineer, Gas-Works, Walsall.
 Wilson, A., Manager, Gas-Works, Dawsholm, Glasgow.
 Winstanley, G., Engineer, Gas-Works, Coventry.
 Woodward, W. W., Engineer, Gas-Works, Bromley, Kent.

ASSOCIATES.

Blackwood, H., Assistant-Manager, Hendon Gas-Works,
 Sunderland.
 Pryce, E. Llewellyn, Chemist and Assistant, Windsor Street
 Gas-Works, Birmingham.

Mr. TREWBY said this finished the business so far as he was concerned. He had now the pleasing duty of asking Mr. Charles Hunt to take the chair, he having been elected President for the ensuing year; and he (Mr. Trewby) did not think the members could have made a better choice.

Mr. Hunt thereupon took the chair.

THANKS TO THE PAST-PRESIDENT.

Mr. THOMAS MAY (Richmond) then moved that the best thanks of the meeting be accorded to the retiring President, for his able conduct of the affairs of the Institution during the past year, as well as for his valuable assistance in bringing about its formation. He was sure it needed no words to commend this resolution. The members owed Mr. Trewby a debt which could never be adequately paid. He had given his time and influence, and had spared no effort in promoting the welfare of the organization. As a member of the Committee of the Council who had had some detail work to do, he could testify to the way in which Mr. Trewby had thrown his heart into it. At the very commencement, he allowed the use of his office, gave up his time, and used every effort to ensure the success of the Institution.

Mr. J. SOMERVILLE (London) seconded the motion; and it was carried.

Mr. TREWBY said he was much obliged to the members for the vote of thanks accorded to him. Whatever services he had been able to render had been given with hearty goodwill; and they would have been of little value if he had not been ably seconded by the Council, and especially by the Sub-Committee, who had all worked most eagerly in forwarding the interests of the Institution.

The PRESIDENT then delivered the following

INAUGURAL ADDRESS.

Gentlemen,—Allow me first of all to thank you for the great honour you have done me in electing me as your second President; in succession, too, to one whose high example I can only seek to imitate. It shall be my aim to maintain the prestige which he has secured for this infant Institution; and I rely with confidence upon your support in the endeavour to extend its usefulness.

It is scarcely possible to forget that this year completes the first century of gas lighting; and although too much might easily be made of the circumstance upon an occasion like the present, yet it must be admitted that much more than a mere academic interest attaches to the birth and growth of so great an industry. One might be excused for enlarging upon the public benefit which has resulted from its operation, or dwelling with complacency upon the many minor industries which are dependent upon it; but, at all events, the reminder will not be untimely or out of place, that its originator was a type of the men who have done so much for industrial progress. Owing nothing to birth or position, and almost untutored, except in the rough school of practical experience, he yet left behind him an enduring name and monument. The spread of education has no doubt done very much to increase our average working efficiency; but it cannot create a Murdoch or a Stephenson. The triumphs of Art and of Industry claim the exercise of a higher faculty than is implied by the achievement of scholastic distinction. Murdoch, seeing in the ordinary phenomenon of the combustion of coal just what everybody else saw, and yet realizing its significance as no one else did, gave evidence of his superiority in the

possession of habits of close observation and restless inquiry, without which the utmost learning can avail but little.

Over the difficulties which beset gas lighting in its early days, or the perhaps more serious mistakes of its maturer years, there can be little need to moralize; although, if a real history of them should ever be written, it will doubtless be conceived, not in the spirit of the mere chronicler of events, but with a desire to inculcate the lessons it affords, and to show how further progress may be best ensured.

One principal legacy of the past is steadily, if not rapidly, disappearing. The capital outlay of the undertakings continues to diminish relatively to the business done. Comparing the Board of Trade returns for the years 1886 and 1890, the average reduction for the period, per ton of coal carbonized, is seen to be 7s. 7d. by the Companies and 16s. 2d. by the Local Authorities; the actual capital invested per ton of coal carbonized at the end of 1890 being: Companies, £5 19s. 3d.; and Local Authorities, £6 os. 10d. The Local Authorities have, in addition, increased their sinking funds by an amount equivalent to 5s. 6.55d. per ton of coal carbonized—the total of their sinking funds now amounting to 20.96 per cent. of their capital outlay; so that their actual liability per ton of coal carbonized is only £4 15s. 6d. This, it must be recollected, is inclusive of large sums paid for goodwill, many of the undertakings having been purchased at a high premium; whereas the liability of the Companies represents nominal value only. The comparison may be stated in another way. It is probable that, taken together, the dividends and interest paid by the Companies average fully 7 per cent.; while the average interest paid by the Local Authorities is only 4 per cent. The invested capital being practically the same in both cases—differing only to the extent of 1s. 7d. per ton of coal carbonized—it follows that the capital charges of the Companies per 1000 cubic feet of gas sold compare with those of the Local Authorities as 7 : 4—that is to say, for every 7d. that it costs the Companies for dividend and interest, it only costs the Local Authorities 4d. for interest charges. The difference that this represents in favour of the latter is probably about 5d. per 1000 cubic feet of gas sold.

These figures are not put forward with any idea of founding upon them a claim for superior management on the part of the Local Authorities. They are a natural consequence of the change of ownership, and the purchase-money of the undertakings being a debt, to be cleared off as soon as practicable. They show, however, a further significance. They show that the Local Authorities are making substantial provision for the future. What if this should prove unnecessary by the continued popularity of gas? "So much the better," is the answer. "We shall, at all events, have cleared ourselves of debt, and be free to supply gas at the cost of manufacture, or employ our resources in any other way that may appear advantageous." If, on the other hand, it should turn out to have been a wise precaution, what is likely to be the position of the Companies? Will it not appear that they also should have been making a similar provision?

When the sliding scale was under discussion a few years ago, it was suggested that, as this had operated so entirely in favour of the Companies, it might be desirable to voluntarily relinquish a portion of the dividends resulting from it. An additional argument in favour of this course was to be found in the fact that the dividend and interest charges of sliding-scale Companies were in some instances in excess of those of Companies working under the old legislation. Although little has yet been done towards the adoption of what Mr. George Livesey called a "decremental rate of increase," it is to be hoped that, with a return to more prosperous times, the idea may be revived, if only for the purpose of wiping out, by means of profit that would be thus unappropriated, some of the capital which is at present practically unrepresented by productive works. Having regard, however, to the present difficulty of maintaining dividends, it is of more immediate importance to consider in what direction relief may be looked for in connection with the cost of manufacture, so greatly enhanced by the recent rise in values both of labour and raw material. Although, as regards the latter, the difficulties of the present period are not to be

compared with those of the years 1872-3-4, when for a time coal was almost at famine prices, they bid fair to be in some respects more lasting. No one, it is true, believes in the permanence of present prices, notwithstanding the determined efforts of the miners to restrict the output. But only the most sanguine can anticipate a speedy return to the low level of a few years ago, even if this should be desirable; whilst the increasing scarcity of cannel points to the advisability of reviewing the position both as regards the continuance of such a high standard of illuminating power as is implied by the manufacture of cannel gas, and also as to the use of enriching material in the production of common gas.

The example which was set by the Corporation of Glasgow a few years ago, in the reduction of its standard, might with advantage be followed where custom or statute continues to impose an illuminating power that, having regard to the conditions under which gas is ordinarily consumed, may be fairly described as wasteful. Whatever may be the exact value which the Glasgow consumer now receives, it is almost certain to be, relatively speaking, greatly in excess of that which he formerly realized under nominally a much higher standard. In addition to a reduction of the standard for cannel gas to a uniform 20 or 22 candles, the desirability of reform may be held to include an inquiry into the actual value of gas of such denomination as compared with common, or (say) 16-candle gas. Unfortunately, the means for making an exact comparison between the two gases are not readily available—which is almost as much as to say that our present methods of gas-testing are, for purposes of comparison, unreliable. It is, however, pretty certain that the richer the gas, the less economically it is used. Why not then seek to extend our lease, so to speak, of the gas by minimizing the waste that is going on. Local circumstances have in the past influenced the adoption of various standards in different parts of the country; but improved communication has now brought the products of various districts so much within common reach as to have paved the way for greater uniformity of illuminating power than at present obtains.

In the meantime, there seems to be a reasonable prospect of our finding in oil a good and reliable substitute for cannel. Oil has frequently figured at meetings of this kind as a powerful competitor of coal gas; but it will on the whole be made none the less welcome in its new capacity as a friend. The valuable information as to its use contained in the presidential address of Mr. [redacted] and in the papers read at the meeting of the Institution last year, will be added to on this occasion by contributors who are in a position to speak authoritatively upon the subject; and may be expected to give the results of a more extended experience with regard to it than has hitherto been available. It is not to be expected, or even desired, that progress in a direction so foreign to previous ideas and practice should be otherwise than deliberate; but the advantages of a new and abundant supply of enriching material are too obvious to be disregarded. Were this supply likely to prove only temporary, its utilization for gas-making purposes would be a matter of secondary importance; but as all authorities appear to agree that it is practically inexhaustible, the prospective, if not the immediate, value of an alliance with it seems to be beyond question.

It is perhaps an advantage that the use of oil is not restricted to one particular method. Besides carburetted water gas and simple carburation, already adopted to a considerable extent, there are—oil gas made as described by Mr. Foulis last year, or in a double retort after Pintsch's method; and mixing the oil with common coal and carbonizing in the usual way, or injecting the oil into a coal-gas retort at some period of the charge. Which of these methods is the most economical it is our business to determine. As a contribution to the discussion upon the question may be mentioned some experiments made under my direction during the past year, which form the subject of a communication to this Institution by Mr. E. L. Pryce, who had the conduct of them. They relate chiefly to the manufacture of oil gas, for which a very simple apparatus—consisting of a single iron retort, 6 inches in diameter by 7 ft. 8 in. long, set in brickwork in the usual way, a condenser, and clean water scrubber—was employed. Perhaps better results might have been obtained with

a double retort, although attended by increased cost of apparatus and possibly of fuel. It is likewise doubtful, also, if prolonged contact with a heated surface is attended with any benefit in the production of gas from oil, owing to its tendency to decompose. It has not appeared from these experiments that there would be any particular difficulty in working as many as eleven single retorts set over one furnace; each such retort being capable of gasifying about a gallon of oil per hour. As was to be expected, it was found that the production of carbon within the retort varied greatly with the kind of oil used, from which it may be concluded that success in the use of oil, for making either oil gas or carburetted water gas, largely depends upon its quality or previous preparation. With some oils, the retorts might be run almost continuously, or for days together without stopping; whilst with others they would require cleaning out every three or four hours. Another very important point is the regulation of the heat of the retort; any sensible variation of temperature greatly affecting the yield. Thus, in one case a difference in the average temperature of 245° Fahr. caused an alteration in the total luminosity obtained of rather more than one-third; the smaller yield corresponding, contrary to our coal-gas experience, with the higher temperature. It is very apparent, indeed, that oil, whilst advantageous from the facility with which it may be gasified under proper conditions, and its almost absolute freedom from impurity, requires careful handling. At present prices, there is little or no margin for unskilful treatment. The total residuals—solid and liquid—vary greatly, according to the temperature of the retort; in one case amounting to 68.1 per cent., a quantity which was reduced under more favourable conditions to 30 per cent. It is a drawback that these residuals are at present valueless; although the tar contains a small quantity of benzol or other light product, which in the opinion of some it should pay to recover. As, however, light oils of the paraffin series are also present in the tar, which are objectionable to the colour manufacturer, it ought not to be mixed with coal tar; so that, contrary to an opinion expressed during the discussion upon this subject last year, the two gases—oil and coal gas—should be kept apart until all condensable matter has been entirely removed from the former. It is then the finished article, requiring neither scrubbing nor purifying.

The cost of enriching common gas by means of oil gas can scarcely be determined by ordinary methods; but, accepting the illuminating power of the enricher as arrived at by means of the most suitable burner, it works out at from about 0.86d. to 1.56d. per candle per 1000 cubic feet for material alone. This is probably an excessive estimate; since by comparing the analyses of the various gases with their ascertained illuminating power, it is found that whereas common gas yields something like 4 candles for every per cent. of hydrocarbons absorbable by bromine, the richer gases, tested with the most favourable burner, yield less than 1½ candles. This may be due to some extent to a difference in the composition of the hydrocarbons; but much must also be attributable to the method of testing, which is unfair to the richer gases. A more satisfactory plan would be to mix the rich gas in definite proportions with gas of a very low quality, testing both the latter and the mixture with an equal height of flame in the standard burner, and correcting in each case to the 5-foot rate. It is not improbable that better results than were obtained in these experiments may follow from our further experience; the preparation of the oils, as well as the mode of gasifying, being of much importance. The investigation should prove not only interesting but profitable also to those who have time as well as inclination to pursue it.

The doubts which have been expressed as to the economy of injecting oil into coal-gas retorts after the charge has been partly burnt off are not to be wondered at, considering the difficulty which is constantly experienced in following the effect of any departure from the ordinary method of carbonizing. Even in the laboratory, no amount of care will prevent the most conflicting results being occasionally obtained; and it can therefore be no reproach if working results do not always appear as intelligible as could be wished. It is probable, however, that the last has not been heard of this method of using oil. Much no doubt depends upon the temperature of the retort at the time the oil is introduced; and my

experiments show that—at least, as regards those oils under test—a temperature which is fairly suitable for coal is uneconomical for oil. Yet, mixtures of coal and oil, carbonized in the ordinary way, have yielded experimentally an increase of luminosity over the same coal alone, equal to nearly double that which is shown can be obtained by the more roundabout process of gasifying the oil separately; the cost of enriching by this plan working out at the low figure of 0.5d. per candle per 1000 cubic feet. May not this result be attributable, in part at any rate, to the more perfect utilization of the illuminating constituents of the oil, consequent upon their being protected from decomposition by the surrounding gases evolved from the coal, and which are necessarily of a lower temperature than the retort itself? Is it unlikely that a similar protection, although in a lesser degree, is afforded in the manufacture of carburetted water gas; thus accounting for any economy in the development of luminosity from the oil which this process may possess? While it is doubtful if heavy crude oil can by any process be successfully gasified, owing to the large quantity of carbon it deposits, on the other hand simple carburation with very light oils, having a vapour tension at least higher than that of benzol, bids fair to rival in economy all other methods of using oil, as it excels them in the convenience with which it can be applied. There should be practically no limit, except the carrying power of the gas, to the employment of such a ready means of maintaining a uniform illuminating power, based upon a supply of oil which may be said to be a residual of other manufactures, and is capable of being wholly utilized for the purpose without residuum of any kind. Every candle added to common gas by its means should represent about 7 per cent. increase in productive capacity, without any appreciable cost for plant, and almost without labour.

This question of labour has not lost any of its importance during the past year; and the proceedings of the Royal Commission, upon which the gas industry is so fitly represented by Mr. George Livesey, have been followed with undiminished interest. The information which has already been collected as regards other industries promises to be of considerable value. The action taken by the Council of this Institution, as to evidence relating to our own industry, has been made known through its report; but it may be desirable to urge the importance of assisting the Commission by placing before it the fullest information, either of a special or general nature, as affecting gas-works management. It will probably be found upon inquiry that the improvement which has taken place during the last few years in the position of the gas worker is almost, if not quite, without a parallel in the case of any other employment. This should afford the strongest proof of a desire to place upon the best possible footing an occupation which may be none of the best, but is certainly not the worst that can be met with. There is, of course, a limit to the concessions that can be made without prejudice to the prosperity of the industry; and it is probable that this limit has been reached for some time to come. When everything is in good demand, it is but right that all should share in the general prosperity; but high wages and high prices for coal, without corresponding receipts for residuals, mean dearer gas. Dearer gas means restricted consumption; and restricted consumption means less employment. These are facts which the miner, even more than the gas worker, needs to bear in mind. He has become imbued with the belief that the railway and gas companies are mainly responsible for low prices of coal, and that they derive all the benefit therefrom, and can well afford to pay higher prices. No one can possibly desire that the gas or any other industry should prosper at the expense of another, either as regards the men engaged or the capital invested in it. All must wish that both the one and the other should be adequately remunerated—the miner especially, for his toil and risk. Is “cheap” coal incompatible with this? Cheap coal has made our industry what it is; and without it there must be less work for the stoker, and less work for the miner. If anyone doubts this, let him compare the consumption of gas under the influence of comparatively high prices, such as prevail on the Continent or even in America, with that which obtains in English towns of corresponding importance.

Speaking as one finds, there does not appear to be any reason to believe that the men as a body are unmindful of

the great improvement which has been effected in the conditions of their work, or have become less amenable to fair and considerate dealing. It is true that here and there conditions have had to be met which are in some respects novel; and there is a general disposition—occasionally manifested by proceedings more or less demonstrative—to attribute all that has been gained to the action of the newly-formed Trades Unions. Without in any way deprecating Trades Unionism—since, not only have all men an equal right to form combinations for any legitimate purpose, but such combinations may, under certain circumstances, be beneficial alike to employers and employed—the claim which has been put forward on its behalf may fairly be disputed. It can be said with perfect truth that there has never been a time when the reasonable and timely demands of gas workers have been denied them; and the events of the last few years form no exception to this statement. The mischief in these combinations is principally to the men themselves, and arises out of the temptation, not uniformly resisted, to rely upon the representations of interested agitators rather than upon their own natural shrewdness and good sense. It is not the principles of Trades Unionism so much as the abuse of them, which may be the cause of misunderstanding. A Trades Union should be a guarantee of efficient work on the part of its members; but when put forward as a mere fighting organization, it is entitled to just as much respect as it can win by the sword, and no more.

With the insight it will have gained into the feelings and aspirations of both sides, the Commission will doubtless be enabled to form a clear estimate of the position; and may, it is to be hoped, see its way to some practical recommendations, if only for the settlement of disputes without recourse to the unsatisfactory arbitrament of a strike. Expectation in this direction should not, however, limit the consideration in the meantime of any plan that may be already in progress for the improvement of the relations between capital and labour; and in this view, Mr. Livesey's profit-sharing scheme commands attention by the prospect it seems to afford of a firm and lasting union of interests. It is one of a group of subjects bearing upon the welfare of the wage-earning classes which is of growing interest; and the influence of which cannot fail to be felt, either directly or indirectly, by all who stand in the position of employers of labour.

Satisfaction, however, at any signs of amelioration cannot limit the obligation to discharge the bill which may be expected to follow. Mr. Field's “Analyses of the Accounts of Gas Undertakings” are always interesting, if they are not invariably pleasant reading. Thus, the Analysis for 1890 shows, by comparison with previous records, the extent to which cost of production has already been influenced by the recent labour movement. At the same time, it shows that this influence has been by no means equally felt by the various undertakings under review. On page 14, part 2, for example, under the heading of “Wages (carbonizing),” a difference is now seen of not less than 2s. per ton of coal carbonized between the highest and the lowest on the list—the figures being 3s. 10.77d. and 1s. 10.73d. respectively. It is not difficult to recognize in the one case an extensive use of machinery in the retort-house, and in the other the predominance of hand labour; but what can there be to justify, as regards the latter, an expenditure of more than double that which has been proved by experience to be sufficient for the same work? It is not easy to account for the little real progress that has been made in the employment of stoking machinery. Even the simple machines that have for a long time been available are in use only to a very limited extent; notwithstanding that it has been clearly proved that they may be profitably employed in almost any works of moderate size. Even where circumstances favour a continuance of hand charging, the drawing machines may be used by themselves with appreciable economy. This equally holds good where the manufacture is upon a larger scale, and with the added advantage to be derived from steam or other motive power. For nearly nine years (with the exception of one or two brief intervals) machine drawing in conjunction with hand charging has been in operation under my direction. During that time, about 900,000 tons of coal have been carbonized by this system—four machines doing the whole of the work of nearly 750 mouthpieces. With these machines, one man (with another to attend to the lids) can draw at a

maximum rate of fully 100 mouthpieces in one hour; and 656 have been regularly done as a day's work for one machine. The total saving in labour has already amounted to nearly five times the original cost of the machines and their equipment complete.

Those of us who are not committed to machinery have now the choice of another method by which hand labour in the retort-house may be minimized. To build the retorts at an angle that will enable them to be charged and discharged by gravitation, is but following out the idea that must always be present in the mind of the constructing engineer who in designing works desires to afford the utmost possible facilities for the handling of material with economy, consistently with a due regard to the cost of construction. After everything practicable has been done in furtherance of this object, then only should machinery be resorted to. Upon the assumption of their practicability, there can be little difficulty in giving the preference to inclined retorts over horizontal retorts drawn and charged by machinery. The absence of machinery more or less complicated, is of itself no small advantage, having regard to wear and tear and liability to breakdowns. It was hardly to be expected that the new system would at the outset give uniform satisfaction—seeing how little beyond the idea of an inclined retort there is in the original arrangement of M. Coze that can be followed with advantage. Where, however, an independent line has been taken with regard to the details, it appears to have been generally successful. A cost of about 1s. per ton for conveying the coals, charging and drawing the retort, and wheeling away the coke, with no machinery to keep in order, would effect an appreciable improvement in many a balance-sheet; and this is not an ideal figure, but one derived from actual practice.

The subject of gas-testing, already incidentally referred to, has become additionally prominent by the appointment, at the instance of the Board of Trade, although at the sole cost of one of the London Companies, of a Commission to determine the very vexed question of a substitute for the sperm candle as a standard of light. It is significant of the slow growth of public opinion that only now, after so many years of agitation, do we seem to be within measurable distance of the adoption of a "candle" without a wick, and of invariable composition. But it is scarcely satisfactory that a matter of such general importance should be proceeded with as though it affected the London Companies solely. It must be the business of all gas undertakings—Provincial as well as Metropolitan—to assure themselves, not only of the practicability for everyday use of whatever may be proposed as the future "candle," but also that this shall fairly represent the unit of light as expressed and understood by the parliamentary definition of a standard candle. Equally important does it seem to be to determine whether the gas is at present consumed in the testing burner under the same conditions as formerly, and also how far the deficiencies of this burner may be remedied so as to justify its title of "standard" burner.

This burner, as has been known almost since its introduction, is not capable of giving, with the same sized chimney, comparable results under varying rates of consumption or different qualities of gas. Throughout its range, the air supply is in excess of the requirements of luminous combustion; such excess becoming more and more marked as the flame is reduced in height. An exaggerated effect is thus produced by any alteration in the height of the flame from whatever cause. This is doubtless the case with all Argands; but not to the same extent. For example, the objection would have but little practical importance if applied to the French standard burner, the Bengel, which, at its maximum efficiency, has a range of consumption of fully 3-4ths of a cubic foot, with a variation of only $\frac{1}{4}$ of a candle; whereas the English standard shows a difference within the same range of consumption of fully four times as much. Compared with itself, it is almost unnecessary to say how variable is the tale which this burner is found to tell under alterations of the height of flame in the chimney. Thus, gas having a value of 3 candles per cubic foot when tested at the 5-foot rate gives 3.25 candles per cubic foot, with the chimney fairly full; sinking to 1.08 candles, and even to 0.23 candle per cubic foot when consumed at the rates of 3 and 2 cubic feet respectively. In like manner, gas having an illuminating power of about 10 candles, when tested at the 5 cubic feet rate, develops upwards of 14 candles if tested with the chimney

fairly full, and afterwards corrected to 5 feet. Whilst height of flame checks the tendency to excess in the air supply, it is not, as has sometimes been supposed, an unfailing index to illuminating power. It varies not only with the consumption, but also with the composition of the gas—such as the presence or otherwise of carbonic acid; or as resulting from the use of different coals, or the temperature employed in carbonizing. It follows that there cannot be uniformity of testing with the 5-foot rate, because the gas which burns with the longest flame for equal luminosity is tested to greatest advantage, owing to its being the least subject to depreciation from excess of air. As to what should be the height of flame in the chimney, is a question that must be answered in accordance with the views that may be entertained as to the desirability of securing practical uniformity of testing for all kinds of common gas. Respecting this, however, there can scarcely be two opinions; and there is only one known method by which it can be done, so far as the burner is concerned—namely, by making the height of the flame in all cases to correspond as nearly as practicable with the maximum efficiency of the burner. This would free the tests from any disturbing influences affecting the height of flame, and bring commercial testing into line with the most approved practice in experimental work involving comparisons between different gases.

It is at once apparent that the adoption of such a method, whether accompanied by retention of the 6-inch chimney or by the employment of a different height of chimney according to the quality of the gas, as suggested by me during the discussion upon a paper by Messrs. Hartley and Heisch in 1884, would be an advantage to the Companies, inasmuch as all gases below about 17 candles would be assessed at a somewhat higher value than under the present system; and some may be disposed to regard this as an objection to the proposal. It was, however, in no such spirit that the present standard burner was substituted for one less favourable to the Companies. It was said in effect, if not in words also, that the Companies were entitled to have their gas tested with the best practicable burner. May it not with equal justice be urged that they are also entitled to the best of which this burner is capable under practicable conditions? It is scarcely conceivable that so reasonable a plea can be denied, and with it the establishment, once for all, of a really National, because uniform, system of gas testing, or that this great opportunity for a permanent settlement will be dwarfed to the necessities of 16-candle gas.

It may appear inconsistent to couple together as characteristic of the present position of gas lighting such apparently opposite conditions as increasing severity of competition and unchecked growth. Yet such a description would not be very far from the truth. At one end of the scale of consumption electric lighting, and at the other oil, find increasing support; but between the two gas continues to occupy an apparently impregnable position, but little disturbed except by the exigencies of the demand for it, and the dimensions which its manufacture has assumed. There can be little doubt that the additional uses to which gas is now applied have brought in their train greater fluctuations of consumption than were experienced only a few years ago. That this was likely to be the effect of an extended use of gas for heating purposes, necessitating more rather than less storage, was suggested by me at a time when the opposite opinion seemed to be in favour, and the increasing sensitiveness of consumption to variations of temperature indicate what is to be expected if gas should ever come to be used more largely for heating than for lighting. It is to be hoped that this time is very far distant. Lighting, and particularly domestic lighting, is, and must continue to be, the principal stay of the industry. Without domestic lighting, which extends throughout the year with almost exceptional constancy, the "load" upon a gas-works would be almost too variable for economy; and this gives additional point to the efforts that are being made for its extension. Whether these efforts take the form of collections at short intervals or prepayment meters, is of little consequence, provided the object be attained. But independently of either method of securing additional consumers, it seems that a gas undertaking may by its ordinary mode of conducting its business either attract to itself a very numerous class of customers, or limit its connection to the comparatively well-to-do.

That both policies are reflected in varying degrees by the statistics of the undertakings, does not admit of much doubt. The range of consumption should be fairly indicated by the average quantity of gas used per consumer, because the wider this is the lower must be the average, owing to the larger number of small consumers necessarily embraced. From the Board of Trade returns, it appears that in the case of the provincial undertakings having more than 5000 customers, and supplying common gas, this average varies as much as from 11,000 to 64,000 cubic feet per customer per annum. The lowest figure corresponds to nearly six times the number of customers, as compared with the highest, for the same consumption. It would be difficult to account for so great a difference by purely local circumstances, such as conditions of trade or occupation. The average quantity used by London consumers reaches still higher—namely, to 85,000 cubic feet per consumer.

Whether the limits of economy in gas manufacture are or can be reached in the scale upon which it is conducted, is an interesting question from more than one point of view. Administratively as well as commercially, it is of the highest importance; and to the engineer, it suggests possibilities in the shape of huge plant that may at no distant date become realities. It can hardly be doubted that there is a more or less close relationship between economy of manufacture and duly proportioned plant. Otherwise, it might be difficult to account fully for the very satisfactory position of some of the smallest undertakings as compared with that of their much more important neighbours, possessing every advantage which manufacture upon a large scale is supposed to give. I do not offer any apology for once again referring to the Board of Trade returns. These show that out of 52 undertakings supplying gas at less than 2s. 6d. per 1000 cubic feet, 34 carbonize under 50,000, and no fewer than 24 under 20,000 tons of coal per annum. Generally, in the case of such works, the relationship referred to is practically recognized by the substitution of larger rather than the duplication of existing plant when the necessity arises for increased producing power. When this is neglected, undue expenditure is almost certain to result. At the works of which I took charge just twenty years ago, a policy had been followed of providing for present needs by making small additions to the plant from time to time with as little disturbance as possible of existing plant. How it succeeded is now a matter of history; but the result might have been different had the Company possessed an exclusive area of supply, as well as a sufficiently high maximum price for gas; because then the consumers and not the shareholders would have paid the penalty. Suppose, however, for a moment, that it had been continued. What would now be the position, with an output increased nearly threefold? What satisfaction could there be in the management of a works which for the production of about 11 million cubic feet per diem required (say) 3000 mouthpieces, 70 purifiers, 30 gasholders, and minor plant to correspond? It may be objected that this is a fancy picture; but is it more unreal than the original from which it is drawn? What, frequently, are large works but aggregations of smaller ones; or large undertakings, but multiplications of comparatively small separate works? It is hardly to be expected that economy of manufacture should under such circumstances keep pace with the tonnage of coal carbonized. Other reasons render it no less imperative that the day of small things in the matter of plant should come to an end. Large plant is much easier to manage than small plant—as all who have had experience of it can testify. It is only by its means that manufacture can be satisfactorily conducted upon a large scale. Moreover, the tendency to concentration, as opposed to the more costly plan of establishing new works, every few years has to be reckoned with, and the best must be made of it. The best is made of it by every departure from the limits which custom or tradition has too often been allowed to impose upon the size or capacity of apparatus; and by the expansion of our views in this respect in sympathy with the demand.

It is gratifying to note that in one important particular a very notable advance is in progress. The era of large gasholders, initiated by Mr. George Livesey, has at length fairly set in; and the satisfaction with things as they are, sententiously expressed by the objection "Too many eggs in one basket," must have been rudely shaken by the

growing frequency of structures which, however much they may be open to criticism from an æsthetic point of view, leave little to be desired as an indication of further possibilities in the same direction.

The importance of a thorough training as a preparation for the duties of a gas-works manager was never more apparent than at the present time, when many new subjects are pressing to the front, and the possibilities of further economy are becoming more and more narrowed to such as can only be attained by superior skill. As Examiner in Gas Manufacture for the City and Guilds of London, I have been impressed not only with the evidences of improvement in the quality of the candidates for examination, but also with the desirability of securing, if possible, a still higher standard of qualification. It is to be presumed that most if not all of those who present themselves at these examinations aspire to occupy, at some time or other, positions of responsibility in connection with gas undertakings. I would say to all such: "Do not undervalue the profession to which you seek to attach yourselves, nor think it sufficient to possess what is called a 'practical' knowledge of gas making; but endeavour to the best of your ability to perfect that groundwork of knowledge without which success is likely to be but partial." Our profession is a peculiarly democratic one, inasmuch as its ranks are open without reserve to the deserving of all grades, and the steps in it are many and varied; but this facility of entrance might become a danger even to the industry itself, unless safeguarded by a consciousness of what is due in return. It is not too much to ask of our recruits that they bring with them, not only an intention to succeed, but also the best earnest of that intention in the shape of a store of such well-ordered knowledge as may be usefully applied to their work.

It should be well within the province of this Institution to build upon the foundation thus adequately prepared. Its constitution provides for the admission, either as Students or Associates, of all who have entered the lists, either by way of a regular pupilage, or in the ranks of service, and who may reasonably look to it for example and guidance. Without taking upon itself the functions of an examining body, the encouragement by the Institution of work done by its younger members could not fail to be of essential service to the latter. Nor is there before it any task more honourable than that of influencing, and in some measure directing, the rising current of thought and activity thus represented; so that the burden now resting upon our shoulders may continue to be borne, lightly and triumphantly, on to a higher and yet more imposing level.

Mr. G. LIVESEY said he felt bound, as he did last year, to break the rule that all votes of thanks should be deferred till the close of the meeting, because he did not think that the admirable address to which they had just listened should pass without immediate recognition. It was no easy matter to prepare an address for a meeting of gas managers. Addresses were very plentiful now-a-days; and for any man to produce an address which was both interesting and useful was a most difficult task. Mr. Hunt had succeeded beyond their expectations—and they were by no means low; and he had much pleasure, therefore, in proposing that the heartiest thanks of the meeting should be tendered to the President.

Mr. R. MORTON (London) said he had great pleasure in seconding the motion, for the address must be very helpful to all, especially to the younger members.

The motion was carried unanimously, and briefly acknowledged by the President.

STANDARDS OF LIGHT.

Mr. W. FOULIS (Glasgow) said he had been deputed by the Council to bring forward the following resolution: "That, inasmuch as any alteration made in the standard of light for the Metropolis will, in all probability, be also legalized for the United Kingdom, this Institution, as representing the gas industry, respectfully submits that, before any alteration in the standard of light, or the value of the same, be made, an opportunity should be afforded for this Institution to be heard on the subject." He said he need not use many words in recommendation of the resolution. The subject was one which they all felt should be settled on a sound basis; and they were very hopeful that the action recently taken by the Board of

Trade, in appointing a Committee, might have this effect. They had every confidence in the ability of the gentlemen who composed the Committee; and he felt sure they would not come to any conclusion without very careful inquiry. At the same time the Council felt that, in all probability, an expression of the views and opinions of the Institution might not only help them to arrive at a decision, but might also make that decision more acceptable, and more readily adopted, than it would otherwise be.

Mr. A. COLSON (Leicester) seconded the motion; and it was at once carried.

Mr. W. W. FIDDES (Bristol) thereupon moved—"That the Council be and are hereby empowered to take such steps as they may deem necessary in furtherance of this resolution."

Mr. H. PEATY (Burslem) seconded the motion, which was also carried unanimously.

Mr. G. LIVESEY, as a member of the Committee, said he was quite sure they would be very glad to receive any representation on the subject from the Institution.

READING OF PAPERS.

The reading of papers was then commenced. They were taken in the following order:—

Wednesday.—(1) "The Failure of the Wages System, and its Remedy—Profit-Sharing." By GEORGE LIVESEY, of London. (2) "Notes on Oil-Gas Manufacture." By A. F. BROWNE, of Rotherhithe. (3) "The Use of Oil for Carburetting Gas." By Professor VIVIAN B. LEWES, F.I.C., F.C.S., of the Royal Naval College, Greenwich. (4) "Notes on the Enrichment of Coal Gas with Liquid Hydrocarbon." By T. S. LACEY, of Pimlico. (5) "The Comparative Value of Various Oils for Enriching Coal Gas." By E. LLEWELLYN PRYCE, of Birmingham.

Thursday.—(6) "The Technology of Water Gas." By T. GOULDEN and A. M. PADDON, of London. (7) A Description of a Six-Lift Gasholder and Tank in course of Construction at East Greenwich." By FRANK LIVESEY, of London.

These papers are given in another part of the JOURNAL; the report of the discussions to which they gave rise being held over till next week.

At the close of the discussion on Mr. Frank Livesey's paper on Thursday, the general business was resumed.

APPOINTMENT OF SCRUTINEERS.

The PRESIDENT proposed—"That Messrs. M'Minn, Lacey, Tysoe, and Price be asked to act as Scrutineers for the ensuing year."

Mr. TREWBY seconded the motion; and it was carried unanimously.

VOTES OF THANKS.

The PRESIDENT next proposed—"That the best thanks of the meeting be given to Mr. Forrest, and to the Institution of Civil Engineers, for their kindness in allowing the Institution to meet in that room." He said the comfort of the meetings was greatly enhanced by their being able to assemble in such suitable premises; and the least they could do was to accord a hearty vote of thanks for the facilities afforded.

The proposition was at once agreed to.

Mr. R. MORTON said the members had all been very highly gratified with the success of the meetings, but much of this depended on the way in which the Council did their duty beforehand; and therefore he begged to propose that the best thanks of the meeting be given to them for their exertions during the past year.

The motion was unanimously adopted.

Mr. TREWBY said the President told him it was his duty to respond to this resolution; and he could only say that it was a great gratification to the Council to know that their exertions had been attended with so much success. They had been ably seconded by the Sub-Committee, who had all worked heart and soul to bring about the prosperity of the Institution.

On the proposition of Mr. C. TAYLOR (Derby), the thanks of the meeting were given to the Scrutineers for their services during the past year; a similar compliment being paid to the Auditors (Messrs. Alfred Lass, Wood, and Co., and Mr. Magnus Ohren).

The PRESIDENT said he had finally to propose that the best thanks of the members be accorded to the Secretary

(Mr. Thomas Cole, Assoc.M.Inst.C.E.) for his able services during the past year. They all knew how much depended on the work of a Secretary for the success of an Institution of that kind; and Mr. Cole had shown throughout the year a very hearty desire to further its interests in every possible way.

Mr. GLOVER seconded the motion; and it was carried unanimously.

Mr. COLE said he was very much obliged for this mark of confidence, which was extremely encouraging. He could most heartily endorse what had already been said as to the work done for the Institution by the Council and the Sub-Committee. The effect of that work was only seen in the result; but he should like the members to know how much was done by the Committee to advance the affairs of the Institution. They had had a great number of meetings—some beginning at two o'clock and not concluding until nine at night. As long as he remained Secretary, he should feel the greatest pleasure in fulfilling his duties to the best of his ability.

Mr. C. GANDON then proposed a vote of thanks to the President, which was carried by acclamation.

The PRESIDENT, in response, said that if he had in any degree succeeded in satisfying the meeting, he was perfectly content. He was fully aware of his shortcomings, and of the kind indulgence of the members towards them. If anything he had done had promoted the business of the meeting, he was amply rewarded.

The proceedings then closed.

PAPERS READ AT THE MEETING.

THE FAILURE OF THE WAGES SYSTEM OF PAYMENT, AND THE REMEDY—PROFIT-SHARING.

By GEORGE LIVESEY.

If the wage-hire system has not failed, why are Capital and Labour at war? The community is rapidly becoming divided into two hostile camps, represented by that most unfortunate expression the "masses" and the "classes." There is a strong conviction amongst workmen, and not without foundation, in some cases at least, that they have not received a just share of the wealth they help to produce. The supreme and pressing importance of mutually advantageous and cordial relations between employers and employed to the industrial welfare of the nation, and to the special industry of gas making, is the sole justification for presenting this paper for the consideration of the members of the Incorporated Institution of Gas Engineers.

Capital and Labour are so interdependent and indispensable to each other, and have such a real identity of interest, that the undoubted fact of their antagonism indicates something radically wrong in the system of payment by wages. There is, in fact, something wanting to bring the buyers and the sellers of labour into accord. Both parties are, unfortunately, too prone to take a narrow, short-sighted, and purely selfish view of their respective interests. The *Daily Chronicle*, which takes the side of Labour, said (but certainly not approvingly), in a leading article on Feb. 25, 1891: "Just now, Labour has but one object—to do as little work as possible, and get as much money for it as it can." And employers too often have endeavoured to get the largest amount of work for the smallest pay. The fact that a considerable proportion of workmen—to their credit be it said—are industrious men, who do their duty faithfully and honestly, and do take an interest in their work, may be adduced as evidence that the above statement is unsound. But of large numbers it is, unfortunately, impossible to say as much. With them, therefore, constant supervision, coupled with the fear of losing their employment, are necessary to stimulate them to do a moderate amount of work.

The payment of wages in return for labour merely purchases the time of the labourer, and does not purchase or secure in any way an intelligent interest in his work, or any desire for the prosperity of his employer. On this point, some quotations from an "Address by Mr. Albert Grey to the Labourers on East Leamouth Farm, 30th October, 1891," are to the point. The former tenant maintained that the farm could not pay, so Lord Grey allowed Mr. Albert Grey to take it in hand. He adopted a simple form of profit-sharing, which five years' experience

has shown to be highly satisfactory to all concerned. The address is well worth reading; it is published by the *Alnwick and County Gazette*. In speaking of the wages system in vogue in Northumberland, where hirings are made for a year, and where the wages and other conditions of employment are much better than in other parts of the country, Mr. Grey says: "I do not think human ingenuity could draft a contract better calculated, in the majority of instances, to steal away from a hind that interest he might naturally be inclined to take in his work; for, under the agricultural labour contracts which obtain in Northumberland and the Lothians, no inducement is given to the majority of labourers to interest themselves in the business of their lives. . . . There is no sufficient incentive to cause a man to put brains and energy into his work. The relation between the amount of his wage and the prosperity of the farm, is so faint and remote as not to weigh with him at all. It matters not to him whether the harvest be good or bad. It makes no difference to his wage. So long as his employer's solvency is assured, it is no concern of his whether the farm prospers or not . . . there is no inducement provided by the healthy and powerful stimulus of self-interest for the agricultural labourers to concern themselves about the efficiency of their labour. . . . Now, a system which tends to degrade an active, thinking man into an automaton, must be wrong. What we want is a principle which is capable of transforming an automaton into a man; and that principle, unless I am altogether mistaken in my views of human nature, is the one that prevails on this farm. What is that principle? It is one which says, if any profits remain after the claims of capital and labour have been paid, they shall be divided in a fair proportion between each. The effect of this principle is to make every one of you, after you have given one year's apprenticeship to the farm, partners with me in the profits of the farm." The result is a most striking success all round. The rent charged to the former tenant has been regularly paid; also the interest on capital. The labourers have, excepting one year, received bonuses ranging from 5 to 6½ per cent. on their wages. Capital has received additional interest; a considerable reserve fund has been formed; while the manager, the steward, and the shepherd have also justly participated in the bonus.

But the want of interest on the part of the labourer in the prosperity of the business by which he lives, is not the worst result of the system. In the last annual report of the Labour Association for promoting Co-operative Production—an Association, by the way, of working men, who also advocate the principle of profit-sharing—there is the following ominous sentence: "Already in some industries, and before long in others, it appears likely that organized labour and organized capital will stand face to face in a position alternating between that of armed peace and open war. But like two hostile, though neighbouring nations, each is essential to the welfare of the other; and the question arises, with ever-growing importance, How will their interests best be harmonized?"

If these statements of the defects of the wages system are true, a remedy ought to be applied without delay. That remedy, or at least an important step in the right direction, appears to be profit-sharing, which is simply conceding to the labourer, over and above his regular wages—not as a gift, but the right to a certain proportion of the surplus profits he helps to earn, after interest at a fair rate has been paid on the capital employed.

It has often been urged as a conclusive objection to profit-sharing, that it ought to be accompanied by loss-sharing, which it is said is impracticable. But if there are no surplus profits, the labourer loses his bonus, and thereby loses the payment for the interest and energy he has put into his work. Moreover, he already shares losses in a very real manner; for wages fall as profits are reduced, and, if profits disappear, the labourer must ultimately lose his employment. Therefore, as a necessary consequence, has he not a just claim to a share in surplus profits when they are made?

It may be contended that under such sliding-scales for the regulation of wages as exist in the coal and iron trades, or the arrangement in the cotton trade, where wages rise and fall with the market values of the coal, iron, or cotton cloth, justice is done to the workman. But although these systems are in many cases successful, they do not go far enough; for wages being governed

solely by the selling price of the product, over which the workman has no control and the employer very little, they fail to give the workman any inducement to put brains and energy into his work. Thus both employer and employed lose an important source of profit, quite independent of the fluctuations of the market. Piece-work also falls short; for, although it undoubtedly induces energetic working, and is in many cases satisfactory, it is often the reverse when it taxes the workman beyond his strength, and when, owing to severe competition, it depresses wages to starvation point, and when it tends to the production of inferior work. And it certainly fails to produce that identity of interest between employer and employed, that is necessary to obtain for both the best results.

Perhaps the most serious difficulties in the way of the general adoption of profit-sharing are—on the part of employers, a disinclination to take the trouble, the fear of the opposition of trades unions, and the hesitation to face the cost in money; and, on the part of workmen, the idea that it is antagonistic to trades unionism. Employers may be told that another strike against it in gas-works is not at all likely; and that the result in improved working, by cheerful and contented workmen, and the friendly relations that ensue, are worth all the trouble and cost. Workmen may be reminded that trades unionism is not another gospel, and is not the be-all and end-all of the workman, but only a means to an end; that its legitimate objects are to obtain just and reasonable conditions of labour, to provide assistance in times of difficulty and old age, and to secure as high rates of pay as the industry can fairly afford. It is only this last-named condition that is affected by profit-sharing, and to the extent in which it accomplishes this object, it so far relieves trades unions of the most difficult part of their work—that part which is by far the most prolific cause of disputes—and leaves them free to pursue their other objects with far greater probability of easy attainment. Unless, however, profit-sharing is not only a just system, but also advantageous to employer and employed, time and trouble would be wasted on its consideration and adoption.

Although, owing to human imperfection, absolute justice in all dealings between man and man is extremely difficult, and probably impossible of attainment in its full perfection, it is undoubtedly the foundation principle of all satisfactory relations; and where there is an honest and sincere desire to do justly, working men are not slow to perceive and appreciate it. Therefore, to be a success, it must be in this spirit that any system of profit-sharing must be entered upon; and this will go a very long way towards ensuring its success. But, in addition to aiming at strict justice, it may and ought to be so worked to the advantage of both employer and employed, as to encourage those cordial and friendly relations which are so much wanted and so necessary to bind class and class together. For instance, one great reason for the workman's indifference is the want of hope with which he works. It is very difficult for a workman to provide (say) during 40 years or more of his working life—as an honest, sober, and industrious man ought to be able to provide—sufficient to enable him to live in comfort and independence in his old age. It is, in truth, very difficult for the average workman to regularly and persistently put by anything out of his weekly wages. To do so requires a combination of qualities that is rare in every class—viz., persevering industry, self-denial, temperance, and thrift. Then, when the workman does save, he has much greater difficulty than other classes in safely investing his savings at (say) 4 or 5 per cent.; and his savings, particularly if uninvested in some permanent security, are very liable to attack by impecunious relatives and questionable friends. Hence one reason for his very common and natural desire to keep his savings secret.

Now, profit-sharing may be so worked as to materially help to meet these difficulties; and it is certainly to the advantage of employers to manifest their friendly interest in the welfare of their workmen, by endeavouring to make it as much to their advantage as possible by giving them opportunities of so saving or investing their annual bonus as to encourage thrift, and to make provision for old age, for which profit-sharing is peculiarly adapted.

The simplest and most generally applicable form of profit-sharing consists in treating the wages received by the workmen as their capital in the business; and after

paying a fixed but moderate rate of interest on the capital proper, dividing any surplus in agreed proportions—giving the workmen a percentage on their wages in the shape of an annual bonus, and giving the capital some additional interest. There must necessarily be modifications to meet the varied circumstances of industrial life; but the principle remains the same—viz., that of giving to both parties an identity of interest in the prosperity of the business in which they are engaged. There will no doubt be difficulties; but “Where there’s a will, there’s a way.”

Profit-sharing as applied to gas companies is simply an extension of the sliding-scale. It was felt, when the South Metropolitan Sliding-Scale Act was passed in 1876, that it would not be complete unless officers and workmen were brought under its operation; and a proposal was made at the time to extend it to the officers. But the Directors declined to entertain the question. It was, however, revived in 1886, in a somewhat crude form, when an annual bonus dependent on profits, was given to the officers and foremen; and in 1889 the necessity of doing something to attach the workmen to the Company, led to its extension in its present form to all the employees.

Why should the workman be denied a reward for improved working, or a share in the prosperity that comes when the price of coal falls or that of products rises? while the consumers and shareholders, who do nothing actively (although both do their part in other ways) to promote the welfare of the undertaking, are well cared for. In truth, the sliding scale is a very halting measure, since the only parties who come under its active influence are the directors and such of the employees as may happen to be shareholders. To obtain the full benefit of the sliding scale, and to make the principle just to all, the partnership which it creates between, and which has been so beneficial to, shareholders and consumers ought to be extended without delay to every official and workman, from the highest to the lowest; and where the sliding scale is not in operation, the necessity for the adoption of the same principle applies with equal force. It only needs some modification to adapt it to the altered conditions.

The circumstances that were the immediate cause of the introduction of the profit-sharing scheme by the South Metropolitan Gas Company were as follows: In 1887, and again in 1888, suggestions had been made to the stokers to adopt the system of eight-hour shifts; but until the men were captured by the Socialists in 1889, these suggestions were not entertained. When, however, they made their demand, in June, 1889, it was at once conceded; and all went well for a short time. But having obtained so much and so easily—for the adoption of the eight-hour system involved a considerable increase of pay—they were constantly demanding further small concessions. As a rule, they obtained them, until at last it became clear that the object of the Union was to become masters of the business; and in the pursuit of that object they endeavoured to coerce every man in the Company’s service into their ranks. The control of the retort-houses had entirely passed out of the hands of the management; and it was felt that the rest of the business would follow, unless a very serious effort was made to retain or to win the goodwill and allegiance of the men. Hence the profit-sharing scheme, which was offered to the men at the end of October; heartily approved by representatives of the free men, and as heartily condemned by the officials of the Union. For a few days this opposition was considered fatal; but the free men began to ask why they should be deprived of so good a thing. On the 6th of November, therefore, it was resolved to offer a participation in profits to any man, or any number of men, who would sign an agreement of service with the Company for twelve months. The object of the agreement was to prevent a strike; but there was a proviso that permitted any individual to leave (with the engineer’s consent) at any time. Within a fortnight, practically all the free men—nearly 1000 in number—had accepted the proposal; but the Union remained hostile, and forbade any of its members to sign the agreements, although by so doing their membership would not be interfered with. Moreover, there was no compulsion. Men were perfectly free to accept or to reject the agreement and the accompanying profit-sharing. They were told that they could remain in the service of the Company just as before; the only effect of not signing the agreements being that they would have no share in profits. The truth, however, that “no man can serve two masters” came clearly home to the Union leaders, who saw that the

profit-sharing was so good a thing for the men (and their members saw it too), that unless they could prevent its acceptance, their power would be gone. But, in spite of this opposition, some of their members signed the agreements; and on the 2nd of December, the refusal of the demand for the “removal” of three of these men at Vauxhall led, on the 4th, to the further demand for the abolition of the profit-sharing scheme, and that all the men (about 1000 in number) who had signed agreements be “removed from the works.” Such an unjust demand, the Directors could not and would not entertain; and the next day came the notices which at the end of a week terminated with the great strike of the entire body of 2000 retort-house men. In sympathy with them also, and without notice, all the coal-porters working on the river, and the unionist seamen and firemen that manned the ships, struck.

This was a tolerably heavy price to pay for the profit-sharing scheme; but it was probably the best work ever done, and the most profitable investment ever made by the Company. It not only shook off a most galling tyranny, and gave freedom to both employers and employed, but it resulted in such cordial relations and identity of interest between the parties, as had been before unknown. Moreover, it purchased the right and the power to take all these good things by all other gas undertakings that have the courage to take, and choose to have them. It also arrested the further aggressive action of the Union.

It now only remains to describe the terms of the profit-sharing scheme. Possibly such a system is as difficult to apply to gas undertakings as to any industry, because, unlike other industries which rejoice in high prices for their product, their interest is to sell gas at the lowest practicable price. The profit-sharing, therefore, cannot be simply based on profits. Fortunately, however, there was the principle of the sliding scale; and this principle for this purpose can be adopted quite as easily, and quite as effectively, by non-sliding-scale companies, and by corporations owning gas-works, as by sliding-scale companies. All that is necessary is the arbitrary fixing of a fair initial price; and to agree that for every reduction of 1d. per 1000 cubic feet that is or can be made in the price of gas, all the officers and workmen shall have annually, or at the end of a shorter term of service, a certain percentage on their salaries or wages.

The initial price under the sliding scale of the South Metropolitan Company (fixed by Parliament) is 3s. 6d.; the selling price in 1889 was 2s. 3d. per 1000 cubic feet; and the increase of dividend is at the usual rate of $\frac{1}{4}$ per cent. for each penny reduction. It was felt that $\frac{1}{4}$ per cent. per penny would not be enough as a percentage on the men’s wages. Consequently, instead of adopting the initial price of 3s. 6d. fixed by the Act, the arbitrary figure of 2s. 8d. was taken; and this could just as well have been done, had the Company not been under the sliding scale. Then, instead of $\frac{1}{4}$ per cent., 1 per cent. was also arbitrarily taken as the bonus on the salaries or wages of the officers and workmen. The effect of this was, at 2s. 3d., to make the profit-sharing bonus equal to 5 per cent. on the ordinary income of the employees—that is, their day wages. Should the price go down 1d., it would be 6 per cent.; and so on. Should it go up (as unfortunately has been found necessary) to 2s. 6d., the bonus will be reduced to only 2 per cent. This, of course, is a severe trial to the system; but so far it has stood the test. The men are working as cheerfully and well, and their relations with their employers are as good as ever; and there is no reason to doubt that their goodwill and confidence in the Company have been in the slightest degree shaken.

The simple distribution of an annual bonus, however, is not sufficient to ensure the highest benefit that may be made to accrue to the men from the system. In many cases of profit-sharing, a certain proportion—commonly one-half—is compulsorily reserved for future benefit; the men only being allowed to draw the balance. The object undoubtedly is good; but that is all that can be said for the practice. If the workmen have a right to a share of surplus profits, as is emphatically contended in this paper, that share, as soon as earned and declared, ought to be at their free disposal, as is the case with their wages. It is true they may not make the best use of it. But the time is past for treating them as children; and it is best that they should feel and bear the responsibility of the use they may make of their bonus. But the employer, while fully respecting

the freedom of his workmen, can help them most materially and effectively by providing the opportunity for safely and profitably investing their savings.

In connection with the South Metropolitan profit-sharing scheme, the Company undertake the custody of the whole or such portion of the bonus as the men choose to leave in their hands, and of any weekly or other savings they may deposit with them, at 4 per cent. interest; such deposits being quite free to be entirely or partially withdrawn at any time, on giving a week's notice. Moreover, facilities have been given to the workmen to invest their bonus or their savings in the stock of the Company at market prices, which yield rather more than 5 per cent. £5 nominal value is the smallest amount of stock that can be purchased; and already £3035 has been invested, which is being increased almost every week.

The profit-sharing system was started by crediting every man with the amount, called a "nest-egg," he would have received during the three years prior to June, 1889; but this was done for special reasons existent at the time, and is now quite unnecessary. The "nest-egg," amounting to £6863, has, by the voluntary and unanimous determination of the men, been left in the Company's hands, to accumulate at 4 per cent. compound interest until June 30, 1894, when both the "nest-egg" and the interest will be at their free disposal. But all bonuses accrued since the year 1889 have been free as soon as they have been declared. The amount for the year to June, 1890, was £6037, of which, in the course of the succeeding twelve months, the men withdrew £3428—the greater part in the first month. The bonus for the year up to June 30 1891, was £8653, of which £4659 was withdrawn in the first month; the satisfactory balance of £4000 being left in the Company's hands. The total amount of bonus and savings belonging to the workmen on March 31, 1892, in the hands of the Company, was £18,716, in addition to their investments in the stock.

It is not stated, nor was it expected, that all the men in the Company's service would either understand or appreciate, or even be influenced by, the profit-sharing scheme. That must be a work of considerable time, for which patience is needed. But the result has far exceeded the most sanguine expectations of the promoters. Whether or not it is due to the profit-sharing scheme, the fact remains that, in place of hostility and antagonism, there are peace and goodwill; in place of doubt and mistrust, there is confidence (of which the strongest evidence is to be found in the fact that the workmen trust the Company with their savings); in place of sullen looks and conduct, there are friendly smiles and greetings. The Company have a body of cheerful, willing, and capable workmen, such as they wish every gas undertaking in the kingdom possessed. Who will enter upon this inheritance?

NOTES ON OIL-GAS MANUFACTURE.

By A. F. BROWNE, Rotherhithe.

At the meeting of this Institution held in May last, a paper was read upon "Oil Gas as a Substitute for Cannel," which elicited considerable discussion.

At that time experiments in oil-gas manufacture were being carried on at the Rotherhithe works of the South Metropolitan Gas Company. These were subsequently continued; and the object of this paper is to place the results obtained before the members of this Institution, together with a comparison of the values of oil gas, petroleum vapour, and cannel as enrichers of gas produced from common coal.

The following table gives in column A the various percentages of some enriching gases of high candle power required to raise common gas one candle power (from 16 to 17); and in column B, the quantity in cubic feet of each gas by which it is necessary to augment every 1000 feet in any existing volume to obtain the same percentage composition.

It will be found to cost more per candle to enrich a gas of high illuminating power than one of lower value. The reason is obvious, if it be granted that the candle power of these enriched volumes may be calculated as a mere matter of figures from the mechanical mixture of their component volumes. Thus to raise 16-candle to 17-candle gas by the addition of 40-candle gas, 4.17 per cent. is needed; but to increase 32-candle to 33-candle gas requires 12.5 per cent., or three times as much for the one candle.

To raise Coal Gas from 16 to 17 Candle Power.

Candle Power of Enriching Gas.	A	B
	Percentage of Enriching Gas required.	Quantity in Cub. Ft. to be added to Initial 1000 Cub. Ft.
30 ..	7.14 ..	76.93
35 ..	5.26 ..	55.55
38 ..	4.54 ..	47.63
40 ..	4.17 ..	43.48
45 ..	3.45 ..	35.71
50 ..	2.94 ..	30.30
55 ..	2.56 ..	26.31
60 ..	2.27 ..	23.25

Note.—The above table has been calculated from the formulæ—

$$A \frac{I P_1 - I P_3}{I P_1 - I P_2} \qquad B \frac{I P_1 - I P_3}{I P_2 - I P_3}$$

in which $I P_1$ is the initial candle power of the gas to be enriched, or reduced; $I P_2$ the candle power of the enricher, or reducer; and $I P_3$ the candle power desired.

Oil Gas.

The apparatus in use at Rotherhithe for the manufacture of oil gas was improved and extended, subsequent to the last meeting of this Institution, by the addition of an exhauster, a meter, a small purifier, and a gasholder of about 100 cubic feet capacity.

The experiments were made with a setting of four iron retorts, each formed of two 12 feet lengths of 12-inch main-pipe set in a bed 20 feet through, with their ends projecting some 2 feet from the face of the brickwork. The oil was stored in an elevated tank, from which it was led into one end of the retort through an ordinary lantern cock and syphon; a slope of brickwork being built within the mouthpiece, upon which a small shoot, 3 feet long, was laid to carry the oil forward. A 5-inch ascension-pipe was fixed at the opposite end of the retort. The bed was heated by a furnace placed at each end. The gas passed from the retorts into a dry receiving main, thence through a seal formed in the 6-inch pipe, which conveyed it to the exhauster; the pipe being about 100 yards long, and having three syphons in its length. Syphons were also placed between the dry receiving chamber and the seal, and between the exhauster and the meter; so that it will be apparent that condensation of the oil has been an anticipated feature of the process of converting it into gas. Experiments have confirmed the opinion that comparatively low temperatures are essential to the production of very rich oil gas. The choice appears to lie between low makes of high illuminating value attended with considerable condensation of oil, and greater quantities of much lower value accompanied by deposition of lamp-black and stopped pipes.

The following table summarizes the results on which these statements are based.

Candle Power of Oil Gas.	Cubic Feet per Gallon. Average.	Highest Yield in Cubic Feet.	Lowest Yield in Cubic Feet.	Condensation per Cent. Average in Gallons.	Rate per Retort per Hour. Average.
35	83	83	—	8.5	unknown
40	60	93	44	10.5	4.25
45	67	81	52	15.0	3.5
50	60	76	52	14.5	3.5
55	60	65	54	16.0	3.0
and upwards					

The oils experimented upon were Russian refined, specific gravity .825, net price delivered 4d. per gallon; and Scotch oil, specific gravity .845, net price delivered about 5½d. per gallon. The experiments were all conducted with the view of making as rich a gas as possible. Gases not only well over 50, but of from 55 to 60 candle power were obtained; and it is certainly safe to say that at proper temperatures, despite heavy condensation, a gallon of Russian or Scotch oil will yield 50 cubic feet of 50-candle gas calculated upon the gross quantities passed through the retorts. There has now to be considered the question at what price per 1000 cubic feet this gas can be put into the holder, as compared with 1s. (the cost at Rotherhithe, into the holder, of common gas, including first cost of coal, carbonizing wages, repairs, and purifying, less residuals).

A gallon of Russian oil, delivered in casks in London, costs 4d. net (this price can be reduced to 3½d. when the oil is delivered in tank-lighter alongside the wharf). At a production of 50 cubic feet per gallon, 20 gallons are required per 1000 cubic feet, costing 6s. 8d. To this must be added, unloading 3d., together with retort-house and purifying charges, which will not exceed 3d.—say 7s. 2d. per 1000 cubic feet. Now to raise gas from 16 candles to 17 candles, by the addition of 50-candle gas, requires,

according to the table already given, 2.94 per cent. Therefore the cost of 1000 cubic feet of gas so enriched will be—

2.94 per cent. at 86d.	2.52d.
97.06 per cent. at 12d.	11.65
	14.17d.

Say, 2.2d. net per 1000 cubic feet for the additional candle in Russian oil, as against 1s. per 1000 cubic feet before enrichment.

Before proceeding to the comparison of the foregoing conclusion with the results of other methods of enrichment, it may be desirable to make some comments upon the stability and comparative purity of 50-candle gas obtained from the particular oils used in these experiments. It has not been found that further condensation takes place after the gas has passed the wet meter. Many of the illuminating power results have been obtained from gas previously stored over water for 18 hours without any diminution of volume; and the richest sample made was found to have suffered no deterioration after upwards of 60 hours' storage over water. The gas may, therefore, be considered to be of a sufficiently permanent character. As regards comparative purity, it has been found that the quantity of sulphuretted hydrogen in the gas is very small, but enough to render it necessary to pass the gas through a purifier. Its purification by lime and oxide has not been found to injure the illuminating power of the gas. Carbonic acid and sulphur compounds, other than sulphuretted hydrogen, are present in such trifling quantities that they may safely be disregarded, and there is no trace of ammonia.

The tests for illuminating power were all made with the sperm candle, and no attempt has been made to determine the illuminants present by chemical methods; neither has the specific gravity of the gas been as yet investigated.

This last is a question of great importance in connection with its use as an enricher. Gases of different gravities and candle powers cannot be properly mixed in the gas-holder, because the process of diffusion takes time. The gases must, under ordinary conditions of supply, be mixed whilst in motion; and, other things being equal, the farther they travel together the better—although, whether for the attainment of a result purely mechanical it is necessary to pass a very rich and nearly pure oil gas through the hydraulic mains, condensers, washers, and scrubbers used in the manufacture of coal gas, is a question which still remains to be settled. Certain mixtures of coal and oil gases have been made in the 100 cubic feet holder referred to. These were percentage mixtures, upon the lines of column A. In each case the oil gas was passed in first, and the coal gas immediately afterwards. This plan appeared to mix the gases thoroughly, since the resultant illuminating values were very fairly in agreement with theory.

To revert to the question of cost, How does this compare with enrichment by gas made from cannel coal? It is found, at Rotherhithe, that to raise the quality of common gas from 16 to 17 candles, 100 tons of the coal to be carbonized must contain not less than 7 per cent. of the particular cannel used there, which increases the cost per ton carbonized by 2s. 4d. And, calculating that the yield of gas is raised by 175 cubic feet per ton, the cost per 1000 cubic feet into the holder is increased from 1s. to 14.6d.

It now remains to compare with the two foregoing methods of enriching, the cost of obtaining a similar increase in illuminating power, by means of petroleum vapour, which plan has been in daily operation at Rotherhithe for some months.

It is unnecessary to do more than state briefly that the apparatus consists of a vaporizer, which has a top and bottom chamber connected by numerous tubes, surrounded by steam. The oil is pumped into the bottom chamber; rising through the tubes, it is vaporized; and the vapour is delivered at the top—passing thence direct to the mains under induced current, due to the action of an injector. The apparatus is an admirable one, speedy in operation, and most efficient. The petroleum used is of .680 specific gravity; and the present price, delivered in London, is 8.75d. per gallon net, to which must be added 0.15d. to cover cost of unloading, fuel, and attendance—making the total cost at Rotherhithe 8.9d. per gallon.

From daily experience, corroborated by special tests made for the purposes of this paper, it is found that 0.25 of a gallon is required per 1000 cubic feet (2.5 gallons per ton of coal) to increase 16-candle gas by 1 candle.

The cost per 1000 cubic feet is, therefore, 8.9d. \times 0.25d. = 2.22d., from which must be deducted the sale value of the vapour at the price into the holder of an equal volume of coal gas. It has been stated that 1 gallon of .680 petroleum yields 100 cubic feet of vapour. If this is reliable, then $100 \times 0.25 = 25$ feet at 1s. per 1000 to be deducted = 0.3d. The cost, therefore, into the holder at Rotherhithe of 1000 cubic feet of common gas, enriched from 16 to 17 candles, is as follows:—

If enriched by petroleum vapour	13.92d.
„ „ oil gas	14.17
„ „ cannel gas.	14.60


as against 1s., the cost of common gas.

It appears from this comparison that oil provides the gas maker with a means of enriching coal gas at a cost which will, even with a production of only 50 cubic feet of 50-candle gas per gallon, contrast favourably with cannel, and compete very closely with .680 petroleum at 8.75d. per gallon.

It may, therefore, be of interest to offer some further remarks upon the process of the gasification of oil or petroleum. The outlook is encouraging, not only from the apparent quantity of oil available, but from the fact that it seems unlikely that petroleum of specific gravity above .800 will advance in price. There can be little doubt, therefore, from the interest that is already taken in the subject (which has received such impetus from the work of Professor Lewes), that it will meet with considerable attention from gas makers in the near future. The end in view is the production of the greatest attainable quantity per gallon of gas of 50-candle power and upwards, with the least condensation of oil, and upon the smallest floor space.

From information already available, it seems probable that 75 cubic feet per gallon of 50-candle gas must be considered the irreducible minimum of good working; this, upon the authority of Mr. Botley, being the average return from a series of oils. This standard result is presumably to be attained by the determination of the proper temperature for gasifying any oil which may be suitable for the purpose of enrichment, and the discovery of the necessary retort surface per gallon of oil dealt with per hour.

As regards temperature, Mr. Foulis, in his paper read before this Institution last May, calls it “a bright red.” A *résumé* of the Pintsch process appearing in the JOURNAL OF GAS LIGHTING of April 21, 1891, speaks of “a full cherry-red retort;” and a pyrometer in use at Rotherhithe indicates 1400° to 1600° (say, 1500°) Fahr. as most suitable for the gasification of Russian refined oil. These statements are fairly concordant.

There also appears to be a rough-and-ready means of determining whether a retort is hot enough for the quantity of oil passing through it—viz., the appearance of the crude gas. This, if the temperature is too low, is white; if too high, is dark; and if right, a pale straw-colour, which latter, probably, indicates that the gas is just upon the point of throwing down solid carbon, and would not bear any increase of temperature without doing so. But, with regard to retort surface per gallon of oil per hour, there is disagreement. Thus, the Pintsch process employs a pair of 10-inch -shaped iron retorts, each 6 feet long, to gasify 5 gallons (36 square feet = 7.25 square feet per gallon). This twin retort produces 450 cubic feet of 40-candle gas per hour, or 10,800 cubic feet per twenty-four hours from Scotch shale oil, specific gravity .860 to .875. Mr. Foulis has passed 4 gallons of oil per hour (shale oil, specific gravity .850) through a retort, 18 inches by 13 inches by 9 feet long (39 square feet = 9.75 square feet per gallon), producing slightly over 300 cubic feet per hour, of 62 to 66 candle gas, or about 7500 cubic feet per retort per twenty-four hours. It was not stated whether this retort was of iron or fire-clay. At Rotherhithe, the rate for the richest gases has been about 3.5 gallons per hour, through a 12-inch circular iron retort, 20 feet long (surface 63 square feet = 18 square feet per gallon), say, 266 feet per hour. Here nothing appears to be gained from the increased surface; and from the point of view of economy of space, the comparison with the work done by the Pintsch retort and that of Mr. Foulis is very unfavourable.

It appears, therefore, that the dimensions and material of the retort best suited for the gasification of 4 to 5 gallons of oil per hour, at a temperature of about 1500° Fahr., and producing 300 to 450 cubic feet per hour, or about 7500 to 10,000 cubic feet in twenty-four hours, have yet to be agreed upon. In this connection it may be remarked that the process being continuous, there is no period of recuperation

in which the retort may regain its temperature, as when charged with coal. Hence, if regular heats are to be maintained, the firing should also be a continuous process; and therefore the employment of gas-producers is desirable. There appears, however, no reason why 4 to 5 gallons per hour should be looked upon as the ideal rate. It will probably be found more economical to adopt some form of chamber or flue of large surface, as suggested by Mr. Foulis, the gasifying power of which might easily be 12 gallons of oil per hour. It also seems desirable that the point where the oil enters should be comparatively cool, so that it may be slowly vaporized, and then gasified and fixed. At Rotherhithe, the retort is kept at a temperature of about 500° at the end where the oil is run in; and the first length of the twin-retort of the Pintsch process would appear to be worked at a lower temperature than the second.

[ADDENDUM.]

The following addition to the paper, as submitted, was made by permission:—

The foregoing oil-gas experiments were made last autumn; and as the plant was too small to produce gas enough to have any appreciable effect upon the bulk of the winter's make, they were discontinued. Upon reconsidering the matter in connection with this meeting, it seemed necessary to attempt something on a working scale. Accordingly, the makeshift iron retorts were taken out; and an ordinary setting of seven clay retorts 21 in. by 15 in. oval, and 20 feet long, was substituted. It was hoped that each retort would prove capable of gasifying at least 10 gallons of oil per hour. The joints of the retorts and mouthpieces were very carefully made; two larger purifiers were provided; and the delivery-pipe was attached to one of the station meters, in anticipation of a large make. These retorts are set in the ordinary manner, and are thus available for oil or coal. Facilities exist for taking gas from either mouthpiece, or from both at once. The setting was not ready until after the date when the paper now in your hands had been sent in. These retorts were heated, like the iron ones, to about 1500° Fahr. at one end; but at the end where the oil was run in they were not coloured. The results obtained were very disappointing, not as regards illuminating power, which was from 40 to 50 candles, but in the yield of gas per gallon. This was greatly reduced; and it was soon discovered that the oil ran through the retorts, and was burned in the furnace. It was at once apparent that if clay retorts were to be employed, the dull end or zone of low temperature must be dispensed with, as the retort would never become sound until highly heated. It was known to be destructive to the gas to pass it through 20 feet of a retort to 1500° Fahrenheit; therefore, while each end was equally heated, the gas was allowed to flow away by the ascension-pipe at that end of the retort at which the oil entered—thus ensuring short contact at the high temperature.

The illuminating power proved to be equally good, if not better, and the yield per gallon was greater, though still considerably below that obtained from iron retorts; and it was again found that oil was leaking into the furnace. This seemed to prove that it will not do to run oil in a constant stream into clay retorts; and a return was therefore made to the plan of intermittent injection under pressure, by which the oil is sprayed, as recommended by Mr. Good, of Carshalton. An experiment made upon these lines gave a result of 80 cubic feet of gas, of not more than 30-candle power—the oil being injected at the rate of 5 gallons per retort per hour; in all, 35 gallons. This was all that two men could inject in the time, though the retorts were apparently capable of gasifying twice as much at each end. It must be admitted that the retorts were too hot; showing a temperature beyond the range of the pyrometer, which was probably not less than 1800° Fahr.—lamp black being deposited. This plan would appear to promise the best results from clay retorts; but it costs too much for labour.

To sum up this latter portion of the paper: The system of feeding oil into retorts by gravitation in a constant stream seems to be unsuitable for clay retorts. If these are to be employed, the method of injection under pressure should be resorted to; but this should be brought about by some mechanical means other than a hand-pump. Gravitation—at once the simplest and cheapest method of feeding the oil—may be employed in conjunction with iron

retorts, when it will probably be found advisable to keep the retorts at a low temperature at the point where the oil enters.

THE USE OF OIL FOR CARBURETTING GAS.

By Professor VIVIAN B. LEWES, F.I.C., F.C.S., of the Royal Naval College, Greenwich.

During the past few years the gas managers of this country have gradually been accustoming their minds to the search for promising sources of enrichment for coal gas, in order to prepare for the not far-distant day when cannell will have to be replaced by some other carburetter.

First and foremost amongst the materials likely to be utilized for this purpose, stand the various grades of oils popularly known as petroleum and paraffin; and the object of this paper is to bring before you the results of a long series of experiments made with the view of ascertaining how far we may rely upon oil as a means of enrichment for coal gas of poor illuminating power.

The main points which it is important the gas manager should have in view, in forming a judgment upon the probable future of oil as a carburetting material, are—

- I. The grades of oil from which to obtain the best results.
- II. The methods by which the greatest illuminating value can be obtained from various oils.
- III. The relation between the cost of the various grades of oil and the results which can be obtained from them.

In attempting to solve questions of this description, it is important that, if the results are to be of any value for the purpose of comparison, the determinations should all be made under as nearly as possible the same conditions and by the same observer; and that the greatest attention should be paid to the determination of illuminating value.

My own views on the subject of photometry are that, before any accurate determination can be made, the rate of flow and size of burner used must be fixed to suit the physical peculiarities of the gas to be tested. With a gas of under 18-candle power, and with a specific gravity of about that of ordinary coal gas, the standard Argand gives the best test results; whilst, as is well known, with illuminating values above 25-candle power, a flat-flame burner must be used—the size of the burner decreasing as the gravity and illuminating value of the gas increase.

In the following experiments, the "London" Argand has been used as the burner for all gases from 9 to 18 candle power; the flame being kept 3 inches in height. From 18 to 25 candle power, both Argand and flat-flame burners were employed. Above 25-candle power, selected Bray burners were used; the flow of gas and size of burner being regulated to give the best obtainable flame, and the rate of flow being accurately noted, the results were calculated to 5 cubic feet per hour. In all cases standard sperm candles were used; and the determinations were made in an Evans-Sugg photometer, with all the usual precautions and corrections. All candle powers given are the mean of three sets of ten readings. The first experiments were to determine the relative values of oils which could be obtained in such quantities, and at such prices, as would render them commercially possible to use for the production of oil gas; and also to find the most favourable temperature of "cracking," to yield the highest results. The retort employed was of iron, 1 ft. 10 in. long, and 4 inches in diameter; the tube by which the oil was fed in, passing from the front to within an inch of the back of the retort; whilst to keep the temperature as nearly as possible the same throughout, the retort was loosely packed with coarse iron turnings.

The oils employed were—

- I. Russian "distillate" oil, having a specific gravity of .864, and a flashing-point—open, 149° Fahr.; closed, 135° Fahr. This is the same oil as that employed on a large scale at Beckton for carburetting the water gas made by the improved Lowe process.
- II. Crude Russian oil, having a specific gravity of .866, and a flashing-point—closed, 55° Fahr.; open, 59° Fahr.
- III. Intermediate shale oil, having a specific gravity of .868, and flashing-points above 250° Fahr.

- IV. Green oil of a specific gravity of .848, and a flashing-point over 150° Fahr.
V. Blast-furnace oils of a specific gravity of .848, and a flashing-point of 221° Fahr.

I.—Russian Distillate Oil.

Temperature of Cracking.	Yield of Gas per Gallon.	Percentage of Residuals.	Candle Power per 5 Cubic Feet.	Candles per Gallon of Oil.	Grains of Sperm per Gallon of Oil.
	Cub. Ft.				
Incipient red*	12	59.1	54.8	131.52	15,782.4
Medium red†	60	22.7	50.7	608.40	73,008.0
Full red‡	84	11.8	42.2	708.96	85,075.2

II.—Crude Russian Oil.

Incipient red*	20	44.3	56.6	226.50	27,180.0
Medium red†	56	17.6	48.4	542.08	65,049.6
Full red‡	80	8.8	47.2	755.20	88,624.0

III.—Intermediate Shale Oil.

Incipient red*	8	81.8	44.8	71.88	8,625.6
Medium red†	48	20.9	56.1	538.56	64,627.2
Full red‡	80	15.4	42.0	672.00	80,640.0

IV.—Green Oil.

Incipient red*	16	18.1	61.1	195.20	23,424.0
Medium red†	48	22.6	59.2	568.32	68,198.4
Full red‡	70	33.3	50.1	701.40	84,168.0

V.—Blast-Furnace Oil.

Incipient red*	12	72.7	40.2	96.48	11,577.6
Medium red†	56	54.1	25.6	286.72	34,406.4
Full red‡	68	36.3	22.9	316.44	37,972.8

* 977° Fahr. † 1292° Fahr. ‡ 1652° Fahr.

These results, having been obtained under exactly similar conditions, may be taken as being strictly comparative; although they do not represent the highest possible results obtainable. They show that the Russian oils are the best for carburetting; and that a full red is by far the best temperature at which to crack them. Other experiments show that, if the temperature of cracking is pushed beyond this point, the increase in yield of gas is considerable; but the fall in illuminating value is so rapid that no advantage is gained. Next to the Russian oils, and but little inferior to them, come the intermediate and green oils; whilst for cracking in this way, the blast-furnace oils are practically useless.

We have now to consider how oil can best be converted into a permanent gas, so as to yield the highest possible illuminating value per gallon of oil used; as it by no means follows that the simple retorting of the oil is the best method to employ.

The first step in this direction was to try and ascertain if cracking the oils in contact with a large surface of carbonaceous material in any way tended to increase the illuminating value of the gas; as it was quite conceivable that the surface-action of a mass of red-hot coke or charcoal might influence the chemical changes taking place during the conversion of the oil into a permanent gas.

In order to do this, two tube retorts 4 ft. 6 in. long and 2 inches in diameter, with an oil-tube passing down the centre and delivering at the closed end, were arranged side by side in the same furnace, so as to ensure equal heating. One of these retorts was packed with small pieces of coke, the size of big peas; while the other was left empty—the gas from each retort being led separately through a depositing tube and washer to a gasholder, where it was collected, and afterwards tested. In all cases the temperature employed was a bright red heat.

The first thing that strikes one in these results is that the use of a long narrow retort has caused a distinct improvement in the quantity, and also illuminating value, of the gas, as compared with that obtained by using a short broad retort; and it has brought into striking prominence the superiority of the two Russian oils over the shale oils for gas-making purposes. The experiments also show that the presence of the carbonaceous surface during cracking, although it slightly increases the luminosity, does so to so small an extent that it would be hardly

worth while to incur the extra risk of choking in the apparatus by using it.

Oil Used.	Without Carbon.		With Carbon.	
	Cub. Ft. of Gas per Gal.	Illum. Power.	Cub. Ft. of Gas per Gal.	Illum. Power.
"Distillate" oil . . .	92	46.00	92	47.13
Intermediate shale oil . . .	60	52.00	56	55.20
Green oil . . .	68	59.00	64	58.80
Crude Russian oil . . .	92	50.10	92	52.30
Blast-furnace oil . . .	52	28.40	52	34.30

In the case of the blast-furnace oils, the increase is much more marked—amounting to no less than 20 per cent., which is due to the fact that these oils contain a certain quantity of phenol, which is converted into benzene by passage over the red-hot carbon.

So far, the experiments have shown that, amongst the oils the price of which renders them available for gasifying, the Russian oils are the best; and we have also seen that very little is to be gained with these oils by using carbon in the chamber in which the cracking takes place, whilst a long narrow retort gives better results than a short broad one.

The next point to determine is whether the illuminating value of the oil gas can be still further increased; in other words, if a higher illuminating value per gallon of oil can be obtained by any other process.

The petroleum oils are all mixtures of highly complex hydrocarbons, which are liquid at ordinary temperatures; and on retorting these oils, the heat first volatilizes them, and then causes a breaking down of their molecules, with the result that simpler hydrocarbons, gaseous at ordinary temperatures, are formed, whilst liquid hydrocarbons of far lower boiling point than any existing in the original oil, are to be found in the tarry residue. Of the gaseous hydrocarbons so obtained, some belong to the saturated or paraffin group; and the higher members—such as ethane, butane, propane, &c.—have a high illuminating value; while still more valuable in this respect are the unsaturated hydrocarbons, of which ethylene, benzene, toluene, and crotonylene are the most abundant in the gas. These hydrocarbons have all been formed from more complex ones by the action of heat; and after their formation, an increase of temperature continues the breaking-down action, and gives rise to marsh gas, which is of little illuminating value, and finally of carbon and hydrogen—the former being deposited, while the latter has no light-giving power.

The range of temperature within which the oil can be decomposed so as to give the largest possible volume of the hydrocarbons valuable for illumination is very narrow; and the wall of a retort is always far hotter than the gas near the centre of the retort. The result of this is that from the central portion some of the oil vapours escape "un-cracked," and deposit from the gas on cooling; while the vapour in contact with the wall of the retort gets overheated, deposits coke and pitchy matter, which tends to choke the exit-pipes, and yields a certain proportion of gas of low illuminating value, so that with the ordinary forms of oil-gas retorts, the full illuminating value obtainable from the oil is never reached.

This loss might to a great extent be overcome on a small scale by altering the form of retorts, and by a very careful regulation of the temperature; but on a large scale this would not be possible.

On a manufacturing scale better results may be obtained by "cracking" the oil vapours in an inert gas, such as hydrogen, carbon-monoxide, or water gas, which by separating and partly protecting the molecules during their decomposition by heat, increase the range of temperature within which the best results can be obtained, and prevent excessive breaking down of the hydrocarbons and consequent loss of illuminating value. That this is the case, is shown by the following experiment: A known volume of coal gas was taken and passed through a porcelain tube packed with broken pieces of the same material, and heated to bright redness. A copious deposition of carbon was the result; and the gas after cooling burnt with an almost non-luminous flame. The same volume of coal gas was now diluted with twice its volume of hydrogen, and was passed at the same rate of flow as before through the tube heated to the same temperature, and only 1-200th of the amount of carbon previously thrown down was deposited.

Ample verification of this interesting and important fact can be obtained from the data collected in carburetting water gas by several of the best known systems, in which the oil vapours are carried by the hot water gas through heated chambers, in which the decomposition of the oil to permanent gases is effected, and yields results which could not be approached by making the oil gas and water gas separately and afterwards mixing the two.

Take, for instance, the Russian "distillate" oil. The best results obtained by cracking it by itself were 92 cubic feet of 46-candle power gas per gallon, which is equal to 846.4 candles per gallon; whilst the same oil, when cracked in a current of water gas in the improved Lowe apparatus at Beckton, yields (according to the figures given by Mr. Goulden in his paper read before this Institution in May last) no less than 1200 candles per gallon, or an increase of nearly 42 per cent.

The working from which Mr. Goulden quotes these results, however, was on a very large scale, and under the best conditions; and in order to obtain comparative results, it was necessary to contrast the results obtained by cracking the oil alone, and also in the presence of an inert gas, under precisely similar conditions.

For this purpose, oil was cracked alone in a short experimental retort and collected; whilst after a time, the rate of flow of oil and temperature being kept constant, a slow current of hydrogen was allowed to flow, in known quantity, through the retort, and the resulting mixture of gases collected in a separate gasholder.

The results so obtained were—

Distillate oil cracked alone yielded per gallon 84 cubic feet of 42.2-candle power gas = 709 candles;
Distillate oil cracked in an atmosphere of inert gas yielded 92 cubic feet of 53.8-candle power gas = 989.9 candles;

or an increase of over 27 per cent.

The results quoted in this paper were all obtained with the view of getting strictly comparative figures; and they must not be taken as representing the highest obtainable results. Working on a large scale with the Russian distillate and intermediate oils, 76 to 80 cubic feet of 50 to 60 candle power gas was about the usual result; and this may be accepted as the normal yield, more especially as the figures obtained in continuous working under the best systems in use confirm them.

We have now to consider the question of cost, in order to form an opinion as to whether a poor coal gas can be economically enriched by ordinary oil gas.

With regard to the cost of the oils experimented with, the Russian oils can be delivered in bulk at almost any English port at 3d. to 3½d. per gallon; whilst the intermediate and green oils can at present be bought in the neighbourhood of Glasgow at 3½d. to 3¾d. per gallon. The cost, therefore, of oil as an enricher will vary according to the distance of the works from the nearest sea-port, and the facilities for carriage.

Taking the price of the Russian "distillate" oil at 4d., which would be the cost at the majority of works, we can calculate the cost of the gas from the following data: Using three retorts, 25 gallons of oil yielded 2300 cubic feet of 55-candle power gas* in 7½ hours, with an expenditure of 7 cwt. of fuel; but the man who attended to the retorts could equally well have taken charge of twenty instead of three.

	s.	d.
25 gallons of oil, at 4d.	8	4
Fuel	2	6
Labour	1	2
Charge on plant, &c.	0	1
	12	1

or 5s. 3d. per 1000 cubic feet of 55-candle power gas.

Taking this in candle units, the cost of the oil gas is 1.21d. per candle; but it would more often work out to five farthings. We can now compare these results with the figures obtained by Mr. A. G. Glasgow with the same oil at Beckton, in the improved Lowe water-gas plant, which are 1s. 6d. per 1000 feet for 24-candle power gas, or at the rate of 0.75d. per candle unit.

These experiments and figures seem to clearly show that no method of retorting oil alone, even under the best conditions, can compete with processes such as most of those in use at the present time in America, in which the oil is cracked in an inert gas, at the expense of the waste heat from the water-gas generator. We can now, therefore,

* A very high result.

answer the questions with which this paper was commenced, as follows:—

- I. Russian petroleum is the oil best adapted for carburetting.
- II. The best results are obtained by decomposing it in the presence of an inert combustible diluent.
- III. The cost of carburetting by such material would be ¾d. per candle unit.

NOTES ON THE ENRICHMENT OF COAL GAS WITH LIQUID HYDROCARBON.

By T. S. LACEY, Pimlico.

The author had not intended to read a paper before the Institution this session; but, in view of the importance of the subject to all gas engineers, he ventures to place before the members the results of his experience, chiefly with the object of eliciting the opinions of others interested in the question. It is to be regretted that the time available for making the experiments necessary to elucidate many points of importance and interest did not permit their exhaustive investigation; and it is, therefore, quite possible that some of the results obtained might be somewhat modified by more complete and prolonged examination. Although this paper has been written chiefly in relation to the use of carburene in the Clark-Maxim process, yet as the author has had occasion to make some trials of the use of various oils by destructive distillation in iron retorts, and as the results obtained may be of some interest to the members, he proposes to briefly describe them also.

During the winter of 1890-91, pending the completion of the carburetted water-gas plant at Beckton, a large quantity of oil was used as a substitute for cannel. Two methods were adopted—the first, by allowing the oil to run through a 2-inch pipe to the centre of a 20-foot clay retort, it being partially vaporized before leaving the pipe, and fixed by contact with the sides of the retort; the other, by mixing the oil (which was refined petroleum .823 gravity) with the coal before charging in the usual manner. The latter process was used for an emergency, but without the intention of adopting it permanently.

The first plan had the advantage of being more under control, and was easily applied. About 8 gallons per hour could be used for each 20-foot retort, making approximately 640 feet of gas, the illuminating power of which was not determined.

The author was instructed by his Directors to make some experiments to determine the results likely to be obtained when using oil in this manner; and as clay retorts were not available, a setting of three iron retorts of D section, 14 inches by 12 inches by 8 feet, was used—the oil being run in to the back of the retort by a 2-inch pipe, as in the clay retorts. One gallon per hour per retort was found to be the most suitable quantity; the heats being regulated so as to avoid, as far as possible, the formation of soot or oils. The figures obtained are given in the accompanying table.

TABLE A.—Refined Petroleum (A) and Solar Distillate (B), Tested in Iron Retorts.

—	Specific Gravity at 60° Fahr.	Number of Gallons to 1 Ton.	Gas Made per Gallon. Cub. Ft.	Illuminating Power. Candles.	Candles per Gallon.	Pounds of Sperm per Gallon.	Percentage by Volume of Tar.
A .	.823	272	101.0	31.4	634	10.86	13*
B .	.859	261	103.4	33.3	688	11.79	21

* Oil run in by gravity.

The figures were certainly disappointing; but there did not appear to be any reason why the results should be worse than those obtained in clay retorts, and until quantitative determinations have been made when using the latter, it does not appear to be reasonable to conclude that better figures would be attained. Experiments were then made, using superheated steam to inject the oil; a 4-inch pipe being substituted for the 2-inch, and the retort and pipe packed with loose pieces of scrap iron. Various sized jets were used; the one ultimately adopted giving 1½ gallons of condensed water per gallon of oil. The figures obtained from the solar distillate are given in Table B [next page]. Seventy feet of gas, giving 75-candle power with Sugg's illuminating-power meter, have been made on some

occasions. The difference in the results obtained under various conditions is certainly remarkable.

TABLE B.—Solar Distillate Injected with Superheated Steam.

Gas Made per Gallon. Cub. Ft.	Illuminating Power. Candles.	Candles per Gallon.	Pounds of Sperm per Gallon.
82	58	951	16'30*

* Retort packed with scrap.

The process of enrichment with the Clark-Maxim carburetter has been largely used both by The Gaslight and Coke Company and the South Metropolitan Company; the former having applied it at Bromley, where it is used on the inlet of the meters, and at the Pimlico cannell station and Horseferry Road gasholder station, both of which are under the charge of the author. In these cases it is fixed at the outlet of gasholders. In these machines, the spirit is evaporated by means of a steam jacket under pressure, which is utilized by a jet to create a current in a bye-pass main, so that a part of the gas is raised to a high illuminating power, then forced into the main stream, and thoroughly mixed with the bulk. The oil is stored in steel tanks, 5 feet diameter, 8 ft. 6 in. deep, containing 1000 gallons, which are completely enveloped in 6 inches of puddle, and sunk in the ground in brick tanks. The filling and suction pipes are carried nearly to the bottom of the tank, which is ventilated by a ½-inch iron pipe, carried 30 feet up an adjoining gasholder column. Each tank is fitted with a float guided by rods and carrying a ⅜-inch tube working through a gland in the crown. When not in use for taking the depth of liquid, the float is pushed down to the bottom of the tank, and a plug screwed into the gland; the only opening to the tank then being the outlet of the ventilating-pipe, which is removed from all source of danger from lights. The carburetter is charged by a small steam-pump, which is also used to empty the barrels. The amount of vapour mixed with the gas is governed by a regulating-valve attached to the injector, and can be adjusted to any quantity required.

The rapidity and certainty with which the illuminating power of the gas can be controlled are very strong recommendations. The cost per gallon of oil is easily arrived at, as the wear and tear are practically *nil*; and the only labour required is the cost of the attendant employed while carburetting and filling the storage tanks. The oil used is delivered at the works as required at 9d. per gallon, and is known as “carburine.” Small quantities of spirit known as “gasoline” have also been used, at a cost of 1s. 2d. per gallon. The results of the distillation of each of these is given; a long-necked flask being used, and the thermometer placed close to the outlet tube in the current of vapour.

TABLE C.—Results of Distillations of Carburine and Gasoline.

Total Per- centage of Original Volume Dis- tilled over.	Highest Temperature Registered in Deg. Fahr.		Total Per centage of Original Volume Dis- tilled over.	Highest Temperature Registered in Deg. Fahr.	
	Carburine.	Gasoline.		Carburine.	Gasoline.
10	138	96	70	176	131
20	143	102	80	188	144
30	150	107	90	206	165
40	155	112	95	220	over 165
50	162	119	100	{ over	lost
60	170	123		{ 220	

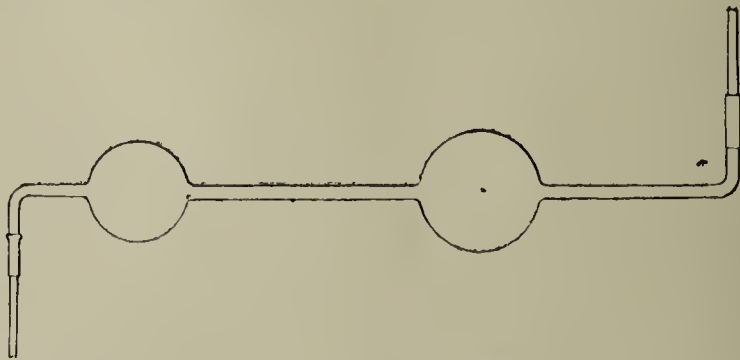
Specific gravity of carburine at 60° Fahr., .681.
Co-efficient of expansion, .00048.
Specific gravity of gasoline at 60° Fahr., .647.

The distillate was measured, and each 10 per cent. by volume distilled over the temperature was noted. The temperature rose continuously; and no sign of any pause could be observed. The oils have since been distilled, using Glynsky's fractionating bulbs, but without any more marked signs of substances boiling at definite temperatures. The author, therefore, concludes they are composed of a number of bodies with slight differences in boiling-points. When shaken with strong sulphuric acid, the oils remained unacted on, only a slight coloration of the acid resulting. The quantity of carburine required to raise gas of about 20-candle power about 3 candles has been tried at various times; the results varying from 1.75 to 2.25 gallons per candle per 10,000 feet of gas enriched. A recent test on 463,000 feet, extending over four hours, took 208 gallons of carburine to enrich gas from 20.38 to 22.96 candles; being equal to an increase of 2.58 candles, and the oil used 1.74 gallons per 10,000 feet of gas raised one candle. The gas was tested with the “London” standard cannell burner at 5 feet per hour; five determinations

being made of the gas on the inlet and outlet of the carburetter.

In order to test the value of this material when applied to gases of lower illuminating power, and the effect of using varying amounts of the enricher, recourse to laboratory experiments had to be made. While recognizing that caution is necessary in accepting figures obtained in this way, when they are supported by internal evidence, and are not contrary to experience obtained on a larger scale, they are always worthy of careful consideration.

A great difficulty was experienced in reproducing the carburetter. The following arrangement was adopted after trying several plans: Two hard glass bulbs, one of 60 septems, the other of 30 septems capacity, when half filled, were joined by a tube ⅛ inch in diameter, leaving 4 inches between the bulbs. The tube was continued on the other side of the larger bulb, and bent to a right angle 2 inches from the bulb. The smaller bulb was fitted with a tube with thick walls tapering to ⅓ of an inch, and bent at right angles in the opposite direction; the bend being 1 inch from the bulb. This tube was passed through a short pipe into the top of a 10-foot test gasholder, so that the point passed through the crown ½ inch. A piece of india-rubber tubing was placed over the end of the open tube looking upwards; and a stopper formed of a piece of small-bore tubing closed at one end, containing a pellet of mercury, was used as a stopper. It also acted as a pressure-gauge.



The method of procedure was as follows: The stopper being removed, the point of a pipette containing the liquid was inserted in the rubber tube, the liquid blown into the large bulb, and the stopper replaced. The volume of gas was then noted, the second bulb heated by an air-burner, and kept hot during the experiment. Another burner was placed under the bulb containing the liquid, which was boiled quickly, so as to give a pressure of 2 or 3 lbs. to the square inch. The difficulty of the condensation of the vapour was thus avoided; and the force with which it entered the holder secured thorough mixture.

A considerable expansion of the gas in the holder, due to the heat of the vapour, might have been expected; but, as a matter of fact, no alteration in the bulk, except the increase due to the vapour produced by the oil, was experienced; the volume being the same after one minute as it was after half an hour. The holder thus appeared to equalize the temperature with great rapidity. By means of this apparatus, the volume of vapour produced by the carburine could be easily and accurately determined; the greatest difference not exceeding 10 per cent., and the larger number of experiments agreeing within 5 per cent.

The volume of vapour from 1 gallon of carburine at 60° Fahr., 30 in. Bar., was found to be 30 feet, closely agreeing with the theoretical volume of hexane. In such an investigation as the one under consideration, the method of ascertaining the illuminating power is of great importance. It is much to be regretted, in this connection, that there is no recognized and rational system of valuing the lighting powers of different gases; it being considered quite sufficient in many cases to simply state the illuminating power, without either specifying the burner used or the rate of consumption when testing. In these experiments the “London” Argand was used, with a 6-inch chimney, the rate adjusted so as to give a flame on the point of smoking, and the illuminating power calculated to 5 feet per hour.

The additions of the carburine were usually made so that each was equivalent to 5 gallons per 10,000 feet of gas in the holder. Owing to the small increase in bulk due to the carburine, the effect was finally the same as adding 15 gallons in one operation; the amount actually added being at the rate of 15.2 gallons per 10,000 feet—a difference within the limits of other errors. As the enrichment of common gas is of most interest, a special ½-inch service

was laid on to the laboratory from a 1-inch service used occasionally on the works. For convenience, this service was taken along the walls of some buildings, and was exposed to a temperature frequently below freezing-point, which, added to the absorbent action of the boiled oil and red lead liberally used in the joints, had the effect of considerably reducing the illuminating power of the common gas. This was rather an advantage than otherwise, for the purpose for which the gas was required, as it increased the range for enrichment.

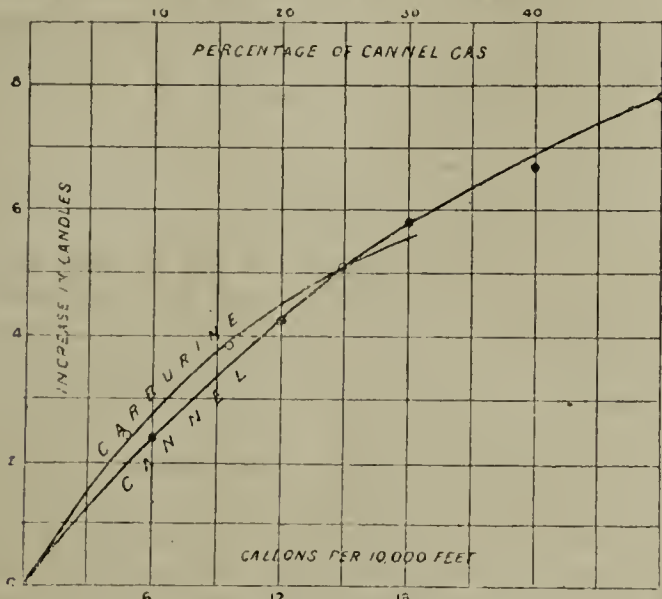
The difficulties attending the use of candles for such

investigations were almost insuperable; but as they were the only instruments available at the time, there was no other course but to use them, or forego the experiments entirely. The same candles were used for each series of tests, and kept alight the whole time. The photometer was of the Evans type; the candles being moveable, and attached to a Keates's balance. The room and photometer were kept well ventilated; and the errors due to the nature of the apparatus as far as possible minimized.

The following two experiments are given as being considered the most trustworthy:—

TABLE D.—Results of Experiments to Determine the Increase in Illuminating Power per Gallon of Carburine added.

Illuminating Power of Original Gas.	Gallons of Carburine added per 10,000 Feet.	Illuminating Power. Candles.	Increase.	Gallons of Carburine added per 10,000 Feet.	Illuminating Power.	Increase.	Gallons of Carburine added per 10,000 Feet.	Illuminating Power.	Increase.	Total Gallons of Carburine added per 10,000 Feet.	Total Increase.
15'00	5	17'62	2'62	4'0	18'92	1'32	6'0	20'20	1'28	15	5'20
15'74	5	18'14	2'40	5'0	19'42	1'28	5'0	20'80	1'38	15	5'06
Average Result.											
15'37	5	17'88	2'51	4'5	19'17	1'29	5'5	20'50	1'33	15	5'13
General Result by Curve.											
15'37	5	17'80	2'43	5'0	19'40	1'60	5'0	20'50	1'10	15	5'13



By plotting out the figures, and drawing a curve to

embrace them as nearly as possible, the figures are obtained in the table under the heading of "by curve." This will give the general result of the series.

If the quantity of vapour made by the carburine is ignored (and for this purpose it is sufficiently accurate to do so), it would be evident that each addition of 5 gallons per 10,000 feet should, by calculation, produce an equal addition to the candle power; and it was in order to decide this point that the experiments were made in this manner. The results, to the author's mind, point to a constant fall in the efficiency of the material. This action may, however, be common to other enrichers. An experiment was, therefore, made with mixtures of cannel and common gas; the mixtures being made so as to give 9 volumes of common to 1 volume of cannel, 8 to 2, and so on. The additions to the illuminating power in this case also would theoretically be equal. The results given in the following table show a similar fall, though not of such a marked character:—

TABLE E.—Experiments with Mixtures of Common and Cannel Gases.

Illuminating Power.		9 Common + 1 Cannel.		8 Common + 2 Cannel.		7 Common + 3 Cannel.		6 Common + 4 Cannel.		5 Common + 5 Cannel.	
Cannel.	Common.	Illuminating Power.	Increase.	Illuminating Power.	Increase.	Illuminating Power.	Increase.	Illuminating Power.	Increase.	Illuminating Power.	Increase.
30'6	16'38	18'82	2'44	20'66	1'84	22'20	1'54	23'00	0'80	24'20	1'20
General Result by Curve.											
30'6	16'38	18'80	2'42	20'65	1'85	22'10	1'45	23'20	1'10	24'20	1'00

Without attaching too great an importance to these figures, the author thinks they are of sufficient importance to warrant further investigation. Experiments are now being made by enriching cannel gas in the same way as the common. But although a fair agreement has been obtained for the three additions of 5 gallons per 10,000 feet of gas, there has been no apparent connection between the results obtained for each addition; the general effect being that the gas could be raised 4.6 candles, from 19-candle power, for the expenditure of the 15 gallons—a result about 7 per cent. lower than that obtained with common gas.

The author wishes it to be understood that the figures in these experiments are not taken as the precise value of the material as used on the large scale, but are given to show the probable tendency when varying the quantities used; the practical figures obtained with cannel, for instance, being somewhat better than those obtained experimentally with the common gas. From figures kindly supplied by Mr. Wright, of Bromley, it would appear that 8000 feet of 15½-candle gas can be raised to 16½ candles with 1 gallon of carburine; the gas being tested in each case with the "London" Argand at 5 feet per hour. This gives 1.25 gallons for each candle added to 10,000 feet of gas. If tested with the Argand, burning up to smoking-point in each case, the quantity required for 1 candle would probably be 1.50 gallons.

The effect of temperature in limiting the amount of vapour capable of remaining uncondensed in the gas, has an important bearing on this process. The investigations of Mr. George E. Davis, on the nature of the less volatile hydrocarbons in coal gas,* are of great value in considering this point. It may indeed be said that, without the assistance of his researches, it would be impossible to make anything but very vague guesses at the probable effects of temperature when using large quantities of the enricher. The boiling-points of the liquids found by Davis are given in Table F [next page].

The mixture of the vapour of a liquid of known tension at different temperatures with a permanent gas, offers no special difficulty to the determination of the point of saturation. A mixture of vapours, however, complicates the question. Without going into detail, the author believes he is correct in stating that, when two vapours are present in a gas, the liquids from which the vapours are found mixing freely, the tension is found to be not the sum, but a tension intermediate between that of each of the vapours taken singly. The addition, therefore, of other vapours to coal gas, now known to contain a large number, representing a considerable amount of liquids, requires some caution.

* See JOURNAL, Vol. XLIII., p. 143; and Vol. XLVII., p. 200.

TABLE F.
Gas distilled at high heats, illuminating power 17 candles, 4 gallons oils.
" " medium heats " " 19 " 3'2 " "
Illuminating Power after Extracting Oils, 8 Candles in both cases.

	Boiling-Points of Hydrocarbons. Deg. C.	Medium Heats. Per Cent.	High Heats. Per Cent.
Below . . .	80	2'0	1'2
	80—83	53'0	50'1
	90—100	3'6	2'5
	108—113	21'0	27'9
	116—128	3'2	2'1
	135—140	8'1	11'2
	145—150	2'0	2'0
	150—160	3'3	1'7
Above . . .	160	3'8	1'3
		100'0	100'0

Cannel Oils.

	Deg. C.	Per Cent.
Below . . .	23	12'0
	30—35	1'5
	35—73	5'2
	73—78	11'2
	80—83	41'0
	85—90	5'0
	90—100	8'3
	100—108	4'0
	108—113	7'1
	116—140	2'4
	140—160	0'8
Above . . .	160	1'5
		100'0

The author gives the vapour tensions of gasoline, carburine (for which a distillate, boiling at 150° to 161° Fahr., was taken—probably hexane), benzene, and a mixture of benzene and the carburine distillate. The tensions of gasoline are from figures by Davis; the others are mostly from experiments made by the author. The effect of benzene in lowering the pressure exerted by carburine is noticeable.

TABLE G.—*Vapour Tensions of Gasoline, Carburine (distilling at 150–161° Fahr.), Mixture of Benzene and Carburine Distillate, and Benzene.*

Temperature. Deg. F.	Tensions in Inches of Mercury.			
	Gasoline.	Carburine.	" Mixture."	Benzene.
32	3'2	2'5	2'0	1'1
40	4'0	3'0	2'5	1'5
50	5'2	3'9	3'2	2'0
60	6'7	4'9	4'1	2'7
70	8'3	6'1	5'1	3'5
80	..	7'5	6'1	4'7
90	..	9'3	7'1	5'7

Note.—The gasoline figures are taken from those published by Davis (See JOURNAL, Vol. XLVII., p.200); the others are by the author. The limit of accuracy is 0'1 inch; the greatest error being probably 0'2 inch.

Taking the liquids from the vapours in the original gas as being equal to roughly 4 gallons per 10,000 feet, giving a volume of about 120 feet, and adding to this 6 gallons of carburine, volume 180 feet, and assuming the tension of this mixture equal to that of benzene, the gas would be saturated at 32° Fahr.

As the Clark-Maxim process is generally used to make up the deficiency in hydrocarbons in the cold weather, the illuminants whose places have to be supplied being probably those bodies of high boiling-point, there seems to be no reason why the gas, when moderately carburetted, should not be permanent. The results of the author's experience confirm this conclusion; none of the liquid having ever been found in the mains in his district.

The commercial aspect of the question is necessarily of greater importance than any theoretical speculations. But, unfortunately, money values are quite as open to errors as experimental data. The Engineers of The Gaslight and Coke Company take 50 gallons of carburine as being equal to 1 ton of Lesmahagow cannel. This value is adopted provisionally; but it is believed to be fairly accurate. For enriching cannel gas 2 candles, from about 20-candle power, the author takes 1'8 gallons per candle per 10,000 feet as the quantity required. At 9d. per gallon, allowing 1'5d. for the gas produced, 1 candle would cost 1'74d. per 1000 feet. The cost for enriching 16-candle gas (say) 2 candles, would probably not exceed 1'3d. per candle per 1000 feet. The author does not think it necessary to add another estimate of the cost of cannel to the conflicting values already published; but he believes the evidence in favour of carburine is sufficient to justify its use in the manner described.

THE COMPARATIVE VALUE OF VARIOUS
OILS FOR ENRICHING COAL GAS.

By E. LLEWELLYN PRYCE, Birmingham.

The investigations detailed in the following paper were made under the direction of Mr. Charles Hunt, with the object of ascertaining the most suitable oil for use as an enriching material; and the writer ventures to think that, in view of the increasing importance of finding a substitute for cannel for enriching purposes, no apology is needed for bringing them under the notice of the members of this Institution.

The oils were gasified in a single cast-iron retort, about 6 inches internal diameter by 7 ft. 8 in. long; preference having been given to this form over that of the double or Pintsch retort, on account of the convenience of placing a number of them in a setting when any considerable quantity of oil gas is required. The oil was introduced at one end of the retort, by means of the usual funnel and syphon-pipe arrangement, and fell into a shallow pan, where it was vaporized. In passing through the heated retort, the vapours were converted into permanent gas, which made its way, by means of an ascension-pipe, to the hydraulic main, thence to a condenser and water scrubber (both of large area), and finally through a meter to a small gasholder. The hydraulic main, condenser, and scrubber were so arranged that the tar deposited in them could be collected for measurement. Considerable difficulty, however, was experienced in separating the water from it.

Although the tables giving the details of the experiments need little or no explanation, it is perhaps desirable to indicate how some of the results were arrived at. In the first place, the temperature of the retort was ascertained by means of a Siemens water pyrometer with iron cylinders—perhaps the most convenient of pyrometers, and one capable of giving fairly accurate results, as has been proved by comparing its indications with those of the Siemens electrical pyrometer, and also with those afforded by certain metallic salts, the fusing points of which have been ascertained by Carnelley.* The illuminating power of the oil gas was determined by consuming it from the largest of Bray's union-jet burners which could be employed without the flame smoking—the pressure being constant. As a standard of comparison, a Methven screen was used; its burner being supplied with carburetted coal gas.

It may not be uninteresting to quote some of the experiments which led to the adoption of this method of testing. A sample of oil gas gave the following results with different burners:—

Burner Employed.	Consumption in Cubic Feet per Hour.	Ill. Power for a Consumption of 5 Cub. Ft. per Hour.
Sugg's "London" Standard Argand No. 1	1'98	29'9
	2'14	32'1
	2'50	31'2
" G Argand	2'30	29'0
	2'68	31'8
	3'04	31'8
" K Argand	3'33	31'0
	3'30	30'5
	4'08	31'5
" 70-candle Argand	4'70	29'8
	5'57	30'0
	5'62	29'8
Bray's union-jet No. 0000	6'33	31'0
	7'08	32'7
	8'22	32'2
	0'75	30'6
	1'02	31'9
	1'32	32'8

No larger union-jet burners were tried with this sample of gas; but with another sample the following results were obtained:—

Sugg's K Argand	indicated 35'8 candles for 5 c.ft. per hour.
" 70-candle Argand	" 40'7 " "
Bray's union-jet No. 0000	" 33'3 " "
" " " 00	" 44'2 " "
" " " 0	" 47'6 " "
" " " 1	" 49'6 " "
" " " 2	flame smoked.

Although this method of testing rich gases apparently does not give their full value (see Table IV.), it is believed that comparable results may be thus obtained. The composition of the gas was ascertained by means of a modified Hempel's gas analysis apparatus; mercury being

* *Four. Chem. Soc.*, 1876, p. 489.

TABLE I.—Results of the Gasification of Oils at Various Temperatures. Rate : 1 Gallon per Hour.

RUSSIAN OILS.										SHALE OILS.			
A.—"LUSTRE."					B.—"SOLAR DISTILLATE."					C.—AS SUPPLIED TO THE RAILWAY AND TRAMWAY COS.		D.—OBTAINED DIRECT.	
I.	II.	III.	IV.‡	I.	II.	III.	I.	II.	I.	II.	I.	II.	
°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	
1255	1385	1540	1616	1470	1400	1668	1473	1662	1425	1662	1425	1600	
1100	1435	1600	1569	1290	1490	1712	1570	1595	1470	1595	1470	1660	
1177*	1410	1570	1592	1380	1445	1690	1521	1628	1447	1628	1447	1630	
63	56	52	46	46	39	43	44	46	46	46	46	35	
62	58	56	54	53	48	48	50	50	48	50	48	44	
Gas.													
Gas produced per gallon of oil (corrected to 60° F.)	74.5	101.3	117.1	58.0	82.9	120.3	82.5	94.6	66.6	94.6	66.6	83.1	
Illuminating power	49.6†	35.7	25.0	58.0	48.2	26.6	41.2	34.3	62.9	34.3	62.9	46.3	
Multiple—Gas produced per gallon × illuminating power	3695	3616	2927	3364	3996	2646	3399	3245	4189	3245	4189	3847	
Specific gravity (air = 1)	0.667	(1) 0.5270 (2) 0.5240 mean 0.5255	0.442	0.909	(1) 0.7370 (2) 0.7320 mean 0.7345	(1) 0.446 (2) 0.448 mean 0.447	(1) 0.6630 (2) 0.6640 mean 0.6635	0.584	0.931	0.584	0.931	0.671	
Composition of gas—													
Carbonic acid (CO ₂)	0.2	0.5	1.7	0.5	0.2	0.2	0.6	0.0	0.2	0.0	0.2	0.5	
Oxygen (O ₂)	0.3	0.4	0.5	..	0.4	..	0.3	..	0.1	..	0.1	..	
Unsaturated hydrocarbons (C _n H ₂), &c.	11.4	17.3	11.6	42.3	28.4	8.3	26.9	19.4	45.6	19.4	45.6	27.5	
Hydrogen (H ₂)	57.3	..	37.7	..	20.7	..	16.8	..	8.5	..	8.5	..	
Carbonic Oxide (CO)	2.7	2.4	0.7	..	3.5	..	0.8	..	2.1	..	2.1	..	
Methane, &c. (C _n H ₂), †	23.6	..	43.2	..	37.6	..	51.3	..	35.9	..	35.9	..	
Nitrogen (N ₂)	4.5	..	4.6	..	9.2	..	3.3	..	7.6	..	7.6	..	
Sulphuretted hydrogen (SH ₂)	none	trace‡	..	none	none	trace	none	trace||	none	..	none	..	
Total sulphur per 100 cubic feet of gas	3.0	10.4	..	..	8.9	..	2.0	3.1	3.7	3.1	3.7	1.8
Residuals.													
Residue left in retort per gallon of oil used	15.0	26.5	36.0	2.5	7.75	44.0	1.0	0.75	6.0	0.75	6.0	6.0	
Residue per cent.	11.3	20.0	27.2	1.8	5.6	31.8	0.7	0.6	4.4	0.6	4.4	4.4	
Tar condensed in hydraulic condenser and scrubber per gallon of oil used	89.5	14.1	0.5	52.4	65.5	0.5	32.2	9.5	43.2	9.5	43.2	16.2	
Specific gravity of tar (water = 1).	0.837	0.933	0.948	0.981	0.984	say 1.000	1.038	1.033	0.983	1.033	0.983	1.016	
Tar per cent.	56.8	10.0	0.4	37.1	46.5	0.4	24.6	7.2	31.1	7.2	31.1	12.0	
Percentage of Residuals	68.1	30.0	27.6	38.9	52.1	32.2	25.3	7.8	35.5	7.8	35.5	16.4	

B.—"Solar Distillate" Oil.

This oil could not be worked for any length of time before the retort would require to be cleaned of the carbon deposited; and if the heat were allowed to reach 1700° Fahr., it would quickly be blocked.

C.—Shale Oil.

|| Not 0.6 grain per 100 cubic feet.
This oil could be worked continuously for a considerable time, there being but a little deposit of pitch in the retort.

A.—"Lustre" Oil.

* The temperature of the retort was insufficient to gasify all the oil, a portion of which burned at mouthpiece when the lid was removed.
† Some of this gas was kept for three weeks in a small holder at a temperature of about 55° to 58° Fahr., and at the end of that period tested 49.2 candles.
‡ Not more than 0.6 grain per 100 cubic feet.
§ In this experiment the oil-retort was partly filled with incandescent coke, over which the oil gas was passed. It would be impossible to work this oil for many hours, on account of the retort becoming blocked with a deposit of carbon.

B.—"Solar Distillate" Oil.

This oil could not be worked for any length of time before the retort would require to be cleaned of the carbon deposited; and if the heat were allowed to reach 1700° Fahr., it would quickly be blocked.

C.—Shale Oil.

|| Not 0.6 grain per 100 cubic feet.
This oil could be worked continuously for a considerable time, there being but a little deposit of pitch in the retort.

used as the confining liquid. Before determining the methane and hydrogen by explosion, the higher members of the paraffin series were absorbed by means of petroleum, as recommended by Professor Vivian B. Lewes.* Up to the present, only one sample of the tar has been examined; and this has been found to contain a hardly appreciable quantity of light nitrifiable hydrocarbons mixed with paraffin oils, the presence of which would render its being run into the coal-tar well inadmissible.

It will be observed from the tables that the Russian oils deposit a large amount of carbon in the retort. More

especially is this the case with the "Lustre" oil. It would therefore be necessary, when working these oils, to stop occasionally for the purpose of removing this. With the shale oils, these stoppages would be much less frequent. It would appear from these experiments that at a particular temperature the oils give best results. At temperatures below this, the value of the gas falls off; and, notwithstanding the increased volume at higher temperatures, the value is also less. This result is contrary to that observed in the carbonization of coal, where with increased volume increased value ensues.*

In addition to the experiments which are tabulated, several have been made with oil from blast-furnace gases; but the results obtained are not promising. At low temperatures this oil affords but very little gas, and of no great illuminating power; while at higher temperatures stoppages are frequent, and the gas is of poor quality. The best result from this oil was but little more than one-half that obtained from shale oil.

In Table III. are given some results obtained on mixing "Lustre" oil with common coal previous to carbonization. There are, however, practical difficulties in the way of adopting this method on a working scale, one of which would be the objection to the introduction of undecomposed

* Lewis T. Wright, *Jour. Soc. Chem. Ind.*, 1885, p. 656; also *JOURNAL*, Vol. XLVI., pp. 1007, 1059.

* *Jour. Soc. Chem. Ind.*, 1891, p. 407; also *JOURNAL*, Vol. LVII., p. 692.

TABLE II.—Description of the Oils, and their Comparative Cost for Enriching Coal Gas.

Name of oil	A.—" LUSTRE."	B.—" SOLAR DISTILLATE."	C.—SHALE OIL.	D.—SHALE OIL.
Price per gallon.	3'2d.	{ 3'5d. (price for 10-gallon drum.	{ 5'3d., plus carriage of empty barrels to Chester	{ 3'3d., plus carriage from Scotland.
Specific gravity (water = 1) . .	0'826	0'8656	0'8495	0'854
Colour	{ Water white—bluish fluorescence }	{ Reddish brown—green fluorescence. }	{ Reddish brown—greenish fluorescence. }	{ Reddish brown—green fluorescence. }
Fractional distillation— (Thermometer in vapour) .	First drop, at 115° C. 5 per cent. 140 " 10 " 146 " 15 " 152 " 20 " 172 " 25 " 176 " 30 " 190 " 40 " 205 " 45 " 212 " 50 " 217 " 55 " 224 " 60 " 230 " 65 " 234 " 70 " 243 " 75 " 255 " 80 " 262 " 85 " 270 "	First drop, at 110° C. 4 per cent. 170 " 10 " 238 " 15 " 246 " 20 " 252 " 25 " 255 " 30 " 267 " 35 " 271 " 40 " 276 " 50 " 285 " 55 " 291 " 60 " 320 " 65 " 345 " Thermometer rising rapidly	First drop, at 225° C. 5 per cent. 248 " 10 " 255 " 15 " 260 " 20 " 270 " 25 " 275 " 30 " 280 " 35 " 286 " 40 " 290 " 45 " 294 " 50 " 316 " 55 " 350 " Thermometer rising rapidly	First drop, at 250° C. 5 per cent. 275 " 10 " 285 " 15 " 288 " 20 " 295 " 25 " 300 " 30 " 320 " 35 " 335 " 40 " 350 "
Best results— Gas made per gallon . . . Illuminating power . . . Multiple Cost (oil only) per candle per 1000 cubic feet—16-candle gas taken as a basis . . }	74'5 cubic feet 49'6 candles 3695 0'86d.	82'9 cubic feet 48'2 candles 3996 0'88d.	82'5 cubic feet 41'2 candles 3399 1'56d.	66'6 cubic feet 62'9 candles 4189 0'78d.*

* Cost for carriage, about 25 per cent. extra.

TABLE III.—Cost of Enriching Coal Gas calculated from increased Illuminating Power obtained on mixing "Lustre" Oil with Coal previous to Carbonization.

Coal used.	Proportion of Oil used.	Multiple.	Increase in Multiple due to the Oil.	Approximate Cost (Oil only) per Candle per 1000 Cubic Feet for Enriching—16-candle Gas taken as a Basis.
	Per Cent.			
Harecastle nuts . .	..	171,991	..	..
" . .	(1) 1'0	183,520	11,529*	..
" . .	(2) 0'5	184,715	12,724	..
" . .	(3) 0'5	180,760	8,769	..
	2'0	..	32,022	0'5d.
Holbrook coal . . .	..	178,811	..	..
" . . .	(1) 0'5	189,497	10,686	..
" . . .	(2) 0'5	183,706	4,895†	..
	1'0	..	15,581	0'5d.

* A portion of the oil was not absorbed by the coal, and was left in the scoop.
† Heat of retort rather lower than usual.

TABLE IV.—Relation between the Percentage of Hydrocarbon and the Illuminating Power of Oil Gas made at various Temperatures.

Name of Oil.	Mean Temperature of Gasification.	Illuminating Power.	Percentage of Hydrocarbons.	Illuminating Power.
	°F.	Candles.		Percentage of Hydrocarbons. 1 per Cent. of Hydrocarbons = Candles.†
A.—" Lustre " . . .	1177	30'8	11'4	2'70
	1410	{ 49'6 60'6* }	28'3	{ 1'75 2'14 }
	1570	35'7	17'3	7'06
	1592	25'0	11'6	2'16
B.—" Solar Distillate "	1380	41'0	42'3	1'37
	1445	48'2	28'4	1'70
	1690	22'0	8'3	2'65
C.—Shale	1521	58'2	26'9	1'53
	1629	34'3	19'4	1'77
D.—Shale	1448	62'9	45'6	1'38
	1630	46'3	27'5	1'69

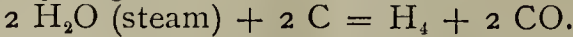
* Illuminating power (mean of seven experiments) found by mixing a small percentage of the oil gas with coal gas, and determining the increased illuminating power due to the admixture.
† 16-candle gas, as tested with the standard Argand, contains about 4 per cent. of hydrocarbons, 1 per cent. of which therefore equals 4 candles. Although the oil gas was tested with the burner which gave best results, 1 per cent. of hydrocarbon was only equal to about 1'8 candles. It would therefore appear that the oil gas was not burned to the best advantage, and that the hydrocarbons were not of equal value with those contained in the 16-candle gas.
paraffin oils into the coal tar. A few experiments were made in this way, using crude Russian petroleum (Novo-

rossisk oil), but with negative results. It is believed that this heavy oil simply distilled over from the retort to the condenser for the most part unchanged.

THE TECHNOLOGY OF WATER GAS.

By ARTHUR MATTHEWS PADDON and THOMAS GOULDEN.
The theory of water-gas production is one of long standing—dating, indeed, as far back as 1780. From 1820 down to the present day, the principle and practice have been intermittently developed; but it is only within the last decade that anything approaching economical efficiency has been arrived at. Hitherto the operations of this industry, on an extensive and commercially successful scale, have been practically confined to the United States of America. There have been recently installations of different forms of water-gas apparatus erected in this country; but the question of their permanent establishment may be said to be still an open one.

It will perhaps be as well to enumerate here the reactions involved in the commercial production of water gas. This is brought about by the decomposition of steam in intimate contact with highly incandescent carbon—the latter generally in the form of coke or anthracite coal. The initial reaction is the disassociation of the steam into its component elements, oxygen and hydrogen. The hydrogen passes forward in a free state, while the oxygen combines with the carbon of the incandescent fuel to form carbonic acid; this, by prolonged contact therewith, being afterwards reduced to carbonic oxide. Water gas in theoretical perfection should therefore consist of equal volumes of hydrogen and carbonic oxide—



A process as simple as the above presents few difficulties in practice. But as the chief, and indeed for many years the only field for water gas lay in its success as a rival or an auxiliary to coal gas for illuminating purposes, subsequent attempts at development were almost entirely in this direction; and the history of carburetted water gas may almost be said to include the advances made in the various methods of water-gas production pure and simple—the *sine qua non* of carburetted water gas—and the highest attainable quality in water gas, having a similar standard of perfection.

Neither water gas, nor its separate constituents have any illuminating power. The acquisition of this property depends, therefore, on some extraneous agent; and this process of enrichment has for some forty years past occupied the attention and energies of those concerned in the industry.

The whole of the apparatus for the production of carburetted water gas may be divided, for the purpose of consideration, into two distinct classes—viz., (1) Retort processes. (2) Generator processes. In the first of these the steam is decomposed by contact with carbon contained in a retort heated externally; thus securing in some degree

continuity of production. In these processes the admission of steam is generally utilized for the introduction of the oil used as a carburetting agent, and the decomposition of the former is accompanied by the gasification of the latter. The most important objections to this method are the imperfect reduction of the carbonic acid formed, and the unstable nature of the light-giving components. The high temperature of the fuel, requisite for the formation of the water gas, is also the frequent cause of decomposition of its illuminating constituents produced by the oil, resolving them into marsh gas and deposited carbon.

Among the many processes of this nature, perhaps the more characteristic are the following: (1) The Salisbury; (2) the Jerzmanowski; (3) the Tessié du Motay; (4) the Meeze; and (5) the Wilkinson.

Of these only the first can be called a true retort process, as in other plants of this description above enumerated, a generator of some form or other is used for the production of water gas; the retorts themselves being merely utilized for vaporizing the oil, and giving to the resultant gases a greater or less degree of permanency.

The "Jerzmanowski" apparatus (known also as the "Boot-leg" plant) possesses a novel feature in the insertion within the vertical and hindmost portion of the retort of a quantity of limestone (Ca CO_3); the gas being passed through this heated material in its progress to the hydraulic main. There is another "Jerzmanowski" process, in which the limestone is used in a secondary chamber, with a generator for the production of the water gas; its enrichment being subsequently effected by the "Tessié du Motay" process. Beyond its acting as a fixing agent in the same way as a heated fire-brick, it is difficult to ascribe any specific advantage to the use of the limestone.

The "Tessié du Motay" plant consists of a single generator, from which the blast gases generated in "blowing up" pass to waste through the stack-valve. The water gas, when made, is stored in a holder, and subsequently passed through a chamber charged with naphtha vaporized by steam. Having been thus carburetted, the gas is finally "fixed" in a bench of retorts specially set for that purpose.

The "Meeze" process is very similar. The water gas, generated in a pair of vessels alternately, is stored in a holder, from which a part of it passes through an ordinary gas-retort fitted with baffle-plates; oil being simultaneously injected. This is cracked up; and the carburetted gas, fixed in contact with the baffles, joins the balance of the water gas in the hydraulic main, and with it passes forward to the purifiers.

These processes are worthy of attention as exemplifying different methods of effecting results more economically attained by the generator or cupola processes. It will now be advisable to consider the latter, as the more important developments in carburetted water gas have been on these lines.

Of the many plants of this description, the following have been the most extensively adopted: (1) The Lowe; (2) the Grainger; (3) the Flannery; (4) the Van Steenburg; (5) the Loomis; and (6) the Springer.

With the exception of the Van Steenburg, these several forms of apparatus are all based upon a common principle of action—that of the "Lowe."

The distinctive and peculiar principle of the "Lowe" process consists in the utilization of the gases produced in the generator in "blowing up" the fuel for heating the carburetting and superheating chambers. This is accomplished by their subsequent combustion in these vessels, in direct contact with the checker-work which effects the vaporization of the oil and its conversion into permanent gas. Prior to the invention of this system, the generator blast products (producer gas) were wholly wasted; and either no provision was made for fixing the hydrocarbon vapours, or this was done in a fixing chamber, heated by an independent furnace.

In the Van Steenburg apparatus, although the sensible heat of the generator blast products is utilized to raise the temperature of a small superheating arrangement in the upper portion of the same vessel, no combustion of these gases is attempted; and the stability of the illuminants produced by the use of a crude oil, or an oil of high specific gravity in this apparatus, is somewhat doubtful, although by using light oils (such as naphtha, &c.), satisfactory results may doubtless be obtained.

In the "Lowe" form of apparatus, three shells are used

for the production of the finished gas. These are respectively the generator, the carburetter, and the superheater—connected by cast-iron brick-lined sleeves. The generator is lined above the fire-bars with fire-blocks; and it contains the fuel bed. The coke-feeding branch is at the top; the blast inlet is immediately below the grates; steam being admitted by a series of distributing pipes at the same point. Four equidistant clinkering doors are provided just above the bars. The ash-pit is in the form of an inverted cone, tapering to a gas-tight door, through which the ashes from the fire fall for removal. The carburetter is lined in the same manner as the generator with 10-inch fire-clay blocks; and it is also filled entirely with a checker-work of fire-bricks laid in tiers. The admission of the air-blast for the combustion of the producer gases which heat this vessel takes place at the top. The superheater is precisely similar to the carburetter in the matter of lining and checker-work; but it is higher by about 8 feet. This additional height serves the double purpose of providing additional superheating surface where most required, and of inducing a brisk draught through the apparatus when the air-blast is closed and the generator doors open, thereby drawing the furnace gases away from the men working at the various openings.

The procedure of working may be briefly described as follows: A fuel bed of proper thickness being ignited in the generator, the blast is admitted. When the sensible heat of the producer gases in their passage through the carburetter has raised the top of the checker-work in that vessel to a dull red heat, air is admitted in sufficient quantity to cause, by the combustion of a portion of the producer gas, the raising of the brickwork to the desired degree of temperature. The balance of the producer gas passes over into the superheater, and is burnt there by the admission of a further supply of air effected at the bottom of that vessel; and, if necessary, to make combustion complete, some is also admitted half-way up. The burnt gases pass through a stack-valve on the top of the superheater into the atmosphere.

The appended analyses of the gases from the different vessels will show the relative combustion effected:—

	Producer Gas.	Stack-Valve Gas.
Carbonic acid	7.94	15.10
Oxygen	Nil	3.80
Carbonic oxide	23.21	0.10
Nitrogen	68.85	81.00
	100.00	100.00

It being necessary to raise the energy of the generator fuel to its maximum in a short time, more air is admitted than is required for the production of a perfect producer gas; and for the same reason a larger amount of gas is generated at times than can be conveniently consumed—the object in "blowing up" being to raise all three vessels to the desired temperature simultaneously, and in the shortest period of time possible. The fuel-bed, carburetter, and superheater being by a careful adjustment of the air supply brought to the proper temperatures, the blasts are shut off, beginning with the superheater; the stack-valve is closed; and steam is admitted under the generator bars. The process of simple water-gas production is thus brought into action. The following analyses have been made of samples taken from an 11-feet diameter generator:—

Analysis of Water Gas.

	From an American Plant.	From Beckton Plant.
	Per Cent.	Per Cent.
Carbonic acid	3.5	2.95
Carbonic oxide	43.4	46.06
Hydrogen	51.8	50.96
Nitrogen	1.3	0.03
	100.0	100.0

A very important property of this plant is the ease with which it may be brought into action in a short period of time. Starting cold, a plant of half a million per day capacity was raised to a working heat in 3½ hours.

In the manufacture of carburetted water gas, the oil is introduced into the carburetter by means of a small pump immediately after the evolution of water gas has commenced; and, being vaporized, it passes with the water gas through the superheater to the hydraulic seal, and thence to the scrubbers and condensers. The oil, prior to its admission to the carburetter, is superheated by the hot gas on its way to the seal. The oil is thus raised to a temperature approximating to vaporization-point before

reaching the checker-work in the carburetter, which effects its ultimate gasification.

Experience tends to show that the best results are obtained from an oil by gradual increments of temperature until the fixing of the hydrocarbons is completed. Thus the base of the superheater should be hotter than the carburetter; and again, the top of the superheater should be hotter than the bottom.

The precise duration of "runs" and "blows" can only be ascertained by actual experience of the particular oil and fuel used; but general practice points to the desirability of short runs and blows. The "run" (period of gas making) must of necessity terminate when the energy of the fuel-bed begins to decrease to any great extent. The quantity of steam admitted must be most carefully adjusted. An insufficiency limits the volume of gas made; an excess causes the production of a large percentage of carbonic acid.

Water Gas in Consecutive Minutes of Run.

	1.	2.	3.	4.	5.	Average.
(1) CO ₂	0.6	2.4	5.0	6.6	7.6	= 4.4 per cent.
(2) CO ₂	0.4	1.0	3.2	5.8	8.2	= 3.7 "

It may be here stated that, when carburetted to 26-candle power, 60 per cent. by volume of the mixture consists of pure water gas.

The criterions of relative efficiency in the working of a carburetted water-gas plant are the following:—

1. The fuel required per 1000 feet of gas made.
2. The oil required per 1000 feet of gas made.
3. The candle power per gallon of oil developed.
4. The character and grade of oil most economically worked in the apparatus.
5. The percentage volume of carbonic acid in the crude gas.
6. The capital expenditure on the erection of plant.

With reference to the first of these standards, it may be assumed that in general practice, from 40 to 50 lbs. of gas coke will be consumed per 1000 cubic feet of gas made. This figure has been arrived at as the result of both American and English experience. It covers the fuel used in the generator, and under the boiler supplying the steam necessary for the run, and for driving blowing engines, exhausters, and pumps. In American practice, according to Mr. Alexander C. Humphreys, in his treatise on water-gas plant, in the United States; some 5 gallons of Lima crude oil per 1000 feet are used to carburet water gas to 26-candle power. The different nature of the oil hitherto used in England, however, makes this valueless as a comparative standard.

With regard to the class of oil amenable to successful treatment, so far as experience has gone, it would appear that the leading drawback to the use of crude oil is the presence of free carbon or pitch in excessive quantities. Provided that the solid residue from an oil in ordinary distillation does not exceed 2 per cent. by weight, it would be fairly safe to assume the oil to be of a workable character. Specific gravity alone offers no criterion of the efficiency of an oil for the purpose; very satisfactory results having been obtained from oils of a higher specific gravity, and very disappointing ones from some possessing a low gravity, having due regard to the higher price of the latter quality. The use of an oil with a high percentage of pitch is attended with the eventual blocking of the carburetter and superheater with deposited carbon, necessitating the suspension of gas manufacture for some hours, until it can be burnt out. With a clear oil, the only appreciable deposit would be a very fine ash on the checker-work of the vessels, which would require renewing about every six months. The degree of heat for the fixing and superheating of the gases, demands careful attention; the vapours from some oils requiring a very high temperature to render them thoroughly permanent, while others, under the same conditions, deposit lamp-black freely.

The presence of carbonic acid in the crude gas is a most serious matter; 1 volume per 100 reducing the illuminating value by 4 or 5 per cent. Not only this, it represents a percentage of impurity, calling for removal, which should have been reduced to a valuable and active constituent—viz., carbonic oxide. Although carbonic acid, theoretically, has no place in water gas, yet in the economical production of the latter it will always be present. It is found in practice that it can be kept (using gas coke in the generator) at about 4 per cent. of the volume of the crude

gas produced. Neglect, however, to preserve the energy of the fuel-bed, or to properly regulate the "runs" and "blows," is likely to raise the carbonic acid to about 9 or 10 per cent. Its production practically varies inversely with the energy of the fuel.

The other impurities in the gas are inconsiderable. There are traces of sulphuretted hydrogen and ammonia, neither of which needs special means for its extraction. The percentage of "carbon bisulphide" impurities also is low enough to obviate the necessity for their removal, even from the gas supplied to the Metropolis. As a matter of fact, it is about 4 grains.

The tar produced is of a light spirituous nature, unfortunately associated with some 70 per cent. of water, remaining after the bulk thereof has settled out by gravitation. This is owing to the high temperature of the gases passing through the hydraulic seal, which is continuously and copiously supplied with water, in order to cool it down between the runs. This supply, and the sprays in the scrubber, account for the large amount used—viz., 60 to 80 gallons per 1000 feet of gas made. The tar deposited in the condensers is freer from water—only containing an amount which is vaporized by the heated gases passing the seal and scrubbers, and in which it is condensed.

In disposing of the tar, it will be found convenient to store that from the condenser separately, and to circulate the watery portions from the hydraulic seal and scrubber continuously, relying upon an auxiliary supply to maintain the volume reduced by vaporization, and occasionally withdrawing the very light tar from the surface of the circulating tank, and any heavy tar which may have settled out at the bottom.

The distillation of the tar is, for the reason above mentioned, associated with much difficulty, since it is mostly in the form of an emulsion, which causes foaming in the stills, and frequently necessitates redistillation of the distillates. Appended is an analysis of the tar after the water has been as far as possible separated by gravitation:—

Approximate Analysis of Oil Gas Tar taken from Condenser Seals, from the 1st to the 6th of January, 1892.

[Specific gravity of tar = .996.]		
	Per Cent. by Volume.	Per Cent. by Volume. Calculated without water
Water	76.50	..
Benzene	0.28	.. 1.19
Toluol	0.90	.. 3.83
Light paraffins, &c.	2.00	.. 8.51
Solvent naphtha (zylolete)	4.15	.. 17.96
Phenol	only a trace	.. only a trace.
Middle oils (naphtha, &c.)	6.92	.. 29.44
Creosote oil and green oil.	5.70	.. 24.26
		Per Cent. by Weight.
Naphthalene	0.30	.. 1.28
Anthracene cake	0.22	Contains 8.33 per cent. anthracene. } 0.93
Coke.	2.30	.. 9.80
	99.27	.. 97.20
Loss	0.73	.. 2.80
	100.00	.. 100.00

The shells of the different vessels used in the "Lowe" process are of boiler-plate, and should be gas-tight under a pressure of 3 lbs. on the square inch. The maximum pressure to be anticipated in ordinary work may be taken at 40 inches of water; and the average pressure in the generator, at 30 inches during gas making. Ordinary Stourbridge fire-brick furnishes a suitable material for the lining, between which and the shells is an annular space of 2 inches, tightly packed with some non-conducting agent, such as slag, wool, asbestos, or wood-ashes.

The superficial area of the checker-work for fixing the gases is about 16 square feet per 1000 cubic feet made per diem, irrespective of linings and flat arches. These latter occur where the blast is admitted; and a space, some 2 feet in depth, is left devoid of checker-work below the soffit of the arch, forming a chamber for the combustion of the gases.

The apparatus is manipulated from a raised stage of wrought-iron framework, with cast-iron plates, level with the top of the generator; and an elevator is required for raising the coke used in feeding the generator to this level.

The blast-valves must be the best of their kind. It is necessary that they should open and close easily, at the same time being perfectly gas-tight. A 1½-inch service is fitted to the blast side of all these valves, communicating with a common outlet on the working floor. During the "runs," the mouth of this is automatically opened; and

any back leakage of gas is at once indicated to the workmen manipulating the plant.

The blast-mains, from 16 to 20 inches in diameter, are of galvanized iron, No. 18 B.W.G., and are provided with relief valves for excessive pressures; the average blast being equal to 14 inches head of water. The blowers supplying the blast work at 2000 revolutions per minute.

The oil for carburetting is raised by a pump on the ground level to a measuring tank upon the upper floor, fitted with a gauge-glass and graduated scale; and the oil is drawn therefrom by a small pump, by which it is forced through the oil heater, into a spray in the carburetter, at a pressure of about 25 to 30 lbs. per square inch.

A reliefholder is an indispensable adjunct for the convenient and safe working of water-gas plant. It has a common inlet and outlet, and works as a differential governor, taking the excess gas that the exhauster fails to pass, or supplying gas to the exhauster when the production is diminished below its capacity.

A few figures are given below as to the capital involved in the erection of a "Lowe" carburetted water-gas plant, for the production of a million feet per diem of twenty-four hours. The cost for such a plant may be taken at about £8000 to £9000.

Building.	£2000
Plant.	1700
Boilers, &c.	750
Engines, blowers, &c.	500
Coke elevator	210
Exhauster and engine mains	950
Relief gasholder	2000
Oil-storage tank	700
	£8810

The above would be the cost of a plant for the enrichment of ordinary coal gas. Meter and purifiers therefore are not estimated for; it being assumed that the existing apparatus would be used. These, if capitalized, might be estimated at from £3500 to £4000.

[APPENDIX.]

Analysis of Crude Carburetted Water Gas.

Gallons of oil used per 1000 cubic feet.	5'46
Illuminating power of gas (candles)	24'68
Candles per gallon.	9'03
Class of oil used; a rough distillate from Russian crude.	
H	21'8
CH ₄	30'7
CnH ₂ N	12'9
CO	28'1
H ₂ S + CO ₂	3'8
O	0'5
N	2'2
	100'0

Experimental Tests of Oil.

[Quantity used : 1 gallon.]

Class of Oil.	Gas Made in Cubic Feet.	Illuminating Power.	Illuminating Power per Gallon in Candles.	Specific Gravity of Oil.	Flashing Point of Oil.
		Candles.			Deg. F.
(a) Crude petroleum	95	47	893	0'864	54
(b) Crude Russian oil (Noverissisk)	91	57	1037	0'950	186
(c) Portesham shale oil	76	55	836	1'0023	142
(d) Distillate from Russian crude oil	89	55	979	0'910	125
(e) Peruvian crude oil	90	66	1188	0'856	65
(f) Refined oil	90	61	1098	0'824	86
(g) Solar oil	90	55	990	0'884	265
(h) Solar distillate.	91	53	964	0'861	125

Remarks.—(a) Flashes at normal temperature. (b) Thick, dark oil.
(c) Dark, pungent oil. (d) Opaque in colour. (e) Flashes at normal temperature.
(f) White oil. (g) Yellow oil.
(h) Pale yellow oil.

A DESCRIPTION OF A SIX-LIFT GASHOLDER AND TANK NOW BEING CONSTRUCTED AT EAST GREENWICH.

By FRANK LIVESEY.

It is not generally customary to write papers on works in progress; the wiser plan being to wait for the completion of the undertaking. As, however, it is the intention of this Institution to visit the works where this holder is being erected, there is a good reason for departing from the usual custom.

The tendency lately has been to increase the size of gasholders quite out of proportion to the natural increase in consumption of gas—brought about, probably, by several and obvious reasons; one being that gas can be stored

more cheaply in large holders, and another by the great variations in consumption that now take place. The use of gas for domestic heating is usually greatest at the time when it is most required for lighting—that is, in the depth of winter. It is not, therefore, unusual in large towns to have a triple combination of intense cold, short daylight, and what there is of it obscured by fog, giving rise to an increase in consumption of 16 to 18 per cent., and that too, probably, when every retort is at work. To meet such demands, the most economical plan is to have ample storage, not necessarily in large holders, though if economy in construction is considered, it is best obtained in that way.

For the easy and safe guiding of a gasholder, the depth of the lift is usually made about a quarter to one-fifth of the diameter, though there are cases where a depth of one-eighth has been used. A deep holder requires a deep tank, which, in most cases, means an expensive one, especially if in a water-bearing soil. If, therefore, the difficulties of guiding a shallow holder can be overcome, it is an advantage to have a shallow tank.

The gasholder which it is the object of this paper to describe, is now being erected at East Greenwich, on ground having the River Thames on three sides. The upper soil is a thin layer of clay, with 6 or 8 feet of peat underlying, beneath which is a deep layer of loose gravel cropping out in the channel cut by the river, and so providing a copious supply of water in any excavation which enters it. The water, in fact, rises and falls with the tide.

In designing the tank, the first object was to avoid the heavy cost of pumping; and it was accordingly determined to carry the tank-wall just into the gravel—deep enough, in fact, to obtain a good foundation. The depth of the tank in the ground having been settled at 13 feet, the next point to be determined was the height above ground. This was settled at 21 feet. It is usual when building a gasholder much above ground, to make the tank an annular one of cast or wrought iron; but as hard core and ballast are cheaply obtained, it was decided to build the tank of concrete with an earthwork backing.

In a concrete tank depending upon the rendering for its tightness, the entire strain due to the internal pressure of the water comes on the concrete, the slightest crack in which will cause the tank to leak. The circumstances are quite different in a tank with a puddle lining outside, and when the water can permeate through the brickwork or concrete. The puddle there forms the tank, yielding to any slight inequalities of pressure without cracking. To make a concrete wall strong enough to resist cracking, standing 21 feet above ground level, even though well backed up with earthwork, would require a very thick wall, if dependent on the concrete only; and for this reason iron bands 5 inches by $\frac{1}{8}$ inch have been inserted about 2 feet apart vertically, riveted to form a complete ring and strutted outwards, while filling concrete around them.

The concrete was composed of Thames ballast, clinkers, broken retorts, and fire-bricks—eight parts to one of cement. This mixture forms a tougher wall, in the author's opinion, than one made of all Thames ballast. The clinkers, having a very rough and irregular surface, hold the mass together better than the rounded pebbles generally found in ballast, though, probably, ballast concrete may be stronger to resist crushing.

Little or no earth has been left in the centre of the tank; for the reason that the greater portion consisted of peat. It would be of little use covering such material with concrete and cement-rendering, and then subjecting it to the pressure of 28 feet head of water, as the peat would be compressed and the rendering crack.

The wall of the tank is 3 ft. 6 in. thick at the top, increasing to 4 ft. 6 in. a little below the ground line. It then becomes a 5-ft. parallel wall to the bottom, no filling—which is seldom as solid as the unmoved soil—being required at the back of the wall. This is stronger and more economical than making a regular slope to the back of the wall, which would require timber-framing for its whole length, both above and below ground.

The inner circle of the concrete wall was set out with a trammel of the simplest and most inexpensive description; being merely a few boards bolted together, with a piece of flat iron screwed to it. That the tank did not vary 2 inches in diameter, proves that the instrument was sufficient for its purpose. But such accuracy in concrete is not obtained without great attention and supervision; for which credit must be given to Mr. Tysoe, the Engineer-in-Charge, and

to Mr. Stradling, the foreman of works—the Company being their own contractors for the tank.

It is not proposed to go minutely into the details of construction of the holder, but rather to describe what may seem novel or interesting—such as, for instance, the system of carriages and rollers, and the difficulties of guiding so shallow a holder.

There are six lifts. The inner one is 287 ft. 6 in. by 31 ft. deep; the second, 290 ft. by 32 ft.; the third, 292 ft. 6 in. by 32 ft.; the fourth, 295 ft. by 31 ft. 6 in.; the fifth, 297 ft. 6 in. by 31 ft. 3 in.; the sixth, 300 ft. by 31 ft. The proportion of diameter to depth of side is a little over nine to one—about the proportion given by the diameter of a penny to twice its thickness. The working capacity of the holder will be 12,200,000 cubic feet. The system of radial and tangential rollers, introduced by Mr. George Livesey, has hitherto worked very satisfactorily; but in a holder of six lifts, it is a difficult matter to pack a nest of six radial and tangential rollers and carriages, one above another, in a reasonable space. The plan has, therefore, been introduced, by the same gentleman, of placing the rollers at an angle—that is to say, neither radial nor tangential, but midway between the two, so combining somewhat the advantages of both.

In this case they are alternately radial and angular; beginning with angular ones on the top curb, and ending with the fifth and sixth angular. Of these upper ones there are 32. At the bottom of the inner lift, there is a wrought-iron carriage holding tangential and radial rollers; at the bottom of all other lifts, a radial roller only. In all these latter cases, there are 64, or double the number of standards; so that the inner lift, which is the difficult one to guide till cupped, has angular rollers at the top, and radial and tangential rollers at the bottom.

The experience gained by the working of three holders on the angular system, shows that they are as steady as when the combined radials and tangentials are introduced; and they have this convenience, that they require shorter legs to attach them to the holder, and are more easily fixed. Should it, however, be necessary to gear the inner and second lifts together, arrangements have been made so that it can be easily done.

Under ordinary circumstances, the vertical stays of a holder 31 feet deep are not required of very great stiffness; but in the present case, where two lifts rise beyond the framing, the inner and second lifts are subjected to severe strains during strong winds when the holder is full. To resist such strains, the inner lift has 64 vertical stays—32 opposite the standards, and 32 placed midway between. They are composed of semicircular plates, 12 inches by 12 inches, No. 10 B. W. G.; those opposite the standards being inclined out at the top, so as to reach the inner curb angle steel.

The second lift has 128 stays—64 inside, of channel iron, forming the roller-path of the radial and tangential rollers, and 64 half-round sheet-iron ones outside at intermediate positions. The vertical stays on the other lifts are 64 channel irons, 7 inches by 3 inches by $\frac{1}{2}$ inch, forming the roller-paths.

The crown is a segment of a sphere rising 25 feet in the centre; all the sheets being steel, weighing 5.7 lbs. to the square foot. With holders of 250 feet diameter and upwards, there is a difficulty in obtaining sufficient pressure before cupping for the purposes of distribution. To maintain a pressure of 15-10ths throughout the district, something over 3 inches of pressure is required, unless the mains are of unusual size. As the inner lift of this holder will not give this pressure, the difficulty will be overcome by pumping the gas into heavier holders at the Old Kent Road. Weight is not wanted when the holder is full. There is then too great a pressure; so that a permanent dead weight is out of the question. There are also many difficulties in arranging to increase the pressure by weighting with water—which is one way out of the difficulty—as the water could run in by gravitation to a circular chamber round the curb, constructed possibly with partitions in it, and run out again when not wanted. If this water ballast, however, could not be placed in the chambers evenly and simultaneously all round the circle, it must not, of course, be used at all, as it is only wanted when the inner holder is uncupped and in its most unstable position.

The curb of the inner holder is built up of 3 ft. 6 in. by 1 in. steel plate on crown, followed by a 24 in. by $\frac{1}{2}$ in. iron, and a

24 in. by $\frac{1}{4}$ in. also iron, a 12 in. by 1 in. steel, and a 12 in. by $\frac{1}{2}$ in. iron, with a 6 in. by 6 in. by 1 in. angle steel at the curb, and a 6 in. by 4 in. by 1 in. on the first ring plate. This is equal in section to 75 square inches in steel and 24 inches in iron; but as the iron plates are lap-jointed, only 12 inches is taken.

	Tons.
75 inches by $7\frac{1}{2}$ tons on the square inch, as a safe compressive strain, steel =	562
12 inches by 4 tons on the square inch, as a safe compressive strain, iron =	48
	610

Giving 610 tons as the total safe resistance to compression of this section of curb; whereas, according to Mr. Cripps's formula, the actual strain on the curb equals 600 tons.

The usual plan of inserting foundation bolts to hold the standards has been departed from in this case; as it was thought that a better hold could be obtained on the concrete, and that it would be a cheaper and a more ready plan to insert three flat-iron bars in the concrete, in a raking position, turned up in the form of a hook at the lower end, and at the upper end standing above the concrete about 18 inches or 2 feet, in such a position as to be easily riveted to the standards.

The standards are 32 in number, H-shaped in section, 2 ft. 6 in. deep at the base, tapering to 1 ft. 10 $\frac{1}{2}$ in. at the top, 125 ft. 10 in. high; thus allowing two of the lifts to rise beyond the framing. They have no horizontal attachment except at the top, where there is a strong girder 2 feet deep with a 22-inch top flange, forming a pathway round the top, securely attached to the standards, and connected together by a 12-inch gusset plate with angle-iron underneath, running round the back of the standard, and thus forming a continuous pathway at that point, and giving rigidity to the weak joints in the 32-sided figure which the framing forms.

As there are no horizontal members to form struts, with the exception of the top girder, the diagonals are made T-shape in section, formed of two flat bars connected with an angle-iron 12 inches by $\frac{5}{8}$ inch and 12 inches by $\frac{1}{2}$ inch at bottom, with intermediate sizes terminating with 8 inches by $\frac{5}{8}$ inch and 10 inches by $\frac{1}{2}$ inch at the top. They thus answer the purpose both of ties and struts; for there is little doubt they play this double part according to the direction of the wind.

The flat bars combined with a horizontal strut, formerly used, do their work satisfactorily; but they are somewhat difficult to adjust when fixing. The same object is gained with one-third less members in the structure, saving a considerable amount of time in erection.

Undoubtedly an important object in designing this gas-holder has been to obtain cheap and safe storage; and if a comparison may be made with the cost of existing gas-holders erected for the South Metropolitan Company, success may certainly be claimed. The oldest gasholder now possessed by the Company, containing 166,000 cubic feet, cost at the rate of £24 5s. 3d. per 1000 cubic feet; the first gasholder constructed with wrought-iron standards and flat-bar diagonals, holding 5,500,000 cubic feet, cost £47,000, or at the rate of £8 10s. 3d. per 1000 cubic feet; while the present one will cost about £61,000, being £5 per 1000 cubic feet, or £8000 less than the first one erected at East Greenwich, and containing 4,000,000 feet more gas.

Messrs. Clayton, Son, and Co., Limited, are the contractors for the gasholder. They have engaged to complete the work by the 1st of October of the present year; and they are sanguine that they will succeed in their endeavour.

Death of Lord Bramwell.—The death of Lord Bramwell at his country residence, Holmwood, Edenbridge, last Tuesday, at the advanced age of 84, has removed one whose name will be remembered by many of our readers in connection with the work of the Liberty and Property Defence League. His Lordship took considerable interest in economic science; and only four years ago presided over the Section devoted to this subject at the meeting of the British Association. An appreciative writer in *The Times* (to which paper Lord Bramwell frequently contributed over the signature "B") says his Lordship had an utter disbelief in the benefit of State interference; *laissez aller, laissez faire*, was in his view the highest wisdom." Yet he was not so insensible to the evils and misery existing under the present constitution of society as was apt to be supposed. "Every good man has been at some time of his life a Socialist," he often said; never failing, however, to add, "and, if wise, very soon ceased to be one."

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 927.)

THE "Great Revival," so long looked for and so ardently desired, appears to be coming at last. Forced on by the large and increasing superabundance of money, purchases of investment stocks are gradually bringing about a general resumption of business, extending to the less favoured and more speculative issues—the supply of the first class not being unlimited. Prices thus have gone up gaily during the week; though a little checked towards the end, when the temptation to snap up a realizable profit became too great to withstand. As for the Money Market, it is, if possible, easier than ever; and the minimum rate looks as if it were going to last a long time. The Gas Market has been pretty active, and prices on the whole were well on the rise. The feature of the week was the recovery in Gaslight "A." Opening at 207, the best price in the week before, it speedily began to move; and, once started, it went along like a ball rolling, and finished with business done at 216½. A pleasant sight for those who sold at 202 a fortnight ago! A fair amount of business was done in the debenture and preference stocks; but not more than was to be expected in view of the great demand for superior investment stocks. Some of the debentures consequently rose slightly in value. South Metropolitan were steadily done at very level figures; and the quotations for "B" and the debentures advanced. Commercial old was put down 1; but little business was done in it. The Suburban and Provincial Companies were very quiet—hardly a deal being done in them; and the only change was a rise of ½ in Bromley new. Continentals were firm, but did not attract much notice. Movements in the rest have been variable. Among the South Americans, Buenos Ayres rose ½; but San Paulo receded to a similar extent. Bahia fell 2; the outcome of their negotiations with the local authorities not being looked forward to very hopefully. Metropolitan of Melbourne rose 1. Business in Water was moderate. The upward movement, however, still continues; and East London, Kent, and West Middlesex are all higher. A comparison of present quotations with those of six weeks ago is interesting and instructive.

The daily operations were: Business was moderate on Monday, mostly in Metropolitan and Suburban undertakings. Gaslight "A" rose 1; and Bromley new, ½. But Commercial old fell 1. Kent Water was opened out to 250-260. There was rather more activity on Tuesday. Gaslight "A" moved up 2 more. Melbourne debentures rose 1; but Chicago second mortgage bonds fell 2½. Wednesday's transactions were largely in Gaslight "A," which advanced 1; and the debenture issues also rose as noted in the list. All interest on Thursday was still centred in Gaslight "A," which made a further advance of 2½. Kent Water rose 5. On Friday, business was rather quieter; but stocks moved up freely. Gaslight "A" and South Metropolitan "B" rose 1 each; ditto, debenture, 1½; Buenos Ayres, ½; and Chicago second mortgage bonds recovered their 2½ fall. Bahia, however, fell 2. West Middlesex rose 3; and East London, 2. Saturday was quiet as usual; but Gaslight "A" got up 1 more. West Middlesex Water lost half its rise of the previous day.

ELECTRIC LIGHTING MEMORANDA.

The Meeting of the Shareholders of the Metropolitan Electric Supply Company.—The Incandescent Electric Lighting of the Chicago Exhibition.—The Board of Trade Unit under a New Name.—The Fruitless Electrical Exhibition.

THE Metropolitan Electric Supply Company have held their general meeting, under the presidency of Sir John Pender; and the proceedings were of the quietest description. The assembled proprietors accepted the statement of accounts which we criticized last week; only one shareholder venturing to express his belief that the dividend to be paid had not been earned. This, the Chairman remarked, is a "matter of opinion;" but a Board are practically omnipotent in these respects, and when Directors recommend a dividend—however small in amount—it is very rarely declined. Yet the circumstances of this particular concern are such as might reasonably inspire dissatisfaction, if not distrust, in the mind of any shareholder. All the capital has been spent, and the capital account is still open; and, in addition, the Board declare their intention of issuing £100,000 worth of 5 per cent. debentures at par. No wonder they strained a point to enable themselves to recommend a dividend, which was indispensable for "sugaring" the debenture "pill." The Chairman comforted his auditory by reminding them that there is another electric lighting concern, under different management, in very much worse plight than the Metropolitan; and he asserted that the applications for light received at this Company's offices during the past three weeks were "the largest number ever obtained in the same time." It is a most convenient thing that these phenomenal increases of the business of electric lighting companies so commonly accrue in the interval between the making up of the yearly or half-yearly accounts and the holding of the meeting! We notice, however, that Sir John Pender has given a sort of engagement

that, when the extensions already in hand have been completed, the Board will wait and see how matters go before launching out again. He recognizes, of course, that electric lighting companies cannot work upon suspense accounts for ever, and that sooner or later the revenue account must express the true state of the business. And this period cannot be far off in the case of the majority of the London Companies.

Some peculiar statements have been made, and have been commented upon in these columns, with regard to the arc lighting proposals for the Chicago Exhibition. It has since transpired that there has been quite as much "unpleasantness" about the incandescent lighting as was caused by the cupidity of the arc lamp contractors. When the tenders for the incandescent lighting were opened, the Edison Company were found to demand \$18.50 for every lamp for the period of the Exhibition; which for the estimated requirement of 93,044 lamps would have amounted to a total lighting bill of \$1,721,314—or, in British currency, the modest charge of about £345,000. This was too much, even for the Exhibition managers; and they accordingly rejected the tender. Thereupon the usual negotiations ensued; and, as a result, the Edison Company cut down their price to \$5.95 per lamp, which was accepted. Thus the Exhibition managers have saved the difference between \$1,721,314 and \$553,409, or the by no means despicable sum of £233,600, out of a demand for £345,000. This is bargaining, with a vengeance. The American electrical press naturally thinks that this is a bit of news which is "calculated to give a bad impression"—but of whom there seems to be some doubt. Plain people might imagine off-hand that the discredit rests with the Edison Company; but this is not how the matter looks to the electrical scribes, who put it all down to "the lack of knowledge as to the costs of electric light and power which is so sadly displayed by the Management of the World's Fair." At any rate, the Exhibition authorities appear to have a shrewd idea of how much electric light ought to be had for a dollar; and they seem to know tolerably well how to deal with their contractors.

It has been announced that by the complaisance of the Board of Trade, and with the acquiescence of Lord Kelvin, the Board of Trade unit of electricity is henceforward to be called a "kelvin," after his scientific lordship. With regard to this suggestion, the scientific press is unable to offer any consensus of opinion. It seems to be thought that, if the convenient B.T.U. needs a name, the accommodation may as well be provided by calling it after the noble lord who has been the first to illustrate the universality of the British peerage, and the adaptability of our peculiar "hereditary chamber" to modern conditions. But why must the Board of Trade unit be called after anybody? Surely the phrase as it stands is as explicit as the older term "thousand cubic feet" used in the commercial measurement of gas? When anybody mentions a Board of Trade unit, or even speaks of the "unit" without reference to its creator, there is no difficulty in following his meaning; but to call the thing a "kelvin" opens up a train of connected thought which is irritating and tiresome. But this sort of thing is an inevitable nuisance. The botanists began it, and all the scientific tribes have followed suit, until we see men's names given with small discrimination to diseases, lakes, mountains, plants, parasites, and, lastly, to a determinate quantitative manifestation of something which is called electricity. We do not like it. There is in reality no more justification for calling a Board of Trade electrical unit a kelvin than there would be for calling a "screw" of tobacco a "Raleigh," or "four of Scotch" a "Burns."

There is a fashion in scientific experiments as in other things. Since Mr. Tesla drew the attention of the "Upper Ten" of science to the phenomena of high voltage currents of rapid alternation, there has been quite a rush of imitators in the same class of performances. Messrs. Siemens first did this sort of thing at the Crystal Palace; and they were quickly followed by the agents of the Thomson-Houston system in England, and, lastly, by Mr. Swinburne. Meanwhile the general public has begun to remark that, while these displays are very pretty examples of electrical fireworks, they are scarcely "business." And so it is unquestionably true that the approaching termination of the Crystal Palace Exhibition without seriously advancing either the science or the practice of electric lighting is being felt in ever-widening circles as a reproach to all concerned, which it will take more than the success of the show as a mere advertisement of a few trading firms to remove.

"GAS AND GAS-WORKS."

THE expected new edition of the well-known "Hughes on Gas-Works," by W. Richards, which was a once well-known volume of Weale's series of technical handbooks, has appeared.* The preceding (seventh) edition has been out of print for some time, during which some notable advances have been made in the technology of gas manufacture. Among these, the veteran

* "Gas-Works: Their Construction and Arrangement, and the Manufacture and Distribution of Coal Gas." Originally written by Samuel Hughes; re-written and much enlarged by William Richards. Eighth edition. Revised, with Notices of Recent Improvements." London: Crosby Lockwood and Son; 1892.

Editor enumerates the improvements in the construction of gas-holders, the general application of machine stoking, the automatic preparation of sulphate of ammonia, Claus's sulphur-recovery process, and "the purification of gas by air or oxygen gas." Mr. Richards's language is rather comprehensive than exact; for coal gas is not, strictly speaking, purified by either air or oxygen. The foundation of this book was laid by the late Mr. Hughes; and its character has not been materially altered by Mr. Richards. It was never a work of brilliant genius; and a student who confined his technical reading to it would miss a good deal he ought to learn, while running some risk of absorbing some "very old and crusted" notions. A stickler for modernity would condemn as hopelessly out of date a book which contains a remark about the "humidity" of damp coal carrying off a large portion of the "caloric" from retorts which have the misfortune to receive such undesirable charges. "Caloric" is, however, a favourite word with our author. In other matters, also, the Editor of Hughes is hardly up to date; nor has he always the firm grip of his subject which is indispensable when it is desired to strip it bare, so to speak, for the ready appreciation of the student. Thus he appears to confuse the question of the suppression of the dip in the hydraulic main with that of abolishing sealing in tar; and in doing so he apparently overlooks the fact that most dip-pipes are now-a-days sealed in liquor or water, and that the so-called "anti-dips" have dropped out of use, for considerations wholly disconnected with the tar in the hydraulic main. Upon the subject of retort furnaces, again, the information that Mr. Richards fails to give is very extensive. He does not illustrate or describe a single gas-furnace, although he admits that such furnaces are very economical of fuel and labour, which should be reasons, one would think, for paying particular attention to the type. Neither is the author's account of gas purification of a character to help a candidate to satisfy the Examiner in Gas Manufacture for the City and Guilds of London Institute. All that he has to say about the use of lime in purification is as follows: "In the ordinary method of purifying, the foul gas is admitted first into the purifier the most impregnated with impurity, thence it passes to the second, and so to the third, where the lime is comparatively clean. When purifiers are of ample magnitude, the foul lime, if properly moistened, remains an active agent in the purification to the last; therefore it is only when the gas begins to indicate signs of impurity at the fifth division, supposing six divisions of purifiers to exist, that they should be changed, and by the employment of apparatus of ample capacity only, can lime be employed to the best advantage." This is a fair specimen of the writer's method and matter. So in describing gasholders, he singles out for commendation a double-lift holder "such as are constructed in gas-works of the present day," which is as antiquated and unintelligent a sample of designing as could well have been discovered twenty years ago. And yet he knows of, and cursorily mentions, the later work in this line of Woodall, Livesey, Hunt, Gadd and Mason, and Pease! In short, this is an essentially out-of-date book, freshened up here and there, after a fashion, by a few sprinkling references to modern matters. It is not wholly destitute of useful information for a reader who is expert enough to pick it out; but it is without a trace of that critical, informing quality, which one is accustomed to expect in modern technical manuals. The best thing that the proprietors can do with their Hughes is evidently to "make pie" of him, and get him re-written by somebody who lives in the art of the present. It is not often that we find it necessary to condemn a technical work in this unsparing fashion; and it is always pleasanter to praise an author than to denounce him as useless. But this time we have no choice, seeing that we should proclaim ourselves incapable of doing our duty to the gas industry if we failed to characterize this bit of book-making as it deserves. Hughes is manifestly used-up.

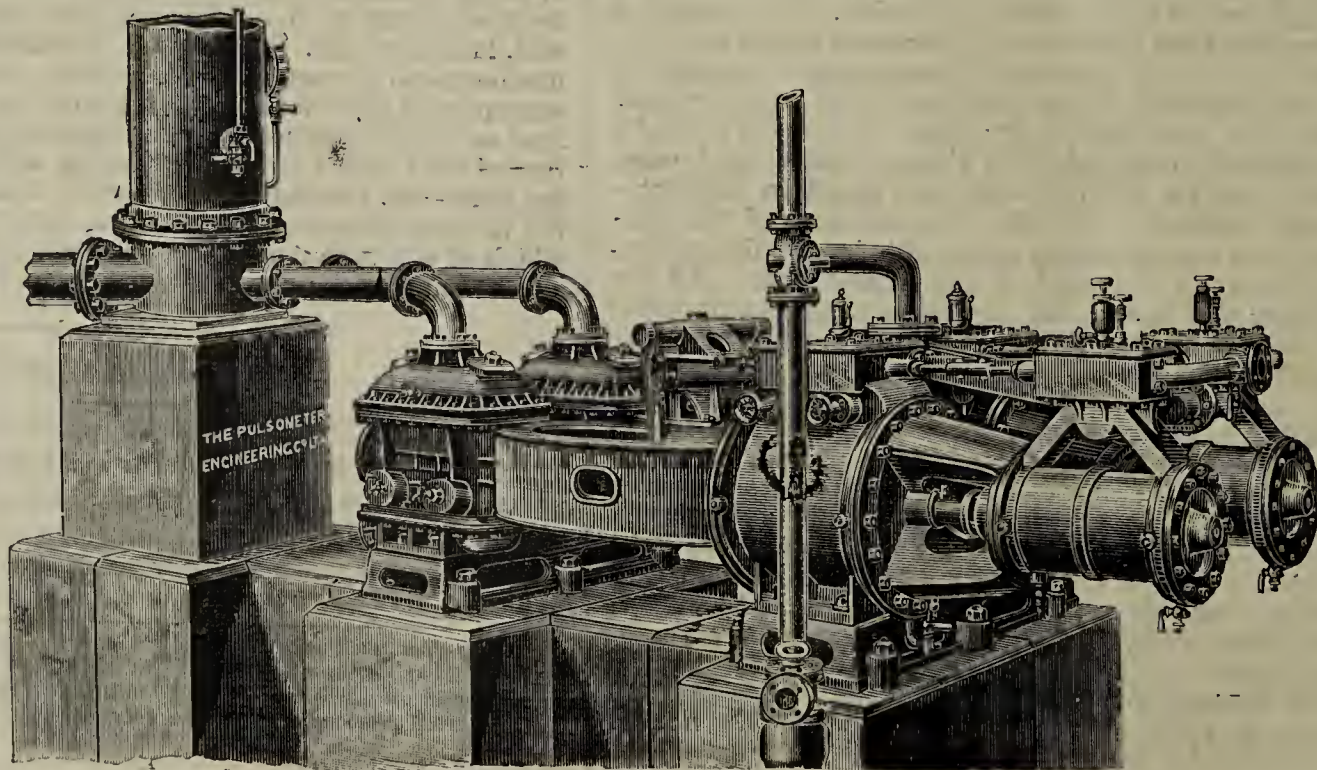
TECHNICAL RECORD.

THE DESTRUCTIVE DISTILLATION OF WOOD.

At the May Meeting of the London Section of the Society of Chemical Industry, the item of chief interest was a paper by Professor W. Ramsay and Mr. J. C. Chorley on the above subject. The data for the paper were obtained by the distillation of well-seasoned samples of oak, beech, and alder, in a glass retort immersed in an air-bath specially devised to maintain a uniform temperature. The delivery-tube of the retort passed through a Liebig's condenser; and the condensation products were received in a small flask, while the uncondensed gases passed on, through a tube containing pumice moistened with sulphuric acid to retain the vapour of methyl alcohol, and potash bulbs to remove the carbonic acid, to an aspirator where the volume of gas unabsorbed was measured. Prior to the heating of the retort, the whole of the apparatus was exhausted of air. In one set of experiments, the bath was heated to about 325° C.; and in another, to 500° C. The average charge weighed 170 grammes; and at the higher temperature it yielded 25 per cent. of charcoal, 60 per cent. of liquid distillate, and 10 per cent. of carbonic acid—the remaining 5 per cent. representing the weight of the other gases. The volume of gas received in the aspirator was 7 litres; and it had the following percentage composition: 73 measures of carbonic oxide, 20 of marsh gas, 1½ of olefines, 5 of nitrogen, and a trace of oxygen. At the lower temperature, the charcoal increased, and the liquid and gaseous products decreased in amount; the olefines being entirely absent from the latter, and marsh gas present in smaller proportion. From 7 to 15 per cent. of pitch, and 6 per cent. of acetic acid, were obtained from the liquid distillate. The temperature of the bath, as well as that of the interior of the retort, was observed; and it was found thereby that when the bath had reached 300° C., there was a sudden rise in the retort from 100° to 400° C. In an endeavour to accentuate the exothermic character of the change taking place, the author persistently styled it "explosive"—a scarcely justifiable extension of the meaning of that hardly-worked adjective. There appeared to be little variation in the products from the different varieties of wood experimented upon. The paper was discussed somewhat fully; but we need only refer to Professor Foster's remarks. He said that some years since he obtained figures which were at variance with those quoted above; but he used an iron retort, and the heat was admittedly much higher. He found in the gas only 25 per cent. instead of about 50 per cent. of carbonic acid; but he also found 18 per cent. of hydrogen, which Professor Ramsay believed to be entirely absent. The amount of carbonic acid, taken at even the lowest estimate, would apparently render the gas almost valueless for illuminating purposes, though it has been used in places where coal and oil are scarce.

PUMPING-ENGINES FOR WATER-WORKS.

On several previous occasions we have called attention to the appliances which the Pulsometer Engineering Company, Limited, of the Nine Elms Iron-Works, make a speciality of their business. Apart, however, from plant intended for the filtration of water on a large scale, they devote considerable care to the construction of direct-acting pumping machinery adapted for every possible service. This is amply demonstrated in a catalogue we have lately received of the Company's productions in this branch of engineering, comprising various forms of the "Deane" and other pumps,



as well as compound condensing engines particularly suited to water-works requirements. It is unnecessary to here deal with the characteristic features of the several appliances illustrated and described in the catalogue; we simply give one sample of the Company's work in the direction just indicated. The accompanying drawing represents a set of compound duplex condensing pumping-engines just sent out by them for a water-works in India—being the second order received from the same town. The high-pressure cylinders are 13 inches, and the low-pressure 26 inches in diameter, with a 24-inch stroke; and the pumps are 8-inch. The condenser is not shown; but it stands at the side of the foundation-stone—the pipe leading to it, with the valve, being given. It is of the "jet" type, of the Company's improved independent class. The pumps are of the latest pattern, fitted with lever motion, and specially constructed for working with considerable economy against heavy pressure and long mains. The general design and arrangement of the machinery are such as to allow of long-continued action without excessive wear and tear or stoppage for lubrication. It will be seen that the entire plant is practically self-contained, and therefore only very light foundations are required. This is an important consideration in connection with the first cost of erection.

Godstone District Gas Company, Limited.—It will be seen, by an advertisement which appears in another part of the JOURNAL, that the above-named Company are inviting applications for their unissued capital. Since the works at Lingfield were opened early last year, the consumption of gas has considerably increased; and when those now in course of construction at Godstone are completed in the course of a few months, a further augmentation will necessarily result. The works have been designed and erected under the superintendence of Mr. Robert Fish, Assoc.M.Inst.C.E., the Company's Consulting Engineer, who has taken offices at No. 5, Great Winchester Street, E.C.

The Gasholder Catastrophe at the Dawsholm Gas-Works.—In the report of Her Majesty's Inspectors of Explosives (Colonels Majendie, Ford, and Cundill) for the past year, reference is made to the explosions which took place at the Dawsholm Gas-Works on Jan. 15, 1891, by which, as may be remembered, two large gasholders were destroyed, and a man sustained somewhat severe injury by burns. The matter formed the subject of a prolonged inquiry by Colonel Ford; and the Inspectors say the result left no reasonable doubt that the case must be ranked with other malicious attempts of a like character—notably the outrage at the Tradeston Gas-Works at about the same period of the year 1883. No public advantage, the reporters say, would result from the publication of the details of the explosion, or of their conclusions as to the amount and nature of the explosive employed, and the method of its application. These points are fully dealt with in a "confidential" report on the case. Owing mainly to some secondary effects, the damage to property was, unfortunately, rather considerable.

The New Electrical Term.—Reference was made in the JOURNAL last week to the new term which will be introduced into the Electric Lighting Orders of the present session. In the schedules to the Orders, it is specified that the "kelvin" shall mean the energy contained in a current of 1000 amperes flowing under an electro-motive force of one volt during one hour. Where the undertakers charge any consumer by the actual amount of energy supplied to him, they are to be entitled to charge him at the following rates per quarter: For any amount up to 20 kelvins, 13s. 4d.; and for each kelvin over 20 kelvins, 8d. Where they charge by the electrical quantity contained in the supply, they will be entitled to charge according to certain rates set forth. The *Electrical Review* is by no means satisfied with the change, and asks when the "absurd fashion of re-christening" is likely to cease. Our contemporary thinks the Board of Trade unit is perfectly well understood under its present appellation; and does not consider its new name to be complimentary either to Sir William Thomson, or redounding to the good sense of those who have forced it upon the public.

The Coal Output of the United States.—In the JOURNAL for the 3rd inst., we gave some statistics of the iron and steel production of the United States. The following figures relating to the output of coal last year will be of interest in connection therewith. The total production amounted to 1,41,229,513 tons. Of this quantity, 45,600,487 tons were anthracite—all from Pennsylvania, except 2000 tons from New England and 53,117 tons from Colorado and New Mexico. The bituminous product yearly is about 95,625,000 tons, or more than twice that of anthracite. The annual output was nearly doubled in ten years. The coal industry furnishes employment to 300,000 persons, to whom \$110,000,000 are paid in wages; and the capital invested is estimated at \$350,000,000. The output of the different States is as follows: Pennsylvania, nearly 82,000,000 tons; Illinois, 13,000,000 tons; Ohio, 10,000,000 tons; West Virginia, 7,000,000 tons; Iowa, 4,500,000 tons; Alabama, 4,000,000 tons; Maryland, Indiana, Kentucky, and Missouri, 3,000,000 tons; and Tennessee, 2,000,000 tons. Other States have a smaller output. More than 25 per cent. of the freight of the country is coal. The average price per ton of coal at the mines was 99c. for bituminous and \$1.44 for anthracite.

REGISTER OF PATENTS.

Gas or Carburetted-Air Engine.—Boult, A. J.; communicated from L. F. Lavasseur, of Evreux, France. No. 9006; May 27, 1891.

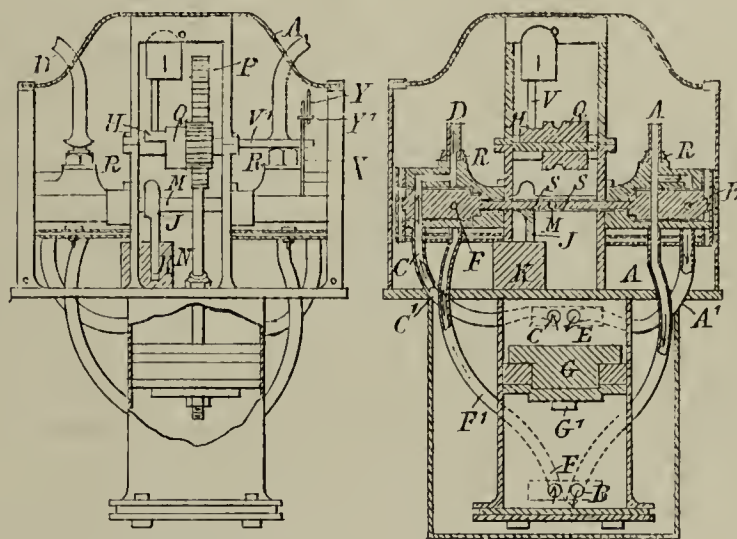
This invention relates to motors or engines operated by means of gas, petroleum, and the like; and it consists in the arrangement of (1) A compound valve for the admission and mixing of the air and gas in predetermined proportions for the purpose of obtaining the explosive mixture in the cylinder; (2) A piston adapted to work between the bottom of the cylinder and a spring-controlled counter-plate or diaphragm, enabling the lighting of the explosive mixture to take place in the centre of the cylinder through the agency of a tube made incandescent by Bunsen or other suitable burners; (3) A hammer or spring-controlled governor raised by a cam adapted to automatically open the mixture admitting-valve or not, according as the speed is above or below the normal standard; (4) A lighting-piston or slide-valve, which may be utilized simultaneously for lighting and distributing the charge (chiefly intended for motor engines of less than 12-horse power with the pressure counterbalanced upon the counter-plate); (5) A petroleum-pump with a plunger, operated by the governor, and automatically distributing the supplies of petroleum required for the production of the petroleum vapour necessary for each operative stroke of the motor piston; (6) A petroleum vaporizer or atomizer with a hollow spiral arranged around an escape-pipe; and (7) A gas chamber mounted upon a pipe of large diameter, with a small gas-pipe arranged within for the Bunsen burner.

Gas-Producers.—Bromilow, J., of Pontymister, Mon. No. 11,416; July 4, 1891.

The first part of this invention relates to the application of steam and atmospheric air in the production of producer gas as used for the raising of high temperatures in regenerative and other furnaces; and it consists in an arrangement of valves in two sets, so that the largest possible amount of steam can be decomposed in proportion to the quantity of fuel used, so as to effect a considerable saving in fuel and labour. The second part of the invention consists in an improved construction of the bottom of the producer, by dividing it into two parts by a brick wall, which is carried up a few inches above the door-frames, thus forming two separate pockets at the bottom, and a little below the level at which the mixed gases enter and come in contact with the solid fuel with which the producer is filled.

Water-Meters.—Haddon, R.; communicated from A. E. Balaciar, of Barcelona, Spain. No. 1465; Jan. 25, 1892.

As shown by the accompanying illustration (vertical sections at right angles to each other), this invention consists principally in the valve mechanism, by which the water is let into the upper and lower part respectively of a cylinder, so that the movement of the piston therein may be utilized to measure the quantity of water which has passed into the cylinder. As completed, the apparatus is enclosed in a casing of light galvanized iron with inlet and outlet for the water-pipes, and a series of dials of the counter on its face, covered by a glass window or other suitable means.



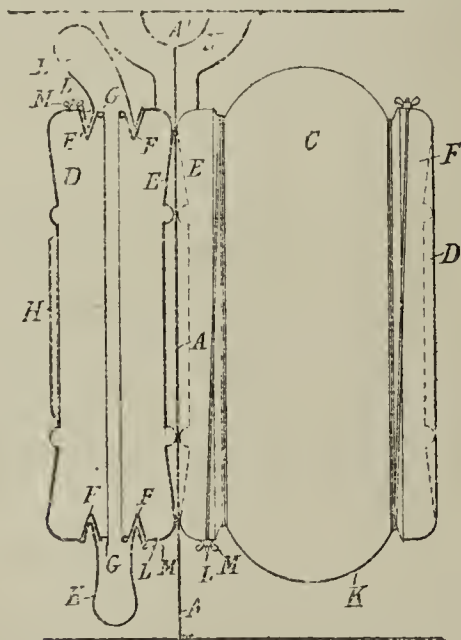
Referring to the right-hand section, the cock 1, which is of the rotary kind, is provided with two passage-ways in different planes, so that in the one position of the cock water passes from the inlet A to the inlet-pipe A1, which issues at B into the bottom of the cylinder G1; and in the other position, it passes from A to the inlet-pipe E, by which it enters the upper part of the cylinder at E1. On the other side, in the same axial line with the cock 1, is the outlet-cock 2, which has likewise two passage-ways in different planes; so that, in the one position of the cock, the water may pass out from the upper part of the cylinder at C through the pipe C1 into the outlet D, and, in the other position of the cock, the water may flow from the lower part of the cylinder at F into the pipe F1 to the outlet D. The spindles S of the two cocks are connected together by the sleeve M, which carries a two-armed or balance lever J. This sleeve, therefore, if turned by a movement of the lever, operates both cocks simultaneously; so that the water passes alternately into the upper and lower parts of the cylinder, and the water previously therein flows out simultaneously alternately from the lower and the upper space—that is to say, the spaces on the opposite sides of the piston G in the cylinder G1. This piston is packed with felt to slide easily in the cylinder. The piston-rod N passes through a stuffing-box O, and carries the rack P with rack teeth on each face; the one set of teeth gearing with the pinion T by which the counter is operated, the other set engaging with the pinion Q carrying on its side the tappet H. As the piston moves under the pressure of the incoming water, the pinion is revolved in the corresponding direction by the rack P. The tappet moves the arm V of the hammer I, and lifts it until the latter overbalanced falls upon the lever J, and rocks the lever against the rubber buffer block K, just as the piston

arrives at the end of its stroke. This action rocks the cocks; and the inlet of water is changed to the other end of the cylinder. The piston then moves back; and the pinion Q, with the tappet H, rotating in the contrary direction, again lifts the hammer until it is overbalanced and falls on the other arm of the lever, returning this lever, and with it the cocks, to the previous position.

The delivery of the cylinder being known—for instance, one gallon for each double stroke—the counter is correspondingly made. On the shaft V¹ of the pinion T is the disc X with the pivoted balanced or spring pawl Y thereon. As the disc revolves back and forth with each stroke of the piston G, this pawl moves the ratchet-wheel Z through the distance of one tooth. The train of wheels Z¹ gives the multiples of 10; each wheel revolving at one-tenth the speed of the previous wheel in the series. The arbors of the wheels Z carry the index fingers, which indicate the sum on the dials of the counter.

Dry Gas-Meters.—Wright, F., of Little Queen Street, Westminster. No. 3556; Feb. 23, 1892.

The object of this invention is to provide means whereby the leathers of dry gas-meters may be more easily attached to the metal heads or discs and rims than by the present method of wrapping with wire or tring, and also to do away with the soldered joints now used.



The illustration shows a view (partly in section) of the bellows of a dry gas-meter constructed according to this invention.

A is the partition, and A' the gas-inlet; and B C, the bellows, whereof the former is shown in section. D is the outer, and E the inner head, which is secured to the partition by solder or other suitable means. The heads D and E are pressed or stamped from sheets of metal, and afterwards spun over a suitable mould to form the V-shaped groove F therein. To prevent the edges of the heads from cutting the leathers, they should be beaded as at G, or they may be simply turned over to a right angle. The heads may also be strengthened, when required, by corrugating or dishing the same, or by dishing and corrugating as shown.

The patentee prefers to form the moving head D with a hole in the centre, through which is introduced an inflated bag or mould, over which the leathers are stretched. When the leathers are secured, the mould is removed, and the hole is closed by a patch-piece H soldered to the head D. To secure the leathers K to the heads D and E, the inflated mould is placed in position between the heads, the leather is stretched over it till quite tight; and, when tight, the leathers are drawn into the grooves F by flexible wires or strings. One end of each wire or string is secured to the studs L (which are attached to the heads D E), and two or more convolutions of the wire or string are passed round the leather—sufficient tension being kept on the wire to draw the leather well down into the grooves. The other end of the wire or string is then twisted or tied round the stud L, and cut off; a nut M being placed on the stud, and screwed down tight on to the wire or string. By this means a perfectly gas-tight joint is made between the leather and the head, with a minimum expenditure of labour. It is only necessary to tack the heads E to the partitions in about four places, and connect by means of a small channel-pipe N to the proper port in the corresponding valve.

Gas-Burners.—Johnson, J.; communicated from H. Kennedy, of Sharpsburg, Penn., U.S.A. No. 3958; March 1, 1892.

This burner is specially devised for burning blast-furnace gases in the furnaces of steam-boilers, &c. It consists of a combination of a gas-blast producing apparatus, a delivery-pipe leading therefrom of substantially as large area as the burner to which it leads, an open-mouthed burner at the termination of the delivery-pipe, wide in one dimension and relatively thin transversely, a furnace into which the burner leads, and an air-inlet space around the burner.

Electric Gas-Lighting Burners.—Pinkham, G. F., of Norfolk, Mass., U.S.A. No. 4610; March 8, 1892.

This invention relates to electric gas-lighting burners; and it has for its object to improve the construction of these appliances, and render the lighting device more durable, reliable, and positive in its action, and at the same time avoid the liability of its getting out of order. To this end, it consists in the combination with the plug of the stopcock, arranged vertically within the shell and provided with a thumb-piece or handle, and the pillar or vertical portion forming a prolongation or upward extension of the plug, of a fixed and a movable electrode composed of a pin or rod having a suitable terminal, and sliding within a guide attached to, and adapted to be rotated with, the pillar. There is also a cam for raising the rod as its lower end is caused to

travel in contact therewith, by the rotation of the pillar to carry it terminal above the level of the terminal of the fixed electrode. The cam has two inclines, one outside the other, extending upwards in opposite directions, and adapted to act alternately upon the rod, and a spring for retracting the rod after it has passed off the end of the upper incline of the cam.

APPLICATIONS FOR LETTERS PATENT.

7753.—MORRISON, J., "Ejectors for ejecting water, thick or thin, or tar and ammonia water." April 25.

7800.—CLARK, J., "Safety gas-cocks." April 26.

7888.—STRINGFELLOW, J. H. W., "Distillation of coal and other substances for gas making and other purposes, and apparatus therefor." April 26.

7923.—FOULIS, W., "Regulating the flow and pressure of gas." April 27.

7983.—DVORKOVITZ, P., "Manufacture of gas for illuminating or heating purposes; applicable also for the distillation of liquid hydrocarbons." April 27.

7995.—BAYLEY, J. P., "Charging inclined gas-retorts." April 28.

8112.—ROCK, T. D., "Gas generators." April 29.

8129.—NORMANTON, T. G., "Lamps and apparatus and appliances for distributing and lighting with petroleum." April 29.

8207.—HAWKINS, W. and T., and FULLER, H. and W. H., "Metallic block to be used in the production of gas." April 30.

8279.—MILNE, J., "Applying gas-bags to gas-mains and the like." A communication from E. Borias. May 2.

8298.—PHILLIPS, W., "Gas regulator for maintaining required temperatures in greenhouses, rooms, ovens, &c., where heated by gas." May 3.

8349.—RYLAND, F., "Cast-iron burners for lamps." May 3.

8365.—NEWTON, P. A., "Tapping water-mains, and forming branch connections therewith under pressure." A communication from H. H. Burritt. May 3.

8382.—ANDREW, W., "Socket and spigot pipes." May 3.

8401.—POLLOCK, G., "Gas-engines." May 3.

8410.—HAWKYARD, J., and BRADDICK, J., "Supplying gas or other fluid on prepayment." May 3.

8426.—LONGSDON, A., "Manufacturing gas from water vapour, and purifying and separating mixed gases." A communication from F. Krupp. May 3.

8462.—BAYLE, P. H., and CAMBRAY, A., "Distillation, heating, and condensation of bituminous schists, and any mineral substances which by distillation in closed vessels will yield mineral oils, paraffins, ammoniacal waters, and analogous products." May 3.

8540.—ROHOVSZKY, J., "Automatic igniting device for gas-burners." May 5.

8542.—TWIGG, R. H., "Liquid-meters." May 5.

8592.—LEVERITT, T. D. C., "Purification of coal gas used for the purposes of heating and cooking." May 6.

8635.—MOBERLY, C. H., "Engines worked by a mixture of gas or hydrocarbon vapour and air." A communication from E. A. Yakovleff. May 6.

8649.—MONEY, F. J., "Water motor." May 6.

8665.—RYLANDS, D., and EMMET, C., "Pressure-regulating valves for highly-compressed gases." May 7.

Three Yorkshire Water Schemes.—Three water-works schemes of some importance are being carried out in different towns in Yorkshire. The first in point of time, and the most important in the matter of expenditure, is that of the Yeadon Water Company, who are constructing on a part of Hawksworth Moor a new reservoir with a storage capacity of 92 million gallons. The first sod of the reservoir was turned on Feb. 8, 1890; so that the work has now been in progress for more than two years, and it is not expected that it will be finished before the end of the present year. This and other work which the Company are proposing to carry out is estimated to cost £28,000. The second scheme is that of the Baildon Local Board, who are greatly enlarging the area of their gathering-ground, and forming an additional reservoir, also on Hawksworth Moor. Parliamentary powers were obtained in 1890 for the scheme, which involves an outlay of £16,000. A start was made with the work in May, 1891; and it is expected that another year or more will be occupied in its completion. The third scheme is that of the Shipley Local Board, who are laying down a new high-level service, to enable them to reach the highest altitudes of their diversified district, and constructing filter-beds for dealing with the domestic supply. The expenditure for this work is computed at £10,000.

The Wexford Gas Consumers' Company and their Coal Supply.—In the High Court of Justice, Ireland, last Wednesday week, a case came before Mr. Justice Holmes and a special jury in which the Wexford Gas Consumers' Company sought to recover £300 damages for an alleged failure on the part of the Walker Coal Company, Limited, to supply coal according to contract. The case of the plaintiffs was that the defendants agreed to supply them with gas coal, not exceeding 3000 tons within a fixed time, at the price, for the first year, of 5s. 6d. per ton, less 2½ per cent., and for the second year of 6s. per ton, to be shipped at Newcastle-on-Tyne, and the vessels to be chartered according to the requirements of the plaintiffs, they paying costs. The defendants, it was alleged, after having delivered 815 tons of coal, refused to supply the rest of the quantity contracted for. Plaintiffs further alleged that, in consequence of a rise in the price of coal (after the making of the contract) to 8s. 6d. a ton, they had suffered considerable loss. The defence was a denial of the contract as stated by the plaintiffs; a plea that it was a term of the agreement, and condition precedent to the supply of the coal, that the plaintiffs should provide vessels for the carriage of it, but that they had failed to do so; that there was a further condition that the defendants should only be required to supply a reasonable portion of the coal from time to time, which they had been willing to do; and the defendants counterclaimed for £500 in respect of loss caused to them by the refusal of the plaintiffs to accept the remaining 2185 tons of coal. The hearing of the case occupied two days, when the jury found for the defendants in the original action, and against them on the counter-claim.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

Supporting Inclined Retorts.

SIR,—With reference to patent No. 9310, published in your issue of the 10th inst., I desire to point out that, so far as it relates to "an improved method of supporting retorts which are set at an angle to the horizontal line," it has been anticipated by patent No. 5078, dated April 1, 1890, taken out by myself, and published in the JOURNAL for March 24, 1891. Retorts corresponding to your illustration were in course of manufacture under my directions prior to the date upon which this later patent appears to have been applied for.

Birmingham, May 14, 1892.

CHARLES HUNT.

The Present Position of the Gas-Works Rating Question.

SIR,—I have read Mr. Humphry's reply to the comments contained in my letter of the 28th ult., and confess that I do not understand it.

I take it, however, from its general drift, that he adheres to his previous statement that "the law lays down, as a first principle, the rule that the rateable value shall be equal to the rent which a tenant would be willing to give for the property from year to year." Now I repeat that this is inaccurate, and therefore misleading.

Although we are all (or most of us) agreed as to the urgent need for some improvement in the law of rating—especially as applied to gas and water undertakings—it is well, in the meantime, to accept the interpretation as we find it; and all the more so as it is quite clear and precise. Permit me, then, to quote the definition of gross value and rateable value, as given in "The Valuation (Metropolis) Act, 1869."

"The term 'gross value' means the annual rent which a tenant might reasonably be expected, taking one year with another, to pay for a hereditament, if the tenant undertook to pay all the usual tenant's rates and taxes, and tithe commutation rent-charge, if any; and if the landlord undertook to bear the costs of the repairs and insurance, and the other expenses, if any, necessary to maintain the hereditament in a state to command that rent." "The term 'rateable value' means the gross value after deducting therefrom the probable annual average cost of the repairs, insurance, and other expenses, as aforesaid."

Manchester, May 13, 1892.

THOMAS NEWBIGGING.

Should External Guide-Framing be Abolished?

SIR,—My attention has been drawn to the publication, in your last issue, of Mr. Livesey's report to the Salford Corporation on the above question.

It is by no means surprising that a gentleman in Mr. Livesey's responsible position should feel it imperative upon himself to take up an attitude of extreme conservatism and caution, in considering a subject or proposal of so radical a character as the entire abolition of the upper guide-framing of gasholders. Indeed, I think it shows Mr. Livesey's characteristic fairness when he so frankly admits that holders up to a certain size may be erected with spiral guides or otherwise, without framing, with perfect safety. His want of confidence is confined to large holders, which, he has recently informed us, commences at about 150 feet diameter, and which, of course, would include the proposed holder at Salford.

Believing myself, most sincerely, that large holders constructed on the spiral system are, relatively, safer than smaller ones, I should like to see a way out of the apparent deadlock produced by the following words in Mr. Livesey's report, wherein he says: "It would be wrong to run any risk until the doubt is completely and satisfactorily removed." If this doubt in Mr. Livesey's mind can only be removed by *experimental* demonstration, with a large holder, it would appear that he must think it wrong to make such experiment to enable us to remove the doubt. On the other hand, if Mr. Livesey intends by these words, that the doubt may be satisfactorily removed *theoretically*, it would give me the greatest pleasure possible to have the privilege of meeting him in friendly discussion for the purpose of thoroughly thrashing the matter out.

I expect before long to be able to point to, amongst a number of others, holders in successful operation of three lifts, constructed on the spiral system, of 90 and 100 feet diameter respectively; but, of course, these will not reach the dimensions of what Mr. Livesey considers truly large holders. Nevertheless, I am hopeful, ere long, that we shall be able to find some engineer, either in this country or abroad, who will have the courage to erect one which shall reach very much larger dimensions; and I firmly believe if Mr. Livesey and myself are happily spared to a reasonable age, we shall live to see holders of the largest dimensions constructed on this system, when, I am perfectly sure, that gentleman will be one of the first to congratulate me upon the fact.

I should well like an opportunity of demonstrating to Mr. Livesey that his illustration of the inverted wicker waste-paper basket is not really analogous to a gasholder, with regard to its relative capability of resistance. This may be proved by an experiment I have made upon a model gasholder, constructed of very thin tin, without any stays or bracing of any kind—nothing but the simple cylinder domed over, and attached to supports at the base. I subjected this to a uniform horizontal pressure, over the whole semi-circular surface, in one direction, of 628 lbs. to the square foot of the equivalent plane, before any permanent set (and that of a very slight character) could be produced.

It is well known that I draw a great distinction between the method of guiding by means of spiral guides, twisting the holder in its ascent and descent, and the method of vertical guiding by means of rope gearing; and, although I claim to be, *de facto*, the first and true inventor of both systems, I readily admit that safety with the latter system decreases as the diameter of the holder increases, and is therefore suitable for the smaller class of holders; whilst with the former I assert that safety is increased with the increase of diameter, thus rendering it specially applicable to the largest possible sizes.

It is a mistake to suppose that, in the spiral-guide arrangement, there is any difficulty in fairly equally distributing the strain over all the points of support, as I hope very soon to have an opportunity of demonstrating.

With regard to wind storms, we have certainly had some very respectable ones during recent years; and the behaviour, under heavy wind pressure, of the spirally-guided columnless gasholders already erected, has been in every way satisfactory, and entirely free from that unpleasant vibration observable in holders guided in the old manner, which I am sanguine enough to believe will in time become obsolete.

Manchester, May 13, 1892.

W. GADD.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress was made with Bills last week:—

Bills read the first time: Electric Lighting Provisional Orders Bills (Nos. 1, 2, and 3).

Bills read a second time and committed: Brynmawr and Abertillery Gas and Water Bill; Mold Water Bill; Ormskirk Gas Bill; Southend Gas Bill; Stamford and St. Martin's Stamford Baron Gas Bill.

Bill referred to a Select Committee, consisting of Earl Ducie (Chairman), Viscount Powerscourt, Lord Churchill, Lord Wimborne, and Lord de Vesci; to meet on Tuesday, May 17: North Shields Water Bill.

Bills referred to a Select Committee, consisting of the Marquis of Bath (Chairman), the Duke of Leeds, Lord Herries, Lord Monckton, and Lord Cheylesmore; to meet on Thursday, May 19: Brynmawr and Abertillery Gas and Water Bill; London County Council (Subways) Bill.

Bills reported, with amendments: Uttroter Water Bill; Newport Corporation Bill.

HOUSE OF COMMONS.

The following progress was made with Bills last week:—

Bills read a second time and committed: Gas Provisional Orders Bill; Tredegar Local Board Water Bill.

Bills referred to a Select Committee, consisting of Sir Joseph Pease (Chairman), Lord F. Hervey, Mr. W. M'Arthur, and Mr. Victor Cavendish; to meet on Thursday, May 19: Ashton-under-Lyne, Stalybridge, and Dukinfield District Water Bill; Bradford Corporation Water Bill; London Water (No. 1) Bill; Rhymney Valley Gas and Water Bill.

Bills reported, with amendments: Cleator Moor Local Board Gas Bill; Electric Lighting Provisional Orders Bills (Nos. 1, 2, and 3).

Bills read the third time and passed: Barrow-in-Furness Corporation Water Bill; Bournemouth Improvement Bill; Electric Lighting Provisional Orders Bills (Nos. 1, 2, and 3); Oxford Gas Bill; Rhyl District Water Bill.

Petitions have been presented for the Bexhill Gas and Water Bill, and for an additional provision in the Exmouth and District Water Bill. The former is under the consideration of the Standing Orders Committee; and the latter has been granted by the Committee.

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Wednesday, May 11.

(Before the MASTER OF THE ROLLS and Lords Justices LINDLEY and KAY)

The Attorney-General (at the Relation of the Mayor, &c., of Tynemouth) v. North Shields Water-Works Company.

This was an information and action claiming an injunction to restrain the defendants from supplying to the Corporation of Tynemouth and the inhabitants of the borough water which had been pumped from the Shiremoor Colliery or any other colliery workings, or water which was impure or unfit for domestic use. The defendants were incorporated by an Act of 1786 for the purpose of supplying fresh water from any "spring, stream, or pond" to Tynemouth; and by an Act of 1866 they were compelled to supply water for domestic purposes. The Company were, until 1883, in the habit of taking a large quantity of water from a well about a mile from an old working in Shiremoor Colliery. This working was full of water; and in 1883 the colliery-owner began pumping it out—causing the well to become dry. The water from the working was pumped into a culvert, and it then flowed into a stream. The Company thereupon took the water pumped out of the colliery at the place where it entered the stream; this water in wet seasons forming half the bulk of the stream. At the trial before Mr. Justice Wright and a special jury, evidence was given that the water was impure, and not fit for drinking purposes. The learned Judge granted an injunction substantially as prayed (see *ante*, p. 585). The defendants appealed.

Mr. LAWSON WALTON, Q.C., appeared for the appellants; Mr. TINDAL ATKINSON, Q.C., and Mr. T. WILLES CHITTY, representing the respondents, were not called upon.

The MASTER of the ROLLS, in giving judgment, said the Company had compulsory powers to obtain fresh water from "springs, streams, or ponds," and to supply that water to the inhabitants of Tynemouth. The Company would not be justified in obtaining and supplying water from any other source. If they exceeded their powers, the Attorney-General could interfere to stop them, though he probably would not do so if the water supplied was good. The evidence here showed that

the water was impure. The Corporation also were parties to the action, in order to protect the inhabitants; the duty of the Company being to supply water fit for domestic purposes. The Company took the water pumped out of the shaft of the mine, and supplied it to the town. The water did not come from a "spring, stream, or pond;" therefore it came from an unauthorized source. The water was also impure, and unfit for domestic purposes. The injunction, therefore, which was confined to the water coming from this old colliery working, was rightly granted.

The LORDS JUSTICES gave judgment to the same effect. The appeal was therefore dismissed.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Monday, May 9.

(Before Justices DAY and CHARLES.)

East London Water-Works Company v. Kellerman.

This was an appeal by the plaintiffs from the decision of the County Court Judge sitting at Bow, in an action brought to recover 14 quarters' rate, amounting to £3 6s. 6d., for water supplied to the defendant. The latter paid into Court the sum of 9s. 6d., being the rate for the last two quarters; but he denied liability as to the remainder. The case raised an important question as to the liability of the owner of a house in respect of arrears of rates which had accrued due before he became owner, and while he was tenant and occupier; the premises being under the annual value of £20.

Mr. DARLING, Q.C., and Mr. H. KISCH (instructed by Messrs. George Keble and Miller) appeared for the plaintiffs; Mr. SETH SMITH and Mr. PERCEVAL represented the defendant.

Mr. DARLING, in opening the appeal, said that from the 16th of January, 1889, the defendant held the premises in respect of which the rate was incurred as a lessee under an agreement, and he covenanted to pay all the rates, including the water-rate. On the 1st of July, 1891, there was a conveyance of the freehold to the defendant; and on the same date a mortgage of it to the House Owners' Association, by which he was to pay by instalments the price fixed under the conveyance. He made default in his payments; but the County Court Judge found that the mortgagees did not take any advantage of this. He therefore decided that, by reason of the existence of the mortgage deed, the defendant was not the owner of the premises within the meaning of the Water Companies (Regulation of Powers) Act (50 and 51 Vict., cap. 21, sec. 4), and that the Company were not entitled to recover.

Justice DAY: Do I understand the decision to be that a mortgagor in possession is not liable to pay water-rate?

Mr. DARLING said the Judge had decided that the defendant was not liable, because he was not the owner under the above-named Act. The Company could not cut off the water; but they had a right to recover the rate due in respect of the house. The other side contended, however, that the Act gave the Company a charge on the property, with interest at 5 per cent.; and the only remedy was, not to recover against the owner or occupier for the time being, but to commence a suit in the Chancery Division.

Justice DAY: It comes to this, that if you have bought premises, and have not the means of paying for them, you are not liable; but if you have the money to pay for them, you are liable.

Mr. DARLING: Quite so. If the defendant had not mortgaged the premises, he would have been bound to pay under Mr. Forrest Fulton's Act.

Justice CHARLES asked why the defendant was not to be responsible as tenant.

Mr. SMITH said because the rateable value of the house in question was under £20.

Justice CHARLES: What you say is that, having become the owner, you accept the responsibility put upon an owner by the Act of Parliament, but you are not liable as tenant before then.

Mr. DARLING said the County Court Judge thought the defendant would have been liable had it not been for the mortgage.

Justice DAY said the real question was whether, by reason of a conveyance executed in July, the defendant became liable for water-rate which had accrued previously.

Mr. DARLING thought that was so. He submitted that the defendant was the owner for the time being, and consequently liable.

Justice DAY: Does it not become a charge upon the land?

Mr. DARLING said the defendant would have been liable if he had been sued in the Chancery Division. Before the defendant bought the property, there was a charge due upon it for unpaid water-rate for which he became liable.

Justice DAY: Suppose he had been a stranger, and bought the property with the charge upon it.

Mr. DARLING: He would have been liable to pay it.

Justice DAY: You wish to seek to convert a charge upon land into a personal liability?

Mr. DARLING: No; I say the Act has given me both remedies—a charge upon the land, and a charge as against the person owning the land.

Justice DAY: There was always a liability on the person. The old owner was always liable to pay the rate.

Mr. DARLING: For the water which he had received.

Justice DAY: The present defendant did not become the owner till July. He buys the land subject to the charge; but it does not transfer to him a personal liability against the old owners.

Mr. DARLING: I submit that, by section 4 of the Act of 1887, all liability is put upon him.

Justice DAY: Suppose he had bought the property at the Auction Mart, do you say he would be liable for these charges?

Mr. DARLING: He would be liable to an action for their recovery.

Mr. SMITH contended that the Act had not enlarged the powers of water companies, though undoubtedly it gave them a charge for water-rate on certain property which they could not, in the ordinary way,

recover from the occupier. As the rateable value of the property was under £20, the only right of personal action was against the owner.

Justice DAY: Are the Company bound to supply water to a new tenant if the old rate is not paid?

Mr. SMITH said he thought they were; and, in support of his contention, he cited the case of the *Sheffield Water Company v. Wilkinson*,* in which it was decided that there was no lien for water-rate.

Justice DAY asked whether arrears were a charge upon the land.

Mr. SMITH submitted they were not. They could only be a charge so far as the rates were due from the owner.

Justice DAY, in giving judgment, said the action was an appeal from the decision of a County Court Judge, who had held that the defendant, although chargeable with some portion of his water-rate, was not liable for the remainder. It appeared that he was formerly the tenant of the premises in question, of which the rateable value was under £20; and therefore he was not personally liable for the water-rate. The owner of the premises for the time being—the person who received the rent—was by statute liable. In the month of July, 1891, the defendant altered his position from being tenant, as he bought the reversion of the property. He did not, however, pay for it, but borrowed money to enable him to do so; and for the purpose of raising this loan, he effected a mortgage. He still remained in the premises as mortgagor in possession, though this fact was entirely immaterial to the case. The defendant disputed his liability to pay the rates which accrued during his tenancy; and no doubt, *quâ* occupier, he never was responsible for them. But it was said that, by reason of the subsequent purchase of the reversion, he had made himself liable, simply because he had become the owner of the premises. Prior to 1887, the Company had a remedy in respect of unpaid rates by cutting off the supply of water; but Mr. Forrest Fulton's Act specified that from thenceforth they should not do this. To compensate them for the deprivation of this power to recover rates due to them, the statute provided, by section 4, that where the owner, and not the occupier, was liable by law (which was the case here) for the payment of the water-rate, such rate, without prejudice to the other remedies for enforcing payment, should be a charge on the dwelling-house in priority to all other charges affecting the premises. Therefore, by force of this enactment, the water-rate, being unpaid, became a charge upon the premises. The statute went on to provide that the amount might be recovered, with costs, from the owner or from the occupier for the time being, in the same manner as water-rates might be recovered by law. It was said that the defendant (who, no doubt, had been tenant or occupier prior to July, 1891), by acquiring the reversion in July, became subject to an action in respect of the arrears, because the Act went on to provide that "the amount may be recovered, with the costs incurred, from the owner for the time being, in the same way as water-rates may by law be recovered." This would be unnecessary if it only applied to the person who was originally liable, because the owner always was liable to be sued in respect of water-rates. The Legislature, when making the water-rate a charge on the premises, specified that the owner for the time being might be proceeded against. It then provided in the case of the occupier, where he was made liable that he should, after certain notice given to him, pay the water-rates to the supplying company, and deduct them from the rent payable to the landlord; that was to say, it was a mode of enforcing, through the occupier, payment of the charge on the land—making him pay to the water company money which otherwise he would have paid to the landlord. The landlord bought the property for so much less, because there was a charge for water-rates upon it; and he was liable to pay off this charge. He was not to be proceeded against by tedious suits in equity; but the supplying company could compel the occupier to stop the amount out of the rent. If the occupier would not do it, he was liable to be sued, although in the first instance he was not liable for the rates, and never was. Afterwards the company might enforce payment against the owner for the time being, through the medium of the tenant or occupier for the time being. In the case where the owner was originally liable, the rate was a charge on the land; and where there was a tenant, the supplying company could proceed against him, and make him pay, and deduct the amount from the rent. If there was no tenant, or it was otherwise more convenient, the company might enforce the charge on the land. For these reasons he thought the Judge in the Court below had erred, and that judgment ought to be entered for the plaintiffs, with costs.

Justice CHARLES concurred.

Mr. SMITH asked for leave to appeal.

Justice DAY said that, although the sum in dispute was small, the matter was one of general importance; and therefore he would give leave to appeal.

Pocklington Water Company's Provisional Order.—With respect to the application made by the Pocklington Water Company, Limited, for a Provisional Order empowering them to divert water flowing into the stream which runs through Pocklington, Major Marindin, who recently conducted an inquiry into the Company's proposals, reports that the existing source of supply cannot be considered satisfactory, owing apparently to the manner in which the reservoir is constructed and that the supply from this source is liable to decrease, owing to the difficulties of collection. There is, admittedly, an abundant supply of water on the hill where the reservoir is situated, if the difficulties of collecting it could be overcome; and it would be an undoubted advantage to the inhabitants of Pocklington to be able to obtain a better and more reliable supply, especially in view of a proper drainage scheme for the town. With such a small undertaking, however, the construction of a compensation reservoir, or the supply by means of pumping, is out of the question. The Company have, moreover, failed to show that all possible steps have been taken to make available the whole supply of water at the present source. Under these circumstances, and seeing that the amount of water in the beck is so small in the dry season that the abstraction of any of it would to a certain extent damage the millers, Major Marindin is unable to recommend that the application should be granted. On this report, the Board of Trade have decided not to grant the Order.

* See JOURNAL, Vol. XXXIII., p. 435.

MISCELLANEOUS NEWS.

THE ROYAL COMMISSION ON LABOUR.

Thursday, May 12.

(SECTION C.—Present: *The Right Hon. A. J. MUNDELLA, M.P., Chairman; the Duke of Devonshire, Mr. Austin, Mr. G. Livesey, Mr. Tait, Mr. Tunstill, Mr. Tom Mann, Mr. Mawdsley, and Mr. Trow.*)

Evidence Relating to the Gas Industry.

At the sitting of the above section of the Labour Commission to-day, witnesses were called to give evidence on matters relating to the gas industry.

Mr. J. Taylor, connected with the Sheffield branch of the National Union of Gas Workers and General Labourers, referred to the reduction of the hours of gas workers in Sheffield from twelve to eight; and on being asked by Mr. G. Livesey whether the men did not do as much work in the eight hours as they had previously done in the twelve, his reply was that this was just the argument they used in support of the reduction. When the stokers made their request for an increase of pay and fewer hours, their representatives were very fairly met; and although they did not get all they asked for, very considerable concessions were made.

Mr. T. Blackburn was the next witness examined. In answer to the CHAIRMAN, he said he was Secretary of the Greenwich branch of the Gas Workers and General Labourers' Union, which was in connection with the works of the South Metropolitan Gas Company. He appeared before the Commission to give evidence with respect to the strike at the South Metropolitan Gas-Works in 1889. At the time of the strike, there were a large number of men members of the Union—from 3000 to 4000 in Greenwich alone. Of these he thought there were now about 3000 financial members. The Union did not deal with wages and hours of labour only, nor did it confer any benefits. It was only to regulate the hours of labour. The members paid 2d. a week. The Union had been formed since April, 1889. The strike began on Dec. 13, 1889. It originated through some members of the Union at the Company's Vauxhall works having destroyed their cards and signed a profit-sharing agreement; but the real origin of it was the men applying to the Company for double time for all work done on Sundays. This was granted under protest. Before 1889 there was no double time on Sundays, and only occasional Sunday labour, when he was working for the Company. In the twelve months there was only one Sunday on which he had to work. It was agreed, however, by every member of the Union, or every worker throughout the Metropolis, that, if they had to work in gas factories on Sundays, they had a perfect right to be paid double time for it—to have two days' pay for one. When he worked on Sunday, he was paid time-and-a-half. There were demonstrations all over the Metropolis; and it was agreed by all who were in any way connected with the Union that the men had a perfect right to ask for it. A deputation attended at the Cannon Street Hotel, on the 4th of November; and the Chairmen of the different Gas Companies, and some of the Directors also, were there to meet the men on the subject. Nothing could be finally settled then; therefore they met again on the 13th. On that day the Chairman of the South Metropolitan Company did not attend; but he invited two delegates from each of the stations to meet him at the chief office, in the Old Kent Road. There they discussed the matter with the Directors and himself (witness). The other two Companies—The Gaslight and Coke and the Commercial—conceded double time for Sunday labour. There was a question in regard to three extra retorts being done; and this was also settled. The Union agreed that the men should do the three extra retorts, provided they were called upon, if they could not get other men, so as not to delay the work in any way.

The CHAIRMAN: So that practically you settled your dispute with The Gaslight and Coke Company and the Commercial Company, but not with the South Metropolitan Company?

Witness: We could not settle it with the South Metropolitan, because neither the Chairman nor anybody was there to represent them on the second occasion.

What happened with the South Metropolitan Company?—We met the Directors, and a profit-sharing agreement was drawn up and offered to us, which was to be considered at the same time. We delegates were an hour and a half discussing the agreement; but we could not see our way clear to signing it. I am speaking of the carbonizing department, because some of the other men, who were working in the yard signed it. After we had discussed the agreement, Mr. Livesey himself agreed that it would bear a little alteration. Mr. Livesey distinctly told us he thought it was very hard of us to act in the way we were doing; that we were never satisfied; that it did not matter what he granted to us, for a day or two afterwards we were coming again with some grievance. He said it was impossible for him to grant it; we had squeezed the orange till it was dry, and could not get anything more out of it. The General Secretary of the Union distinctly told Mr. Livesey that the men were determined that they would have the double time for Sunday; and if they did not get it, the result would be that they would have to send in their notices. Every one of us understood then that it would be but very shortly before it would come to a strike.

Up till that Monday they did grant the double time?—Yes, under protest, and that was just the same as saying "We grant it you under protest; but we shall have it back the very first opportunity." And it was not long before they did it, because, when the men at Vauxhall signed the profit-sharing agreement, the Executive of the Union wrote to the Directors on the 2nd of December, asking them if they would kindly remove those men, on account of their having torn up their Union cards, which was causing a disturbance among the other men.

What was the result?—The result was that 2000 of us gave in our notices; and we continued out until the 4th of February, 1890. On that day the strike was brought to an end—or rather it was agreed that it should be brought to an end—in consideration of the Company taking back the old hands in preference to strangers, provided we would bring the strike to a close officially. We did so, and four days

afterwards there was posted up on the gates a notice that the Union men were not required; and they are not allowed to work there now. No man carrying the Gas Workers' Union ticket is permitted to work for the Company; and this is really the grievance we wish to bring before the Commission.

Do you say that a man employed by the South Metropolitan Gas Company can no longer be a member of your Union?—Not if they know it. Of the 2000 men who sent in their notices, some were taken back; but this was while the struggle was going on, and they had to leave the Union. They deserted from us when they went back.

Did half of them go back?—Oh, no; not a quarter of them. The best part of them are now walking about, doing nothing. One has gone to one place, and another to another.

They have not been idle ever since 1889, have they?—No; I am speaking really of the effect the strike had upon them. They had to go here, there, and everywhere. Those who have remained in Greenwich have not got much, I assure you.

Did you understand the profit-sharing scheme—under which you would have the same wages you had been previously receiving, and a bonus on division? Did you carefully consider that scheme?—Yes; I thoroughly considered it; and I believe the greater portion of the men did so likewise.

What was the objection to it, if it gave you the wages you had before, double pay on Sundays, and a share of profits besides?—It was that you entered into an agreement for one year—that was one clause which was very objectionable. Of course, providing we signed the agreement, we should not have required any Union whatever. We should have had nothing whatever to uphold, because we were already bound for a year, and that clause stated that, if at any time a man wished to leave, he must give notice to the Engineer, and he would give his answer within a month. Therefore after a man had once signed the agreement, it would ultimately come to this, that he must stop in the gas-works for the rest of his life, because no employer would keep a situation vacant for a month while a man was waiting to get the reply from the Engineer.

It required that you should give a month's notice to terminate the agreement?—No.

Mr. LIVESEY: You had better read what it was.

The CHAIRMAN: Give it to us in your own way.

Witness: The agreement was that you should apply to the Engineer if you wished to leave; and the Engineer would consider whether he could spare you, and you would have your reply within one month.

You could not give a month's notice to leave?—Oh, no; you would only be bound under the week's notice, by the way we were working.

Is there anything further you would like to state respecting it, or is that your whole story?—I should like to ask if I should be at liberty to give the reason why the Company really did break the agreement they entered into with us, that they would take back the old hands in preference to strangers, as vacancies occurred.

Had you that in writing?—Yes; that was an agreement entered into with Mr. Shipton, of the Trades Council, Mr. Thorne, and Mr. Ward. Mr. Livesey signed it on behalf of the Company.

Have you a copy of the agreement?—I have not; but you can have a copy of it. I daresay you will have it forwarded to you. I am not here on behalf of the Union. The men in Greenwich wished me to come and give evidence as to this strike; and therefore I do not hold these papers.

You have told us your own story respecting it; but the official story will be told by whom?—I believe by Mr. Thorne, the General Secretary; or Mr. Ward, the Assistant Secretary, is here, and he could tell it. He was working for the Company at the time I was—almost at the same time that the dispute arose.

Mr. TUNSTILL: I understand that the foundation of your grief and trouble lies in the fact that the Company did not take you back again, as you expected they would, and as they had contracted to do?

Witness: Yes; that is my principal grievance.

Mr. LIVESEY: Going back to the question of Sunday labour, you told us you had time-and-a-half. You remember, I suppose, the agreement that was come to in June, and you remember that a notification was put up. Perhaps you know it was the practice at one works to pay time-and-a-half?

Witness: Yes.

That notice is dated July 1, is signed by myself, and reads as follows: "For Sunday labour between 6 a.m. and 10 p.m., on the rare occasions when it would be necessary to work, time-and-a-half will be allowed at all stations." Then we come to your statement about the further demand. On the 23rd of October, this letter was written—perhaps you may know it; it is addressed to me: "Gas Workers and General Labourers' Union. Dear Sir,—I am requested by the Executive Council of the above Society to ask you for double time on Sundays from 6 a.m. to 10 p.m. An early reply will kindly oblige, yours respectfully, W. Thorne." Accompanying the letter was this notice: "National Union of Gas Workers and General Labourers of Great Britain and Ireland. Council meeting held at the Registered Office, Barking Road, on Sunday, Oct. 20. The following resolution was passed: That on and after Sunday, Nov. 10, double time be paid for all work done by stokers, firemen, coal trimmers, and pipe cleaners between the hours of 6 a.m. and 10 p.m. on Sundays; and all labourers doing firemen's work receive firemen's pay, and firemen time-and-a-half when not carbonizing. By order of the Executive Council, W. Thorne, General Secretary; W. Byford, General Treasurer." Do you remember that?—Yes; I remember the bill. That was the first resolution passed by the Council. I might state that the Council meeting is an assembly of delegates from each of the stations, who have orders exactly how they are to vote; therefore it really comes from the majority of the members of the Union.

But this was intended to lead to a resolution that you would have double time, was it not?—Yes; a resolution that we were entitled to double time from 6 a.m. to 10 p.m., and that we meant to have it if we could get it.

Then you have spoken of a meeting at Cannon Street. I was not present; but the Engineer was. The meeting at which I was present was in the offices in the Old Kent Road; and you were there?—I was there too.

And we discussed this matter for four hours, I think?—From two hours to two hours and a half were occupied with the profit-sharing agreement, and another hour and a half was spent over the double time question.

I was told then, on the off-chance—I do not say by you—that the reason you demanded the double time was to stop Sunday work?—Quite correct.

I think I asked you what you had to complain of about Sunday work with us; and you admitted, as you have admitted now, that there was practically none?—I quite acknowledge that as correct. At your works, so far as the station I was in was concerned, there was no Sunday labour. I worked only one Sunday.

I think I ascertained from you that this demand originated from works belonging to another Company? It was said that, at certain works belonging to another Company, the men were working nearly every Sunday?—That is correct.

It was to stop that that you made this demand?—Yes. The idea of our Union was then that we, as a body of workers throughout the Metropolis, should stand with the others, and that the other side should do the same with us.

Do you suppose this demand would have been made if the other Company had worked as we do?—I do not think it would, because nobody would have troubled about it if they had not had to work.

It is very fair of you to say that. Then did I not point out to you that, as we did not work on Sunday, I thought it a very unfair demand on your part?—You certainly did. You said that there were two opposite Companies; and you considered that it was a very unfair and unjust thing that you should have the other Company crammed down your throat. I do not say that you made use of so vulgar an expression, but it meant the same.

I said, did I not, that we should not be punished because of the misdoings of the other Company?—Yes.

The CHAIRMAN: Did I understand that the South Metropolitan Company employed Sunday labour scarcely at all, or only once in the year?

Witness: I was twelve months with them; and I only worked one Sunday.

Therefore it was not to punish the South Metropolitan Company?—No; because they never had to do it.

Mr. LIVESEY: At the settlement in July or June, it was arranged that Sunday work should be paid for at the rate of time-and-a-half from 6 a.m. to 6 p.m.; and then, on this resolution of Oct. 20, it was resolved that, on and after a certain day, double time should be paid for all work between 6 a.m. and 10 p.m.?

Witness: Quite right.

The CHAIRMAN: Including four hours more of Sunday work?

Witness: Yes. I might state that the reason they wished to do away with it was that they had once to go in from six to ten o'clock—four hours. We had the satisfaction of going to the factory while the church bells were ringing; and we wanted to see if we could not possibly do away with the four hours. The retorts would not hurt, I think, through being left for that time. If we had not to work then, there would have been no need of the double time. That was the idea of asking for the double time; we wanted to abolish it.

Mr. LIVESEY: The cessation of Sunday work applies only to the daytime on Sunday?

The CHAIRMAN: I understand from six to ten was not recognized as Sunday work, was it?

Witness: No; it was not, at that time. And there was no increase of pay whatever; it was the ordinary pay.

Mr. LIVESEY: Previous to the adoption of the eight-hour shifts, the men would go in at six o'clock, and work the whole night?

Witness: Yes; but they did not go in with a good heart, I can assure you. The hardest thing we ever had, the whole time I had experience of a gas factory, was the going in on Sundays.

As a practical man, you know it is hardly possible to suspend work during 24 hours on Sunday?—I quite understand that; but very often it was done with the other Company—the Company who have caused a great deal of this trouble.

And to stop that, you passed this general resolution?—Yes; to stop that we all formed into a Union; and if we are all one body, it was our duty to have the same system throughout the Metropolis.

When I saw you, did I not say to you: "An agreement was come to on the 1st of July, and you expressed yourself satisfied. Why do not you stand to that agreement—why do you want to alter it now?"—You did not say that.

Did I not say: "What is to be the end of this?"—Yes; you did.

When I stated that we agreed to their time-and-a-half for twelve hours on Sunday, I said; "Now you are reopening the question, and you have made other demands in variation of that agreement, and where is it to end—what is to come next." And then did not Mr. Thorne say to me: "Well, I am in favour of waiting till the half-yearly accounts are out, and seeing what is the position of the Company, before we make any other demand?"—I do not remember Mr. Thorne making use of that language.

Do you remember Madden, the Vauxhall man, saying, "Speak for yourself; we do not say so"?—I remember them saying that they would not pledge themselves that they would not ask for anything at all; but I do not remember that it was Thorne who suggested that it should stand over till February.

Then I said: "I will not risk a strike on such a question as this it will not affect us much. I object to your going from your agreement, or breaking it; but it shall be given, though I will give it under protest"?—Yes.

"I will take it back as soon as I can"?—Well, I did not say you said that, but I had a good mind to do so. It was your intention to take it back at the first opportunity.

Was it not the fact, when this double time for Sunday was given, that in many cases the men wanted to work on Sundays then?—No; I am not aware of that.

At some works did they not try all they could to run the Company short of gas on Saturday, so that they would be obliged to work on Sunday to get the double pay?—More disgrace to them if they did; but I was not aware that they did such a thing.

Then you also spoke about the origin of the strike with the Vauxhall men. At that meeting, when we met at the office, you objected to the clause in the agreement about the men leaving?—Yes.

It is not at a month's notice, but it reads in this way: "No obstacle will be thrown in the way of any man engaged in the above work." The agreement was to be for twelve months. But it was felt, I think—and I explained this—that it would be very hard for a man who had signed an agreement for twelve months, if he had a chance of getting a better berth, to be held to it, and not allowed to take advantage of the opportunity; and so it was altered?—You did make the remark that two or three clauses could be altered.

The CHAIRMAN: Why did you object to that clause?

Witness: We objected to it on the one ground that, if at any time we really wished to leave the factory, it would be a matter of impossibility for us to do so without the Engineer giving his sanction, because that would put us under the Conspiracy Act at once.

Mr. LIVESEY: Then it was altered in this way: "On such notice, the Engineer shall, in his discretion, consider whether the services of such man can be dispensed with without detriment to the Company; and, if so, permission will be given on the expiration of the usual week's notice"?

Witness: Yes; but under that profit-sharing agreement, it all lay with the Engineer, not with the workman. You are bound for twelve months, and there is no escape.

Do you know of any single case in which a man who applied to leave has been refused permission?—No; I do not. I believe candidly that they had come and asked you, you would have let them go; but I do not say the same of the Engineer or the under-foreman.

It was intended that there was to be no objection whatever to any man, or any reasonable number of men, leaving. But if the whole of the men wished to leave, the Engineer would then say: "I cannot dispense with your services to the detriment of the Company; and therefore I cannot allow you all to leave at once."—Yes; that is really the true meaning of what it was.

The CHAIRMAN: Could he not say that with respect to any good man who wanted to leave the service?

Witness: Certainly.

Mr. LIVESEY: But he never has done so?

Witness: No, he never has, that I know of. Since that time I have left the Company's service; and I could not tell that the thing has never happened.

There were other things talked about?—Yes; there was one thing about giving the foreman entire power to put a man to any work he felt inclined, so that if he should have any petty spite (as they very often have), he could put you to work which was very disagreeable, and really cause a man to break the agreement, and forfeit every penny that would be coming to him under it.

It is the second clause of the agreement, and you contended that this gave the foreman the power of making a stoker who was getting his 5s. 4d. or 5s. 6d. a day into a yard labourer?—Yes. The reason I objected to it really was that I was working for the Company on the other side of the water; and I was sent away from firing to go on the top of the gasholder and sweep off the snow. Therefore as, under the agreement, I was bound to stop for twelve months, I could not consent to it.

Is it not the fact that gas companies employ a greater number of stokers in winter than in summer?—That is quite correct.

What becomes of these men in the summer time?—Some of them go into the brickfields. But in your Company there are a lot who go into the yard; and I believe there are a great many who do so in other companies.

When we could not keep them on as stokers, that clause was to enable them to take work in another capacity?—The word "summer" would have done that, if it had been required; and, as I have stated to the Chairman, you said it wanted altering. You had to agree with us that there were faults; and you said you would rectify them.

Two or three that you mentioned I did agree to, there and then?—Yes. I did not see anything very objectionable in the agreement, except the signing for twelve months. I would have agreed to serve you for two years for half of what you would have given me under the profit-sharing scheme, if I had not to sign for a year. But you said: "No, Mr. Blackburn; you cannot have it that way." There was no compulsion to sign the agreement, only you said that all those who signed would have work in preference to those who did not; and the result would have been that those who did not sign would have to go.

Another point you mentioned was about the breaking of the agreement with us to settle the strike. On the 4th of February, the consumption of gas greatly decreased, and men were being discharged every week at that time; and, of course, you know that the strikers, or the Union, having held out so long, there was very little chance of their getting employment after that date.—Yes.

The Company said all through that they would not discharge one of the new men to make way for any of the old ones; and in the agreement, as you have stated very fairly, it was specified that, if vacancies arose, they should be filled up with the old hands in preference to strangers. Now you say that is broken?—Yes; and the other part of the agreement you entered into is also broken—that you would still stand to the eight-hour shift, if it was not otherwise agreed to. But you are working under the twelve-hour shift now; so that two parts are broken.

It was this, I think: "We will work on eight-hour shifts unless otherwise mutually agreed?"—"Mutually agreed;" that was it.

Was it not mutually agreed that they should go on the two shifts at the Bankside works?—I could not say; you were really dealing with non-union men when the strike was brought to a close. We had left you. If the men who were working in the factory—the non-unionists—agreed to return to the twelve-hour shift that did not make it the carrying out of the agreement you had entered into. We cannot be answerable for them if they were outside the Union.

They went to work on the twelve-hour shifts on their own option?—Yes.

Did Mr. Thorne make a speech at Plymouth on Saturday, the 15th of February?—Yes.

I think you said that after we agreed to take back the old hands as

vacancies arose, in preference to strangers, we shortly after that refused to employ members of the Union?—Quite right.

In that speech there is a good deal about the gas strike; and towards the end of it Mr. Thorne is reported to have said: "The time would come when men would not be compelled to sign an agreement; and he warned the consumers of London that the men would not give seven days' notice again before striking. It was evident that partial strikes would not succeed; and he advised all labourers to federate, so that, in the event of another strike, they should all go out together." You have heard of that speech, I suppose?—I heard that he made a remark there to that effect; but I never read the speech. It is really his own utterance. There was never any meeting called; and the men did not give him authority to use that language.

Do you know that the men, while they were out, repeatedly said that the mistake they made was in giving a week's notice, and that they ought to have come out without notice?—I have heard that remark made. It has been remarked by some of them that they should have left without the week's notice.

In consequence of that, did the Company put up a notice that they would not employ unionists?—Yes, and I know they have been refused; and I know further, though I was not working for you, that your foreman told men that, if they came to live in my house, they would lose their situations. I said to the Engineer: "I have come to you to speak about this; and if I cannot get satisfaction, I will go to the Chairman, because I do not think he would be guilty of preventing me getting a living because I have left his employ."

The CHAIRMAN: Did Mr. Tysoe admit the truthfulness of your statement?

Witness: Yes; he said he had heard of it; and he told the foreman that the men could live where they pleased, and that it had nothing whatever to do with the Company. This man remained at my house, and stopped there about six months.

Mr. LIVESEY: Now we come back to what Thorne said. A notice was put up quoting it; and then it stated this: "To protect the consumers of London, notice is hereby given that no members of the Gas Workers' Union will be employed." That is what you complained of?

Witness: Yes.

Going back to the question of Sunday labour—I have thought of it since—you asked for double time from 6 a.m. to 10 p.m.? Did I make any offer?—You made an offer that you would do away with all Sunday work if you possibly could; and, further, that if we objected to working from 6 a.m. to 10 p.m., we should do the work on Sunday morning instead of Sunday evening, because you considered that it was quite right, and that the men really should be at home if they could on a Sunday evening. I do not think you agreed to time-and-a-half up to 10 o'clock; but I will not be positive.

Did I not say: "I will not agree voluntarily to the double time from 6 a.m. to 6 p.m.; but if you like to accept this as a compromise, I will extend the time-and-a-half to 10 p.m., and make the time-and-a-half from 6 a.m. to 10 p.m."? Then you remember, when you came for a character, you said that there was a great mass meeting in Deptford Broadway to determine whether they would accept this offer, as a proposal was going to be made to accept it?—Yes; an amendment was going to be put to accept it; but this was not done. The resolution was not put that Sunday. Instead of agreeing to the double time, the meeting took the course of not signing the bonus agreement.

Mr. W. H. Ward, Assistant-Secretary of the Gas Workers and General Labourers' Union, was then called and examined by the CHAIRMAN. He said the Union extended throughout the United Kingdom, and embraced at least 70 different descriptions of labour. On the formation of the Union, it was intended for gas workers only; but several applications had been made to join them, seeing that they had gained what might be termed a "bloodless victory" in obtaining the eight-hour working day; and then they had to extend the name, and have the rules altered. They then called it "The National Union of Gas Workers and General Labourers." At the commencement, there were about 45,000 gas workers in the Union; but they had to thank Mr. Livesey for decimating their numbers. They had now between 45,000 and 50,000 members of all kinds. Only a little more than half were gas workers; the number having diminished to a great extent, owing to failures in strikes. They had now from 25,000 to 30,000 gas workmen; so that the number had dropped about 15,000. In Belfast, where the Corporation were owners of the gas-works, every workman in the carbonizing department was a member of the Union; and they obtained for them very great concessions—as much as 7s. a week advance in wages, besides getting them an eight-hour working day. Then, he supposed, they considered the Union had done as much for them as they expected; and they became dilatory, and fell away from it to a great extent. They had, however, still some members there. The majority of the gas workers throughout the kingdom were now working eight hours a day; and their wages were, on the whole, better than they were three years ago. Having diminished the hours of labour, the men, as a rule, managed to do the same amount of work in a less time than they did formerly. He might explain that there was an erroneous idea in the minds of the public that the gas workers, by getting an eight-hour day, only did two-thirds of the work; but they were doing more in the eight hours, comparatively speaking, than they formerly accomplished in twelve—he meant, more per hour. Taking the Beckton station of The Gaslight and Coke Company—the largest gas-making station in the world—the men formerly did 84 retorts in twelve hours, whereas now they did 72. In the South Metropolitan Company's works, they did 96 retorts in the twelve-hour, and 80 in the eight-hour shift—a reduction of 16 in the latter Company's works. The hours were reduced by one-third, and the production of gas by one-sixth in that Company. In the Commercial Company's works, the men did now, on the eight-hour system, 66 retorts per man per day; whereas formerly they did 72. In some companies they had not altogether the same method of working. It might be a far easier job to do 80 retorts in one company's works than 70 in another.

The CHAIRMAN: What I want to get at is the comparison between the amount of work done in eight hours now with what was done in twelve hours before. How much less is it?

Witness: It would be something like 22½ per cent. all round. It is 33 per cent. in one department, because there was one man before

where there are two men now. There are three men doing what two men formerly did in the firing department. The cost of production is necessarily increased wherever the eight-hour system is adopted.

Examination continued: We are content with our present arrangements as to labour. The Union, as a whole, are in favour of the legal enactment of the eight-hour day. One of the honourable members of this Commission has deprived the men, so far as his works are concerned, of the eight hours, and put them back on the twelve. We have no security. What we want is to have it placed upon the Statute Book of the country, so that it will be impossible for Mr. Livesey, or any other man who may be so disposed, to deprive us of it. I wish to say something about the sanitary arrangements in the workshops. The men in most of the works have no place in which to wash themselves after their day's work. A gas stoker, when he goes into the works, divests himself of all his clothing, and puts on any old rags—chiefly flannel—to do his work in. Then the fine coal dust penetrates through this flannel; and he is perspiring all day long. I therefore think that, after a man has finished his work, there ought to be means for properly cleansing himself. I should like to have in all gas-works proper rooms, where the men could be supplied with chairs and tables on which to take their food, and also cooking utensils. In some cases this is done on a very elaborate scale; but in other cases it is not. Then as to the introduction of machinery in gas-works. In the Manchester Gas-Works, where I worked for 17 years, we had an eight-hour shift, and we enjoyed all the blessings of an eight-hour day for upwards of twelve years till machinery was introduced, and then we went back to twelve hours. I am acquainted with the strike at the South Metropolitan Gas-Works. I deprecated intimidation on all sides in connection with that strike; but I have been intimidated in taking the men strike pay.

The CHAIRMAN: Are you sure that none of the men who came up from Manchester, for instance, and who took service under the South Metropolitan Gas Company, received insults or attacks upon them?

Witness: I believe there was an attack. However, I was on a bed of sickness at the time. I was informed that an altercation took place in Blackwall Lane between some of the Manchester men and some of the strikers.

But you are aware that there were some men who came up from Manchester, and took service under the South Metropolitan Gas Company?—Yes; because I took them out of the Old Kent Road works, and paid their railway fares back. I took 23 out of the East Greenwich works, and their fare also was paid back.

Is it the case that for some weeks it was dangerous for anyone employed on the works to go outside, and that many who did so were badly injured; that for many weeks the men employed were fed and lodged on the premises, and, in addition, that the works were guarded night and day by policemen?—Yes; I believe the works were so guarded. As to the rest of your question, I should be the first to admit it if so; but, as I said before, I was very ill at the time, and for anything that occurred I had it only on hearsay.

Then personally you are not aware that men were molested and injured during that strike?—I am not. I have read of men being convicted and sent to terms of imprisonment for something or other. This I am aware of, that certain men, in East Greenwich especially, were supplied with revolvers, and they made very good use of them, because, passing down Blackwall Lane myself one day, Jackson, a foreman whom I had formerly worked under, said when he met me: "Bill, this is the way we do it;" and he discharged two barrels of the revolver. Whether or not he meant to intimidate me, I do not know. I was ill at the time; or I assure you his revolver would not have frightened me.

Mr. Blackburn was here recalled, on the suggestion of Mr. Trow.

The CHAIRMAN: As far as you are aware, was there intimidation and violence during the strike at the South Metropolitan Gas-Works?

Witness: Yes, there was.

And the men who were inside, who were from a distance, could not safely come outside the works, could they?—It was not very safe for them outside. Some of them, I believe, were rather roughly handled. I was not actually there myself to see it; but I have heard of a good many cases. There was one public-house just outside the works, where non-Union and Union men both went, and the meetings generally ended up with rather serious quarrels. It is quite correct to say the police were stationed at the works till the strike ended.

Did the Union, directly or indirectly, countenance this intimidation and outrage upon the non-Unionists who were inside the works?—Oh, no; the Union in no way whatever helped the men, or wanted them to commit that kind of thing. It was really done by the men themselves out of spite, because the others had come in—that is the way to put it. The Strike Committee meeting was held at my house; so I can answer for the fact that the Committee for the district advised the men, on four or five different occasions, to go along quietly, and then we should get public sympathy, and win the battle far better than we could with sticks and stones.

You say deliberately that the Union did what it could to discountenance violence?—It did. I have heard the officials of the Union there tell the men to go quietly to work, and not to create any disturbance at all.

Mr. LIVESEY: I will ask one question of you about that. The Union did put on a great many pickets, I suppose?

Witness: Yes; but pickets were merely to advise the men not to go in—to ask them if they would stand to the cause of Unionism, and win the battle. If any of the pickets took it into their own hands to strike anybody, or to cause any disturbance, they did it on their own responsibility, and were not so advised by the Union.

How many pickets did you put on?—We had six at the big gate, and four at the other gate, down by Taylor's, the Audience Rooms, and three at the other gate. I am speaking of the immediate neighbourhood where I was. I do not answer for any other place.

You have said the disputes arose over drink?—Yes; a great many of them did.

But a good many quarrels took place in the road, away from the public-houses?—Yes; but that was all their own matter. They were not advised by the Union in any way whatever to do it.

Mr. Ward, in further examination, stated that in regard to violence

the General Secretary, himself, and the President of the Union, denounced it in every way. There was never a branch room that they visited on this side of the water where they did not always advise the men to avoid violence of every description. They told them to treat the men with disgust, not to associate with them—not even to speak to them; but certainly not to lay hands on them. This was their advice continually during the strike; and he must say that many times the men asked permission to have a fair “go in,” and settle it one way or the other. They did not allow them; and he was almost sorry they did not.

The CHAIRMAN: Do you say you are sorry you did not?

Witness: Conscientiously, I am. When I saw men who had worked for years for the South Metropolitan Gas Company, and had comfortable homes, compelled after the strike to sell everything, I could not help it. I can hardly describe it. It was very hard to see men coming from all parts of the country to deprive honest working men—men who had been in some cases 20 years in the service of the Company—of their livelihood. It was very hard to see as many as five and six men brought in to do one man's work, in order to defeat them. There is one statement made by Mr. Blackburn, in answer to Mr. Livesey, during his examination, which I should like to correct. He said there was no Sunday work carried on at the East Greenwich station. I say there was, because Mr. Blackburn and I worked there together; and I never knew a Sunday while I was in the employ of Mr. Livesey that a gang of men did not have to go in from six o'clock in the evening till ten at night, winter and summer.

But Sunday work was understood to be work done between six and six on Sunday, was it not?—In the twelve hours.

But that was what was generally understood as Sunday work. Was not that so?

Mr. Blackburn: That is, I believe, the understanding.

Mr. LIVESEY: You said something as to there being no place to wash in. You do not mean that to apply generally?

Witness: I most decidedly admit that, in your works at East Greenwich, there is nothing to be desired further in that respect. I will give you credit for that.

In the large gas-works of London, they generally have accommodation?—Yes; but it is not what it should be. I might say that in the London gas-works they are years in front of the provincial ones in the matter of sanitary arrangements, and the provision of cooking apparatus for the men. They look to the interests of their workmen far better than is done in the provincial works.

Was it not your object, when you started the Union, to get the men, yardmen and all, into it?—Undoubtedly. We would not refuse any of them.

You would have used gentle persuasion?—Yes; and I think you, Mr. Livesey, do not know of any instance where we ever used force of any description to make men become members of our Union.

Such cases were reported; but there was not sufficient proof. At any rate, you got all the stokers in?—Yes.

Mr. LIVESEY then questioned witness on the subject of the eight-hour day, and the introduction of machinery. He said, in reply, that he knew there had been an eight-hour shift for 40 years at the Toxteth Park works of the Liverpool Gas Company, where he had worked a long time ago, and also at Bristol. So that it was not a new thing in gas-works when the Union asked for it. One of the reasons for applying for it was the displacement of men by machinery. A good deal of machinery had been introduced for gas-making purposes before the Union was thought of. West's machinery had been adopted at Birmingham and also at Richmond; and he believed Mr. Livesey and his co-Directors had put it into the Old Kent Road works, and would extend it if it suited them. He did not think a great impetus had been given to the use of machinery since the formation of the Union.

Mr. LIVESEY: You do not think so?

Witness: No; I do not. I might as well be frank with you, Mr. Livesey. You used a great many adjectives in referring to our Union; and I heard you do so to-day, when you called it a very “aggressive” Union. But the very fact of its being aggressive might be an inducement, or at least an excuse, for engineers and managers of gas-works to say: “Well, we had better introduce machinery, on whatever pretext it may be.” Your Company have expended thousands upon machinery which is now only fit for the scrap heap. Who is paying for that? Not the Directors; the gas consumers have to pay for it, indirectly. Take the case of The Gaslight and Coke Company. I do not know that there is a company in the world which experiments more than they do. The result is, up goes the price of gas. The price has gone up since the adoption of the eight-hour shift. As to the Commercial Company, they know very well that they will never get any sort of machinery to supersede manual labour; and, in fact, as far as the production of gas is concerned, they are content with labour. They will adopt all new kinds of retorts; but machinery they fight shy of. The result is that they have no need to increase their price. They have done so a little in the last quarter.

The CHAIRMAN: The price of the Commercial Company's gas is 2s. 6d. per 1000 cubic feet, and that of the gas supplied by The Gaslight and Coke Company is 3s. 1d. Do you say that the 7d. difference in the prices of these two Companies is due to outlay on machinery on the part of The Gaslight and Coke Company?

Witness: To a great and foolish outlay in the way of experiments. It is the only cause I can assign for it. There are men working for the Commercial Gas Company the same number of hours, carbonizing the same weight of coal, getting the same amount of wages, doing the same quantity of work, and using the same materials; but in their balance-sheet, you will not find a line of four or five figures for machinery. They believe in manual labour for making gas; and very wise on their part it is, too. They do not believe in bringing in drawing-machines or charging-machines; and they are as well off as if they did. The Company expect bone and sinew in the men, to keep them in perpetual motion; but if the men stop away, it is attributed to drunkenness, even if they are members of temperance societies. Mr. Chairman, if you knew the way in which gas workers are, as a rule, treated, you would hardly credit it. I do not say that the shareholders, or Directors, or even the managers, are responsible for this; but their foremen are, to a great extent.

Mr. LIVESEY: Have you any idea of the amount The Gaslight and Coke Company have spent upon machinery? Is it £50,000?

Witness: I do not know the exact figure.

That does not account for the increase in price, does it? Do you not think that the advent of the Union has led gas companies to go more into machinery than they did before?—Yes; I believe it has.

You said something about the foremen at East Greenwich being supplied with revolvers. Who supplied them?—The Company—at least, so we were given to understand; and I shall always believe it till you prove the contrary.

You may take it from me that we did not do that.—I will take your denial. I simply give you the information that was conveyed to me; and, of course, it looked very suspicious.

Mr. LIVESEY next proceeded to question the witness as to a meeting on Peckham Rye last summer. In reply, he said he remembered the meeting, and also that Mr. Tysoe (the Superintendent of the East Greenwich station) was present. He had no recollection of saying to him: “We shall have all your men in the Union before Christmas, and then we shall have another turn out.” He happened to make some allusion to the East Greenwich works; but no one, with the exception of a few of the East Greenwich men, out of the 4000 or 5000 persons, knew Mr. Tysoe. As soon, however, as he lifted his hat to emphasize the reference to East Greenwich, they said: “Oh, this is Mr. Tysoe that Mr. Ward is referring to;” and then there was a sort of wave, and they pushed him back. He (witness) begged them not to injure him, because if they did so it would be injurious to them; and he denounced violence upon that platform. Mr. Tysoe stood upon the step of the van, and said: “You know, Ward, they are only injuring their own cause by the step they are taking to-day.” He (witness) said: “Do not be frightened; they will not injure a hair of your head. Depend upon it, Thorne and I will not see you injured,” and he added, jocularly: “It is no good, you will have to turn all over to us again.” But as to saying they would have to strike then or at any other time, that was not so. He merely used the words jocularly, and never threatened a strike of any description; and it hurt his feelings when he heard about it.

By Mr. AUSTIN: We do not object to work with non-Union men. We use all moral persuasion to get them into the Union if possible; if not, we work amicably with them. The men who took the places of the strikers came from all parts of the country—a good many of them from Manchester and Salford. They were very liberally dealt with. I have a complaint to make as to the way in which the officials of the Union and the pickets were treated by the police authorities. Whenever we were holding demonstrations previous to the strike, we were never interfered with on the south side of the water; but after the strike occurred, we sometimes met with very rough handling. We knew very well that it was only an invitation to resent it; but we thought discretion was the better part of valour. We only wanted to maintain the name we had of being the quietest body of processionists that ever went through the streets of London. I mean by “rough handling” that the policemen shoved us about to see if we would retort. The strike cost our Union £12,000. Since it was formed, we have spent £27,000 in strikes; but the wages of the men have been increased by more than £1,000,000. As I have said, the members of the Union work amicably with non-Unionists; but, as a society, we have struck because there were a number of non-Unionists on the works. In the Manchester case, however, the thing was done by our District Secretary—a man named Horrocks. We knew nothing about it till it was too late; and our General Secretary (Mr. Thorne) proceeded to Manchester at once, and sought an interview with the Mayor, and also with the Mayor of Salford. The Salford men had no grievance at all. They were all members of the Union; and they simply came out in sympathy with the Manchester men, for fear the Salford Corporation would supply Manchester with gas. We did not at all approve of it. The General Secretary went down and condemned the action of Horrocks in calling the men out. They were young to Trade Unionism; and, unfortunately, they were too impetuous, and wanted it all their own way. In fairness to the Manchester and Salford Corporations, I might say that they conceded everything the Union asked for except a few petty matters, such as putting down weighing-machines. The affair was on the point of settlement, when Horrocks made use of some violent language. When the General Secretary went to Manchester, he ordered the men to return to work. But the Gas Committee would not take them back; and they had to stand at the gate and take their chance of being engaged as well as anybody else. We asked the men to do this as a protest against the action of the Secretary. The real cause of the strike, so far as we could ascertain, was the fact of there being six men in the Manchester works who, from conscientious scruples, would not join the Union. Unfortunately for us, no matter what the men may do by impetuosity, or anything like that, the blame is thrown upon the Executive Council.

Mr. LIVESEY: You gave the Manchester men very little pay?

Witness: They were not entitled to it. We did that also as a protest. They had not been five weeks members of the Union; and, according to the rules, they must be in it six months before they can come out on strike pay.

Mr. TAIT: You did not give them any strike pay?

Witness: We simply gave them a sum of £200 after the General Secretary came back. We pointed out plainly to them that they should abide by our rules.

Witness was then questioned on the subject of intimidation. He remarked that if it was not intimidation or coercion for an employer to call his men together and tell them that they must either leave his service or leave the Union, he did not know what was. If this did not come within the law, he would amend the law so as to cover such a case. With regard to the general question of the supply of gas and water, he thought the Legislature should give County Councils and Corporations full authority over it, because in Leeds 18-candle gas was sold for 1s. 11d. per 1000 cubic feet; being 2 candles higher quality than was given in London, where the charge was 2s. 6d. and 3s. 1d.

On being reminded by Mr. Livesey that the Newcastle Gas Company supplied gas as cheaply as the Leeds Corporation, witness replied that they were right in the coal-fields. Gas companies were not, he said, content with less than 13½ per cent. dividend.

Mr. TROW remarked that at Darlington the gas-works belonged to the Corporation; and, though these were in the midst of the coal-fields, the price was 2s. 6d. per 1000 cubic feet. On the question of the effect of reduced hours on foreign competition, witness said they could not send gas in balloons from Germany.

The CHAIRMAN asked witness what course he would adopt to prevent strikes.

Witness replied that he would advocate a Court of Conciliation and Arbitration of the parties interested. He wished the London Gas Companies would appoint their managers to represent them; the Gas Workers' Union would then nominate an equal number of representatives, and so settle all disputes. If this course were offered, they would gladly try it.

Mr. AUSTIN asked, in the event of the adoption of an eight-hour day not having the effect of finding employment for all, whether witness would recommend a further reduction.

Witness said he certainly would, where, as in gas and chemical works, the employment was extremely laborious.

The Commission then adjourned till next day.

GAS PROVISIONAL ORDERS FOR THE PRESENT SESSION.

The Board of Trade have issued a Memorandum stating the nature of the proposals contained in the Provisional Orders included in the Gas Orders Confirmation Bill, the introduction of which was noticed in our "Parliamentary Intelligence" on the 3rd inst. There are five Orders in all. The first is to empower the Cullingworth Gas Company, Limited, to maintain and continue gas-works, and to manufacture and supply gas in the township and parish of Bingley and the township of Wilsden, in the parish of Bradford, all in the West Riding of York; also to fix the capital at £18,000 by shares and £4500 by loan, and the price to be charged for gas at 3s. 6d. per 1000 cubic feet, with sliding scale as to price and dividend. The second is to authorize the Kempston Gas Company, Limited, to maintain and continue gas-works, and to manufacture and supply gas in the several parishes of Kempston, Elstow, and Wootton, all in the county of Bedford; also to fix the capital at £5000 by shares and £1250 by loan, and the price to be charged for gas at 5s. per 1000 cubic feet, with sliding scale as to price and dividend. The third is merely to enable the Mitcham and Wimbledon District Gas Company to construct and maintain additional works. The fourth is to empower the South Normanton, Blackwell, and Hucknall-under-Huthwaite Gas Company, Limited, to maintain and continue gas-works, and to manufacture and supply gas within the parish of Blackwell and parts of the parishes of South Normanton and Tibshelf, all in the county of Derby, and to supply gas in bulk by agreement beyond the limits of supply. The capital is to be fixed at £12,000 by shares and £3000 by loan, and the price to be charged for gas at 5s. per 1000 cubic feet, with sliding scale as to price and dividend. The last Order in the Bill is to authorize the Sutton and Hooton Gas Company, Limited, to maintain and continue gas-works, and to manufacture and supply gas in the townships of Willaston, Hooton, Childer, Thornton, Great Sutton, Little Sutton, Ledsham, and Capenhurst, all in the county of Chester; to fix the capital at £8000 by shares and £2000 by loan, and the price to be charged for gas at 5s. 3d. per 1000 cubic feet, with sliding scale as to price and dividend.

EXHIBITIONS OF GAS APPLIANCES.

An exhibition of the well-known gas stoves and appliances of Messrs. Fletcher, Russell, and Co., of London and Warrington, was held in the Lesser Colston Hall, at Bristol, during the past week. Cookery lectures were given each evening by Mrs. Wilkinson, late of the National School of Cookery, South Kensington. Under the auspices of the Darlington Corporation Gas Committee, an exhibition of stoves manufactured by the Davis Gas-Stove Company, of London, was held during four days of last week. The exhibition was opened on Tuesday, by Mr. T. M. Barron, the Chairman of the Gas Committee; and Mrs. C. F. Pitcher gave practical demonstrations on cooking by gas each day. The Harworth Gas Company held an exhibition of gas appliances during the first part of last week. Messrs. J. Wright and Co., of Birmingham, showed a number of cooking and heating stoves, and Messrs. W. Russell and Son, of Darlington, had a good display of gas fittings and other appliances. Miss Shaw, of the Nottingham School of Cookery, delivered interesting lectures daily. It should be mentioned that, with a view to extending the consumption of gas, the Directors of the Company have reduced the price of gas used for cooking and heating purposes to 3s. 6d. per 1000 cubic feet. An interesting exhibition of gas appliances, held by Mr. Steed Bayly, in conjunction with Messrs. Richmond and Co., Limited, of Warrington and London, was opened by the Mayor of Deal, in St. George's Hall in that town, last Tuesday. Lectures on cookery were given twice daily by Mrs. Bennett, of the South Kensington School of Cookery, to large and appreciative audiences. Short and concise addresses were delivered by Mr. Steed Bayly and Mr. A. Mead; the latter gentleman being Messrs. Richmond's representative. The exhibition closed on Friday. During the past week, the Lea Bridge District Gas Company held an exhibition of gas cooking, heating, and lighting appliances at the Victoria Hall, Walthamstow. Lectures on cookery were given twice each day by Miss Garstin. Messrs. Fletcher, Russell, and Co., of Warrington and London, had a large display of their well-known gas cooking-ranges, fires, &c. The lighting exhibits and gas apparatus were of a varied character; the whole forming a very interesting collection. All the arrangements were admirably carried out by Mr. W. Thorman, the Company's Manager.

New Joint-Stock Company.—The Ironbridge Gaslight Company, Limited, has been registered with a capital of £8550, in £7 shares, to supply Ironbridge, in Shropshire, with gas.

MANCHESTER CORPORATION GAS SUPPLY.

The Proposed Reduction in the Price of Gas.

At the Meeting of the Manchester City Council last Wednesday—the MAYOR (Mr. Alderman Leech) presiding—there was a debate on the proposal to reduce the price of gas.

Mr. BROOKS moved that the price of gas be reduced within the city, from 2s. 6d. to 2s. 3d. per 1000 cubic feet; beyond the city, from 3s. to 2s. 9d.; and beyond the River Mersey, from 3s. 6d. to 3s. 3d. He said he thought the rate paid by the consumers had for many years been excessive. The recommendation made for a reduction of 3d. all round was not, in his opinion, other than very moderate.

Mr. MAINWARING seconded the motion.

Alderman KING said the proposed reduction in the price of gas was inopportune, especially as they had an increased School Board precept and knowing the important works the Council had in hand. He considered the price was not too high, and that a reduction would be neither justifiable nor equitable. The reduction in the price of gas would result in a less amount by £36,000 payable to the citizens by the Gas Committee, entailing a further charge of 3d. in the pound on the ratepayers. This made a total increase in the estimates of £107,000, or 9d. in the pound on the rates of the city. He read a long speech, giving reasons for his objection to the resolution, and moved, as an amendment, that the proposed reduction be not agreed to.

Mr. RUSHWORTH seconded the amendment.

Alderman Sir J. J. HARWOOD asked those who were in favour of the proposed reduction to pause before they voted. This year the Gas Committee would have to pay £10,000 more for coal and cannel; and it was estimated that the Committee would get £12,000 less for tar. Then it must be remembered that they were putting down an installation for electric lighting at a cost of £100,000; and this would be unproductive for a considerable time. Then they were constructing additional gas plant, which would only be called into requisition, and only be productive, a short time in the winter or in foggy weather. Having regard to these matters, would it not, he asked, be wise to wait for twelve months, in order that they might obtain full information upon the matter.

Alderman GRIFFIN, as a member of the Gas Committee, appealed to the Chairman to withdraw the motion.

Alderman HIGGINBOTTOM said the policy of the Committee was the proper one to support; and it was the carrying out of the direction given to them by resolution of the Council on May 6, 1890. As to putting the matter off for twelve months, he thought that Sir John Harwood had shown that they would then be in a worse position than at present; and if they did not make a reduction in the price now, they would probably never get it.

Mr. MURRAY held that the gas consumers were entitled to the benefit of the proposed reduction.

Mr. MAINWARING said there was no time so opportune as the present for the proposed reduction; and there had never been more unanimity in the Committee on any question than on this, for 14 had voted for and only 4 against it. It would bring direct taxation on the ratepayers, which was a desirable thing; and then the ratepayers would put a check on the extravagant spending departments of the Corporation.

Mr. WILSON believed that more gas would be consumed after the reduction. Some of the 44 per cent. of the population who did not use it would do so; and the profits of the Committee would be thus increased by the reduction.

Mr. CLAY remarked that the gas consumers of Manchester had paid more than £2,000,000 for the gas-works. They were ratepayers as well as consumers; and with the proposed reduction, they would still have a reasonable profit.

Alderman THOMPSON said that if the Council were not careful what they did, they would drive people who were heavy ratepayers out of the city. He implored them to pause and consider these matters carefully. Since he had been in the Council, they had reduced the price 50 per cent.; and yet members still contended that they were doing nothing for the consumers.

Other members spoke in a similar strain; and, in the end, the amendment was passed by 41 votes to 29.

ROCHDALE CORPORATION GAS SUPPLY.

A Diminution in the Profits—Water Gas—An Advance in Price Recommended.

At the Annual Meeting of the Rochdale Town Council last Thursday week—the DEPUTY-MAYOR (Mr. W. T. Heap) in the chair—the above subjects were introduced to the notice of the members.

Alderman PETRIE, in moving the adoption of the minutes of the Gas Committee, said that, seeing their operations were very largely responsible for the increased rate that was being so much talked about, it was desirable that he should say a few words, in order that the Council might judge whether the Committee were blameable for the diminution in the profits. The result of the working of the Gas Department was determined mainly by four things—(1) the cost of coal; (2) the cost of labour for manipulating it; (3) the value of residuals; and (4) the price of gas. Of these four items, only the last was under the control of the Committee; the other three were regulated by the state of the market. In the year ended March 25, 1891, the cost of coal, including carting and stacking at the works, was 12s. 3 2-10d. per ton; for the past year it was 13s. 5 1-2d. It might be remembered that the last contract for coal was 6d. per ton less than in the previous year. How was it, then, that the money paid for fuel was more? It was only in theory that the contract price was less. Nuts were purchased to mix with the ordinary coal. When the previous contract was made, they still had 7000 tons of nuts bought at 2s. 9d. per ton less than they were now paying. That coal was worked up during 1890-1891, and made the price of the mixed coal really less than the price of the new contract. This accounted for some part of the increase in the price of coal. The remainder was caused by the Committee having to buy 5000 tons of cannel. It might be said that for some years they had made gas without the use of any cannel. That was so; but they knew that in the depth of winter they

had been put to great straits to keep anywhere near to the standard of illuminating power, owing to the increased consumption and the greater expectations of the public. The improvement in the quality of the gas accounted for an advance for the year of 1s 2½d. per ton on a consumption of 40,300 tons. Then there had been a very sad falling off in the amount received for residuals. For coke, while they sold 2800 tons more than in the previous year, they received £148 less. Taking the residuals altogether, they yielded in 1890-91, 7s. 5 3-10d. per ton, and in the year just ended only 6s. 9½d.—a difference of 7¾d. on the 40,000 tons. Deducting the price of the residuals from the payment for fuel, they found that the net cost was 4s. 9 9-10d. per ton in the previous year, and 6s. 8d. in the past year—a difference of 1s. 10d. With one more item the comparison would be complete. The cost of labour was 2s. 10 8-10d. the previous year, and for last year 3s. 0½d.—a difference of 1¾d. The total net cost of carbonization was 7s. 8¾d. in 1890-91; and in the past year, 9s. 8 6-10d., which was practically an increase of 2s. per ton. In 1890-91 the cost of carbonization was £15,389; and in 1891-2, £19,601, or an increase of £4212. This about accounted for the difference in profits. They could have made the profits larger by increasing the price of gas. Some members, he believed, would suggest the advisability of doing so; but he hoped the Council would not for a moment entertain the idea. What would be the effect if they did? It would mean that, because one man used more gas in a year, he would be bearing more than his share of the taxation, which in his (Alderman Petrie's) opinion ought to rest on a basis different from that. If in past years they had not had such great profits, and had let the rates stand on their own bottom, they would not have been so badly off as they were now. So long as they took the gas profits, or any other profits, to relieve the rates, they did not feel the weight of it; whereas, if the rates rested on a proper basis they would begin to do something when there was an increase. He hoped the Council would deem this statement satisfactory.

Alderman TAYLOR asked what was the result of the Committee's investigation into the question of manufacturing water gas.

The TOWN-CLERK read the official report, which, after describing the system, said it had not been tried sufficiently as yet, and that there were not enough data as to the cost, &c., to justify the Committee in making any recommendation in regard to it.

Alderman PETRIE, in reply to questions, said the public lamps cost about £4600 a year. The Committee had not considered an increase in the price of gas; but an advance of 1d. per 1000 cubic feet would realize, he believed, about £1500.

Mr. SHARP said the amount spent on public lighting brought the profit up to £9000 or £10,000, and he thought that was very good indeed. He was one of those, however, who considered that taxation and representation should go together, and that every elector in the town should be made to feel it when the rates went up. He suggested an advance in the price of gas, in order that the increase of rates might not fall upon one class of the community alone—that class which was directly taxed by the Corporation.

Alderman BARON said unhesitatingly that there were thousands of consumers in Rochdale who obtained gas for less than it cost the Corporation, taking the cost of meter inspection, collecting, &c., into consideration; and he was prepared to support an advance in price. This he considered the most equitable way of dealing with the matter, taking the whole population into consideration.

Mr. LEACH thought Alderman Baron was entirely overlooking one important matter. To say that they did not charge enough for their gas, when they had a yearly profit of from £9000 to £10,000, was preposterous.

The DEPUTY-MAYOR said that £10,000 was only 7½ per cent.; and, as a matter of fact, they did not derive £10,000, but only £4000 which was but 3½ per cent. Beyond that, he thought they ought to depreciate to the extent of several thousands a year more than they now did. It was true that the public lamps were lighted; but that was for the benefit of those who did not pay rates. There were a great many people who paid no rates whatever except through their gas bills.

Alderman PETRIE remarked that, if they reckoned their profits in the same way that limited cotton companies did, they would amount to more than double the 7½ per cent.; and if they raised the price of gas in order to make the small consumers pay a fair share of the expenses, what an enormous profit they would be making out of the large consumers! The way to deal with the matter was not to increase the price, but to alter the scale of discounts.

The minutes were then confirmed.

BOLTON CORPORATION GAS SUPPLY.

The Annual Statement.

At the Monthly Meeting of the Bolton Town Council last Wednesday week, the annual report on the working of the Gas Department was presented, as briefly noticed in the JOURNAL last week.

Alderman MILES, the Chairman of the Committee, in moving the adoption of the report, said that, for some years back, they had been enabled to considerably reduce the capital account by doing certain work out of revenue. The Committee kept this object steadily in view, and were determined not to relax their efforts until the capital account was brought down to a perfectly satisfactory figure. During the past financial year, their revenue had not been quite so good as he could have wished; and this arose mainly, if not wholly, from causes over which they had no control. The increase in the sale of gas had been very gratifying; being 34,625,000 cubic feet, or about 5½ per cent. on the year—representing an increase in income of £4600. Coke, owing to the seriously falling market, had produced £4717 less than in the previous year; and sulphate, for the same cause, £541 less—the present price of this article being the lowest on record. The gas-fitting department had not done quite so well as formerly; the net profit being £930, as against £1186 last year. The average price per ton of coal had been exactly 6d. more than the preceding year; representing an extra expenditure to them of £2000. Wages for carbonizing had advanced; but the other items were pretty regular in their amounts. There was one he wished to refer to in this connection. It was

that of £245 for bad debts, as against £90 last year. This was accounted for by the abolition of the deposit system; and it had become necessary to reimpose the deposits on one particular class of consumers, which had made the greater portion of the loss. The gross profit on the past year's working was £47,127, as compared with £53,756; and after providing for the requisite standing charges, there was a balance of £16,352, which the Committee recommended should be transferred to the relief of the district rates. This amount was equal to about 3 per cent. on the capital. With regard to the prepayment system, the Committee had now 134 meters fixed. He believed that this system was a great boon to the poorer class of ratepayers; and it was likely to extend when properly known and understood. They had 100 gas-engines in use in the borough and district; and about 1350 hired gas stoves and cookers of various kinds, in addition to about 1000 stoves owned by consumers. The annual consumption of gas from these sources was more than 25 million cubic feet, and was increasing at the rate of 20 per cent. yearly. In conclusion, he said the Sub-Committee having charge of the electric lighting question had been vigorously prosecuting their inquiries, and would shortly present a report for the approval of the Council. Their works were in excellent condition generally; and he had pleasure in complimenting the staff on the manner in which they had performed their duties.

Mr. ENTWISTLE considered that a reduction in the price of gas by 3d. per 1000 cubic feet would lead to a greater consumption, and ultimately be to the advantage of the Corporation.

An amendment was moved to the proceedings of the Committee, to the effect that £10,000 of the profits of the Gas Department should go to the reduction of the rates; and the balance of £6351 in reduction of the capital account. The argument of those supporting the amendment was that the ratepayers whose rates were included in their rent derived no advantage from the profits made upon the gas.

Alderman MILES, in reply, pointed out that, with a reduction in the price of gas, the relief at present forthcoming in rating would be greatly diminished; and they should not forget that the ratepayers in the borough ought to reap the full advantage derived from the undertaking, which would not be so if they followed out the suggestions of the supporters of the amendment. There was no reason why they should make a present of £1580 to the outside consumers, who had not the slightest responsibility. As to the reduction of capital account, they were doing that by leaps and bounds. In 1878, it stood at £1154 5s. 3d. per million feet of gas made; while in 1892, it had been reduced to £680 9s.

The proceedings of the Committee were confirmed by 31 votes against 13.

WIGAN CORPORATION GAS AND WATER UNDERTAKINGS.

The Results of the Past Year's Working.

At the last Monthly Meeting of the Wigan County Borough Council—the MAYOR (Mr. Woods) presiding—the annual statements were made respecting the operations of the gas and water undertakings.

Mr. HOLMES, in moving the confirmation of the minutes of the Gas Committee, referred to the decline of the cotton industry of the town. When they looked back, he remarked, and saw the way in which mills had been closed or taken down, and the exceptionally small number that had been erected on more modern ideas, it made them almost feel that the spirit of enterprise was sadly wanting among the townsmen; for had the number of mills that existed ten or fifteen years ago been now in full work, a much greater demand would have been made on the gas-works, and the revenue would have increased in proportion. The net profits received from the gas undertaking during the past seven years were as follows: Commencing with the financial year ending March, 1886, £865; March, 1887, £3573; March, 1888, £3705; March, 1889, £6202; March, 1890, £10,646; March, 1891, £11,111; March, 1892, £9140. These were exclusive of all interest, sinking fund, and other taxes and charges brought against the works. The increased capital invested in the undertaking had grown from £230,000 in 1886 to £306,000 at the present time. The total net profits this year equalled a gain to the town of £9140, or nearly 3 per cent. on the capital invested, after paying all other charges. During the year several important additions to the gas-works, under capital charges, had been made—viz., a new sulphate-house, smithy, stables, boiler-house, and locomotive-shed, together with an extension of the boundary wall. Considerable extensions and repairs of the mains had also been effected for the better supply of Scholes, Haigh, Aspull, and Higher and Lower Ince, amounting in the aggregate to above 4½ miles in length, and varying in diameter from 2 inches to 18 inches. Connections had been laid on for a new governor to supply Higher and Lower Ince as a separate district; and this would require the erection of a new governor-house. The works were now capable of carbonizing 144 tons of coal and cannel a day; and the present number of retorts was 252, producing 1,612,000 cubic feet per day. The maximum daily consumption in the short dark days in the past year was 1,670,000 cubic feet, or 58,000 feet more than the works were at the present time calculated to yield. When they took a casual review of the actual increase in the sale of gas for the past five years, commencing with the year ending March, 1888, they found in that year an increase of 111 per cent. over the previous year; in 1889, 185 per cent.; in 1890, 492 per cent.; in 1891, 812 per cent.; and this year, 1036 per cent. This clearly showed that an extension of the retort-benches was an absolute necessity, if they were to keep the district of gas supply lighted. Towards this end they had sufficient room in the retort-house; and foundations were already laid for an additional 140 retorts. The carbonizing power of these would be 80 tons, yielding 890,000 cubic feet more gas per day, and thus bringing up the producing power to 2,508,000 cubic feet, or about 51 per cent. in excess of the maximum daily consumption. The unaccounted-for gas had steadily decreased from 951 per cent. in 1886 to 484 per cent. in 1892. The present system of gas-making was adopted in 1887; and it continued to give very good results—the make of gas per ton of coal and cannel carbonized averaging 11,355 cubic feet of 18½-candle power. The number of new consumers registered during the past year was 608; and this was, without doubt, due in great measure to the abolition of meter-rents and charges for service-pipes

and fittings. There was one more point to which he felt bound to draw attention; and it was the only one which could not be regarded with satisfaction. There had been a somewhat large falling off in the consumption of gas outside the mile radius; and it equalled 2,161,800 cubic feet, or 5.37 per cent. This opened up a serious question as to whether this was to be allowed to go on, or whether such a reduction should be made in the price to the out-districts as would enable the Committee to draw them more in touch with them. He had no doubt that, should a reduction be decided upon, the Corporation would in the end be the gainers. This, he felt, was a matter which should be dealt with at an early date.

Alderman HOPWOOD, in seconding the motion, said he had had the honour of being Chairman of the Gas Committee for upwards of twelve years; and the leakage then was 30 per cent. It was only through the efforts of their late Manager (Mr. J. G. Hawkins) and their present one (Mr. J. Timmins) that the percentage had been reduced.

Mr. HOLMES, in reply to a question, said the amount handed over towards the rates was £12,000; but the net profits were only £9140, and the other portion had been added from the reserve fund (which was only created last year).

Some discussion ensued with regard to the expenses of a deputation (consisting of four members) who had visited various gas-works with the view of inspecting the retort-house arrangements; and an amendment was proposed that the expenses over and above those of three members be not allowed. This, however, was negatived, but by only one vote—ten members being in favour of it, and eleven against.

The minutes were then formally confirmed.

Mr. RIDDLESWORTH, in moving the adoption of the minutes of the Water Committee, said last year was the first since the commencement of the water-works that they had paid their way; and he hoped in the future they would be able to do something towards paying the other expenses connected with the Corporation. It appeared that last year the amount of the revenue was above £10,000. He thought it was satisfactory to know that the undertaking, which had been a burden on the Corporation so many years, had at last got into a proper position. He could not pass over this matter without saying that the present Chairman of the Water Department (Mr. Alderman Richards) had devoted a great deal of time to its work; and he thought it was through his influence, and the way he had worked, that they were placed in their present position.

The minutes were adopted.

Eight-Hour Shifts at the Rotherhithe Gas-Works.—At the Rotherhithe station of the South Metropolitan Gas Company, where since the strike the men have worked under the eleven-hour system, a notice has been issued stating that from yesterday the eight-hour system would be adopted.

Winding Up of the Heywood Chemical Company, Limited.—Mr. Justice Stirling had before him, a short time ago, a creditor's petition for a winding-up order in respect of the Heywood Chemical Company, Limited. After its presentation, the Company passed a resolution for a voluntary winding up; and his Lordship has now ordered that this should be continued under the supervision of the Court.

The Birmingham Water Scheme.—Owing to the crowded state of our columns this week, we are unable to continue the report of the proceedings before the Parliamentary Committee on the Birmingham Water Bill. The inquiry was closed last Friday, when the preamble of the Bill was declared to have been proved. For the purposes of their water scheme, the Corporation are authorized to borrow £6,600,000; and power is also given to them to make $3\frac{1}{2}$ miles of railways in Wales "to facilitate the construction and maintenance of the water-works." The clauses of the Bill will be considered to-day.

Cooking by Gas at Newport (Mon.).—Notwithstanding the proximity of the town of Newport to the coal-fields, cooking and heating by gas are popular. On the occasion of the distribution of prizes to members of the Athletic Club by Lord Tredegar, in the Albert Hall, last Thursday, a banquet, the menu of which was varied and *recherché*, and at which 251 guests sat down, the entire cooking was done by gas, and gave the utmost satisfaction. An ante-room was improvised as a kitchen, in which were placed the cookers properly hooded and flued. No one in the hall was aware of the presence of the gas-ranges, so efficient were the ventilating arrangements. The entire work was carried out by the Gas Company; the cookers being supplied by Messrs. Wright and Co., Limited.

The Suburban Districts and the Metropolitan Water Supply.—At the meeting of the Bromley Rural Sanitary Authority last Friday, the Clerk reported that the Joint Committee of the representatives of the Local Boards of Bromley and Beckenham and the Bromley Rural Sanitary Authority had drawn up a statement to be laid before the Royal Commission on Water Supply. It stated that these authorities "desire to urge that under no circumstances should their districts be called upon to contribute any portion of the expense which may be incurred in obtaining water from sources of supply other than those at present utilized, nor should the rates be raised in consequence of such additional supply. To tax the inhabitants of a district which has an ample quantity of water at its feet, for bringing an additional supply either to that district or to an adjoining district, would be almost inequitable. The Bromley and Beckenham Local Authorities respectfully urge (1) that, having regard to future local requirements, no water can be spared from that part of the Kent chalk which underlies their respective sanitary districts, for the needs of other localities; and (2) that if the undertakings of the Kent and Lambeth Companies are acquired by a Metropolitan Water Authority, either by compulsion or agreement, the local authorities shall be entitled to purchase from the Authority, on fair terms, but without profit, so much of the undertakings of the Companies as relate to their respective sanitary districts. The object of the Bromley and Beckenham Authorities is to have the water supply in their own hands, and to afford the inhabitants of their district a constant and plentiful supply of pure water at the very lowest cost." After the report had been considered, it was decided to withdraw the opposition to the Bill promoted by the London County Council.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Although the fact has not been in any way made public as yet, I am able to state that the Edinburgh "sensation" which I have been obliged to refer to in my "Notes" for the past two weeks, has fallen altogether flat. No one has taken the least notice of it; and, what is of more importance, the Works Committee of the Gas Commission have resolved that they will not do so. I understand that Mr. Mitchell made an explanation of the circumstance, which was regarded as quite satisfactory—that a bench of retorts is being renewed, and the work has been entrusted to the contractor who erected it. Nothing could be more natural; and the wonder is that any newspaper should have been so easily befooled as the *Scotsman* was. The belief gains ground that the author was a Gas Commissioner; and his conduct is being universally condemned as "a very dirty trick." When the minutes of the Works Committee are laid before the Commission, the subject will likely be mentioned. It will be interesting to observe if there be any vacant chair at the next meeting, as we have seen before when a Commissioner who had erred in the matter of rushing into the press what should have been kept private, was afraid to face his colleagues.

In the present lull in the agitation upon the question of liability for providing light in common-stairs, it may be stated that the Corporation of Edinburgh have taken the opinion of Mr. Cowrie Thomson, advocate, the senior Legal Assessor for the city, as to their powers in the matter of cleaning, lighting, and extinguishing lights in common-stairs; and that the opinion of Counsel is that with their present powers the Council cannot undertake a universal system of lighting common-stairs and charge it upon the rates, but that each case must be specially adjudicated upon. This means that, until application is made to Parliament, the present system, under which the occupiers are required to do the work, must be maintained.

An exhibition of gas appliances was opened at Dumfries on Monday. The appliances shown are those of Messrs. H. Darwin and Co., of London and Glasgow. One-man exhibitions of gas appliances are becoming the order of the day—a state of matters quite different from what prevailed in the early days of gas exhibitions, when there was, if not competition, at least a choice of apparatus at the command of the visitors. As is now the fashion, practically illustrated cookery lectures were given during the week, which is probably the best method of advertising gas-stoves. The lecturer was Miss Phillips, late of the South Kensington School of Cookery.

The proposal to form a combination among gas-owning bodies in the Forfarshire district, for the purpose of taking over the Elliott works of Messrs. John Dobbie, Sons, and Co., and working them as a joint undertaking in the treatment of residuals, is, I fear, not to become a reality. The Arbroath Gas Corporation met on Thursday night and rejected the scheme; only one member being in favour of it. I confess that I lean to the view expressed by Mr. Cargill, who moved its rejection, that disputes would be likely to arise between the parties carrying on the works as to quality of the liquors delivered by them and the allocation of the returns. Bailie Mackintosh, his seconder, added a more cogent reason—the undertaking is not within the powers of the Corporation. The strongest plea for a joint refinery is that it would enable them to get rid of the middleman. Yet a joint refinery would require management; and the management of such an undertaking would be open to so many abuses that it is doubtful whether the cost would not be greater than the profits of the middleman. It would be an interesting experiment were the scheme to go on. But the capital of gas-works is not raised for the purpose of experimenting at large; and that consideration alone is sufficient to prevent Mr. Tait's proposal being entertained.

Last week, I wrote of the resolution of the Hamilton Town Council to proceed with the extension of the Corporation Gas-Works. This week, I have to record the death of Mr. John Johnstone, the Manager of the works. Mr. Johnstone was in business on his own account as a blacksmith, when, in 1877, he was appointed Manager of the gas-works. He has proved himself to be a capable manager. One of his first duties was to devise and superintend an extension of the works which almost doubled their capacity. He has lived to see the works flourish under him till another extension is necessary; and his removal at this time, when his advice would have been of much advantage to the Corporation, is matter of regret. His death, which took place on Monday morning, resulted from lung disease of long standing.

I am glad to be able to announce that the Dunbar Gas Commissioners, of whose doings, amounting almost to persecution of Mr. Cuthbert, their Manager, I have had occasion to write more than once recently, show signs of returning to reason; and it is also a pleasure to have to record that Mr. Cuthbert is getting the better of his oppressors. The Commissioners have this week held a meeting, at which there was no recrimination, nothing of the nature of a "scene," but everyone seemed to be imbued with a desire to do his best for the undertaking they manage. At their previous meeting notice was given of a motion that Mr. Cuthbert should be dismissed, because he would not weigh the coal upon a small weighing-machine. A steel-yard of satisfactory dimensions is now to be provided; and Mr. Cuthbert will doubtless use it to the advantage of the Commissioners.

The report by Professor Kennedy on the proposals of Messrs. Urquhart and Small for the electric lighting station in Dundee, has been received. It is just as I expected; the Gas Commissioners might have saved the fee which they will have to pay to the Professor. The system which the engineers propose is the same as he has employed in London for some years, and "upon which he is now carrying out the lighting of Glasgow." As becomes a superior person reporting upon the work of inferiors, he suggests one or two variations in the details of the proposals; and in conclusion he gives his opinion that the scheme of Messrs. Urquhart and Small is "a well-thought-out scheme, and one of a type which has been thoroughly tested and found to be efficient and economical in practical work." A meeting of the Gas Commissioners is to be held on Tuesday to consider the report, and to determine the action of the Commissioners upon the scheme.

In these days of eight-hour day agitation, it is not surprising that

municipalities have the subject brought before them. In the Glasgow Police Commission on Monday, Mr. Tait, the gentleman who directed the Scotch railway strike, moved for the appointment of a Committee to inquire if all the Corporation employees should not be placed upon an eight-hour working day. His chief argument was that the employees in the gas-works already work upon an eight-hour shift. The Commission, by 30 votes to 11, agreed to the appointment of a Committee; but several of the speakers pointed out that they supported the proposal merely because it was one for inquiry. Although he got the Committee appointed, Mr. Tait himself appeared to look upon his proposal as a hopeless one.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, May 14.

Sulphate of Ammonia.—The markets generally are extremely dull, and there is a great stagnation of business. This is especially perceptible at the East-coast ports, where the shipments show a decided falling off. The local market keeps fairly steady; and among the exports are again noticed some American shipments. A resumption of the demand for the latter country would be a welcome factor at the present juncture, and might prevent the downward tendency. Quotations are £10 f.o.b. Hull, Leith, and Liverpool. Nitrate has declined to 8s. 6d. per cwt.

LONDON, May 14.

Tar Products.—The contrast between the value of products to-day and what they were about this time last year is simply astounding; for, whilst benzol was then difficult to obtain at 4s. 6d. per gallon, its selling value to-day is only 1s. 6d. Anthracene, creosote oils, and other important products have all shared in the same extraordinary collapse. Benzol for forward delivery is quotable 1d. higher. Business is said to have been done in "A" anthracene at 11d.; whilst the value of "B," according to quality, varies between 6d. and 9d. There is a little more inquiry for tar oils; and prices are slightly firmer. There is a distinctly better feeling as to the future of pitch; and buyers are beginning to see that the production for next season is not likely to be in excess of what is required. It is now thought that, instead of receding in value, pitch will probably be dearer in the autumn. Important tar contracts have been let at prices, ranging according to quality and position, from 10s. to 13s. per ton. Other prices are: Pitch, 27s. to 30s. Benzol, 90's, 1s. 7d.; 50's, 1s. 3½d. Toluol, 1s. 2d.; Solvent naphtha, 1s. 2d. Crude benzol naphtha, 30 per cent., 8d. Creosote, 1d. Naphthalene salts, 20s.; pressed, 45s. Carboic acid, 60's, 1s. 1d.; 70's, 1s. 4d.; crystals, 5d. Cresol, 8d. Anthracene, 30 per cent., "A" quality, 10½d.; "B" quality, 7½d.

Sulphate of Ammonia.—This market is utterly devoid of any life; and business drags. It is difficult to obtain more than £10 less 3½ per cent. The production is now decreasing rapidly; and as stocks are not large, it is hoped that lower prices will not be touched this season. The outlook, however, is far from encouraging. Gas liquor (10-oz.) sells at 5s. to 6s. 6d.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—There is a continued steadily lessening demand for all descriptions of round coal; and although stocks are not accumulating to any appreciable extent, very many of the collieries are not working more than four days per week. For house-fire consumption, requirements are necessarily rapidly diminishing; but so far, the output of the better qualities of round coal have been moving away without difficulty, and prices have been well maintained. At the pit mouth, best Wigan Arley is still quoted at 12s. 6d. per ton; but the second qualities of house coal are easier, and scarcely average more than about 10s. 6d. per ton for Pemberton four-feet and second qualities of Arley, and about 9s. per ton for common house-fire coals. The lower qualities of round coal are hanging upon the market, owing to the depressed condition of the principal coal-using industries; and requirements, for iron making, especially, are only very indifferent. The shipping trade also continues extremely quiet; and with plentiful supplies offering in the market, prices continue to ease down, although there is no actually quotable reduction in list rates. For inland requirements, good ordinary descriptions of steam coal scarcely average more than 8s. to 8s. 3d. per ton, at the pit mouth; whilst for shipment, ordinary qualities of steam coal have been offering freely, for delivery at the Garston Docks or the High Level, Liverpool, at about 9s. 3d. to 9s. 6d. per ton. With the resumption of work at the cotton mills, there has been a better demand for engine classes of fuel; but supplies of these are still in excess of requirements, and low prices are quoted in the market. At the pit mouth, burgy averages about 6s. 6d. to 6s. 9d. per ton; best slack, 5s. to 5s. 6d.; and common qualities, 3s. 6d. to 4s. per ton.

Northern Coal Trade.—There are fuller supplies of coal in the northern markets, several of the smaller pits having commenced working; and this, and the expectation of an early general resumption of work, has caused the prices of coal generally to fall. Best Northumbrian steam coal, which had been sold at 13s. per ton, f.o.b., has fallen about 1s. 6d. per ton for prompt delivery, and is quoted at 1s. per ton less for delivery in a week or so; whilst for more forward delivery a lower rate is asked. Small steam coal, which had been sold as high as 10s. per ton, has fallen to about 7s. 6d., and must fall further. Indeed, the effect of the resumption of work at the Durham collieries is already being anticipated as far as prices are concerned, though it must be some time before a full resumption of work takes place. Gas coal is now being produced at several of the smaller unassociated collieries that started a week or so ago; and the limited summer needs of the local gas companies are being well met. About 10s. 6d. per ton, free on rails, was paid last week for unscreened gas coal; and lower prices will now soon rule, for the output will increase steadily for some time. Bunker coal has also fallen in price, and household coals are flat. Gas coke is dull; but there has been a larger consumption, some of

the companies having almost cleared out their stock. Blast furnace coke is still scarce, though the production is being now increased very steadily. Prices as high as 25s. per ton have been paid for coke; but it may be hoped a return to more normal rates will soon be known.

Scotch Coal Trade.—In the West of Scotland, the coal market has retained a steady tone, due on the one hand to the re-starting of steel furnaces, and on the other to heavy shipments to Mediterranean ports, chiefly of gas coal. The miners are disposed to kick at the reduction of wages which is imposed upon them; but, though one or two pits threaten to strike, the movement is by no means general, and the idle day a-week has little perceptible effect on the market. In the east of Scotland, trade has been slow and flat, the prospect of a settlement of the Durham strike having a tendency to limit the demand. Prices have been maintained in both east and west; but with the resumption of work in Durham, there is every prospect of a fall. The quotations this week are: Main, 7s. 6d. to 7s. 9d.; ell, 8s. 6d.; splint, 8s. 3d. to 8s. 6d.; and steam, 10s. to 10s. 3d. per ton. The shipments were 170,369 tons—an increase of 4973 tons over the corresponding week of last year. For the year to date, the shipments from Scotch ports have been 2,290,279 tons—an increase of 277,770 tons upon the shipments in the same period in 1891.

The Fire at the South Metropolitan Gas-Works.—We learn that the fire at the Old Kent Road station of the South Metropolitan Gas Company, to which reference was made in the JOURNAL last week, was not so serious as at first reported. The damage consisted only of the roof of the Board-room in the old office, which was used as a meeting-room by the workmen. It is a single-storey building. As at the time of the fire, the night shift of stokers happened to be coming in, they set to work with the Company's fire-engine, and obtained the mastery of the fire before the Brigade arrived.

Lambeth Water Company.—The report of the Directors of this Company for the half year ended March 31 last, shows an increase of £1135 in the water-rents, &c., and a decrease of £971 in the expenditure, as compared with the six months ended March 31, 1891. The surplus transferred from revenue account to dividend and interest account is £67,256. There is to the credit of the latter account, after payment of interest on debenture stock, an available balance of £62,299. The Directors propose to transfer a further sum of £2750 from the contingency fund to the credit of this account, and thereby increase the available balance to £65,049. Out of this, they recommend to the proprietors the distribution of the maximum dividend at the rate of 7½ per cent. per annum on the shares issued under the Company's Act of 1856, and a dividend at the rate of 9½ per cent. per annum on all the other share capital of the Company—all less income-tax. These will amount to £64,813, and a balance of £236 will remain to be carried forward.

Action as to the Sale of a Gas-Stove.—At the Westminster County Court last Wednesday, an action was tried in which The Gaslight and Coke Company sought to recover £5 3s. 3d., the value of a gas-stove, together with £1 as compensation for its detention and the loss of rent thereon. In 1890 the Company let a stove to a Mr. Haslingdon, of 26, Sydney Street, Chelsea. Subsequently a distress was put in by his landlord, and a stove was seized and sold. The plaintiffs contended that the stove was their property, and that the seizure was illegal, as, according to the judgment in *The Gaslight and Coke Company v. Hardy*, the stove must be regarded as a "fitting." Evidence was given as to the sale of a heating-stove for 5s.; but it was stated that there was no badge upon it to show that it belonged to the Company. A cooking-stove bearing such a badge was left at the house. It was urged by Mr. Neville, on behalf of the plaintiffs, that they were not bound to put a label on their stoves. In the result, the Judge (Mr. F. Bayley) said he was not satisfied that the stove sold really was the Company's; and he gave judgment for the defendant, with costs.

The Action of Liverpool Water on Lead.—Dr. J. Campbell Brown has submitted a report to the Water Committee of the Liverpool Corporation, in which he states the results of some experiments he has made on the action upon lead of filtered and unfiltered water from Lake Vyrnwy and of a sample of Rivington water. The water was allowed to stand on sheets of lead for five days; and the amount of lead dissolved was then estimated. The results were as follows: Unfiltered Vyrnwy water: Parts of lead dissolved in every 100,000 parts after five days, .8; total solids in solution, 3.76; reaction, slightly acid. Filtered Vyrnwy water: Parts of lead dissolved, .08; solids in solution, 6.68; reaction, neutral. Rivington water: Parts of lead dissolved, .23; solids in solution, 8.76; reaction, slightly acid. The unfiltered Vyrnwy sample Dr. Brown says, would be objectionable for public supply; and the filtered sample, on the other hand, takes up less lead than ordinary Rivington water. The cause of the action upon lead is twofold: (1) The peaty matter in the water; and (2) the acidity of the water. Filtration removes the greater part of the first cause, while the second cause can be remedied either by admixture with a sufficient proportion of alkaline water, or by the addition of a small carefully calculated quantity of either milk of lime or soda ash previous to filtration. Mr. J. Parry, the Water Engineer, has also submitted a report to the Committee, in which he deals with that of Dr. Campbell Brown. He says that the reduced action of the filtered Vyrnwy water on lead, as compared with that unfiltered, is partly due to the influence of the limestone tunnels through which the water flows at Cynynion and Llanforda, as well as to the effect of passing through the sand filter-beds. With regard to the action of the Rivington water upon lead, he reminds the Committee that, when public attention was called to this subject in 1886, through the reports of lead-poisoning in Huddersfield and Sheffield, he submitted to Dr. Brown samples of water drawn from new lead-pipes in various parts of the city district after standing for over twelve hours in contact with the lead. Dr. Brown then reported that in districts supplied with well water, and with mixed Rivington and well waters, there was no trace whatever of lead; and in the few districts supplied wholly with unmixed Rivington water, only a slight and unimportant trace of lead was discovered. No unmixed Vyrnwy water has yet been supplied to the city.

The Gas Question at Bideford.—On the recommendation of the Lighting Committee, the Bideford Town Council last Thursday resolved to advance their offer of £14,000 for the Gas Company's works to £15,000.

The Willenhall Local Board and the Gas-Works.—At the meeting of the Willenhall Local Board yesterday week, a Committee was appointed to inquire as to the desirability of acquiring the gas-works on behalf of the ratepayers.

West Bromwich Gas Supply.—The quantity of gas sold by the West Bromwich Corporation Gas Committee during the year ended March 31 last was 203,780,700 cubic feet, as compared with 201,319,700 cubic feet in the previous year—an increase of 2,461,000 cubic feet. The amount of gas-rental for private and public lighting was £25,860, compared with £25,550 the previous year—an increase of £310.

Another Artesian Well in the City.—At the meeting of the Commissioners of Sewers of the City of London last Tuesday, the Medical Officer of Health (Dr. Sedgwick Saunders) reported that a well had been sunk in Broad Street House, by Messrs. Docwra and Sons, to a depth of 400 feet. The supply capable of being raised daily was stated to be 30,000 gallons; and an analysis of the water showed it to be of great purity.

Winding up of the Pamplona Water-Works Company, Limited.—In the Chancery Division of the High Court of Justice last Saturday, Mr. Justice Kekewich heard a petition for the winding up of the above-named Company. Mr. Eustace Smith said the petition was presented by a judgment creditor who was the holder of debentures on which interest was in arrear. Bondholders to the amount of £5500 supported the petition. His lordship asked if the Company opposed; and on being informed that they were not represented, he made the usual winding-up order.

Bolton Corporation Water-Works.—The accounts of the Water Committee of the Bolton Corporation for the financial year ended in March last show that a profit of £11,100 has been earned and handed over to the borough fund in relief of rates, as against £11,675 in the previous year. The total income was £53,619; the principal item being £31,565 for water supplied for domestic purposes. The expenditure amounted to £40,518, as against £38,277 in the previous twelve months. Maintenance of works took £4644; salaries, £1850; rents and rent-charges, £1380; rates and taxes, £3002; interest, £24,710; sinking fund, £2414; and instalments of loan paid off, £1990.

Haverhill Local Board Gas Supply.—According to the accounts of the Haverhill Local Board Gas Department for the past financial year (to March 25), the gas supplied produced a net revenue of £1769; residuals stand for £281; a sum of £78 was received from the Board for the supply of steam, &c.; and the total receipts were £2176. The outlay for coals was £996; wages and gratuities at works came to £239; and interest on loans, to £219—the total expenditure being £1731. There was consequently a profit balance of £445. The instalment and of loans, repaid in the year amounted to £153. The working statement of the Manager (Mr. B. Gibson) shows that there were 848 tons of coal carbonized, and 8,900,000 cubic feet of gas made. Of this quantity, 7,363,800 cubic feet were employed in private lighting, 519,000 cubic feet were used in the 73 public lamps, and 218,800 cubic feet on the works; making 8,101,600 cubic feet accounted for, and leaving 798,400 cubic feet, or 8.9 per cent. The make of gas was at the rate of 10,495 cubic feet per ton of coal carbonized.

Malta and Mediterranean Gas Company, Limited.—The accounts of this Company for the year ended March 31, 1892, are of a satisfactory character; there having been a general increase of rental. At the Corfu and Sicilian stations, the price of gas to private consumers has been reduced; and there has been an improvement in the sale of residuals and fittings. According to the profit and loss account, the revenue amounted to £34,695; and deducting the expenditure, there remains a balance of £10,678. The distributing plant at Malta has been increased by the enlargement of the leading main, and by an extension of mains to Sliema—a populous suburb of Valletta. To meet this outlay, the loan capital has been increased by the issue of £6300 additional debentures. After providing for dividends on the preference capital, the Directors recommend that a dividend of 4 per cent. be declared on the ordinary capital, which, added to the interim dividend already paid, will make a total of 6 per cent. for the year, leaving a balance of £2412 to be carried forward. The Directors announce the death, on Nov. 7 last, of their valued colleague, Mr. Charles Newton; and to fill the vacancy, they have elected Mr. Stephenson R. Clarke for the remainder of the period for which Mr. Newton was elected.

Liverpool Gas-Fittings Company.—At the annual meeting of this Company last Wednesday, the Chairman (Mr. J. B. Smith) had the pleasure of presenting to the shareholders a very satisfactory report on the working of the past year. The turnover, he said, had been much in excess of the previous year—being £25,697, against £21,181; and the profit was £2081, as against £1451. This enabled the Directors to pay, in addition to the ordinary dividend of 10 per cent., a bonus of 5 per cent., which had been withheld during the last three years, at the same time leaving £581 to be carried forward, as compared with £451. The main reason of this was that there had been a great increase in the sale of automatic meters. Apart from this, however, competition was as keen as ever; and they had to be content with small profits in order to get business. They could not calculate, perhaps, upon the sale of the automatic meters continuing on the same scale; but for some time there was no doubt there would be a considerable demand for them. It was a question whether the system, which had been working so satisfactorily, might not be still further extended. He understood that a company was about to light a village with gas; and that the whole supply was to be paid for by means of these meters. There was another Company coming out, to be called the Automatic Gas-Meter Company, for the purpose of extending this business; and he might add that their Manager, Mr. Haynes, had succeeded in producing some very valuable patents, of which the new Company would have the advantage. The report and recommendation as to dividend were adopted.

The Electric Lighting Question at Taunton.—The report prepared by Mr. Gisbert Kapp, M.Inst. C.E., on the value of the buildings and plant of the Taunton Electric Lighting Company (see ante, p. 861), came before the Town Council last Tuesday; and, after considering it, they arrived at the following decisions: That steps should be taken to obtain a Provisional Order; that for the present the system now in use (the Thomson-Houston) should be continued; and that a Sub-Committee should be instructed to negotiate with the Company for the purchase of the works on the basis of Mr. Kapp's valuation, and make arrangements for carrying them on until an Order is obtained.

The Blackpool Corporation Gas-Works.—Under the management of Mr. J. Chew, the Blackpool Corporation Gas-Works make excellent progress. During the year ending March 25, the production of gas was 193 million cubic feet—an increase of 29 millions over the previous year. The revenue was about £30,000. The capital expenditure by the end of the present year will have reached £100,000. It is intended to further extend the works, and complete the alterations now in progress as early as possible. It is expected that when the alterations are finished, they will be able to make 150 million cubic feet more gas per annum. Coal cost the Corporation £600 more in the year just closed than it did in the previous one; and owing to the fall in the price of coke, there is a diminution of between £300 and £400 in the receipts under this head.

The Annual Report of the Stafford Corporation Gas Committee.—The Gas Committee of the Stafford Corporation submitted their annual report at the meeting of the latter body last Tuesday. It appeared therefrom that, notwithstanding the great fall in residuals in the past year, the gross profits had been above £8000, and the net profit £2500. They recommended that £500 should be carried to the reserve fund, £1500 paid to the district fund account in reduction of the district rate, and £500 to the borough fund, to enable the Baths Committee to completely equip the baths without any further charge on the rates. The Committee proposed that for the future no charge should be made for meters, and that there should be a sliding scale of discounts, in order that large and small consumers alike might benefit to an equivalent of nearly 2d. per 1000 cubic feet reduction on the present prices. The report was adopted.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

For Stock Market Intelligence, see ante, p. 913.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon invest. ment.
£			p. c.					£ s. d.
GAS COMPANIES.								
590,000	10	13 Apr.	10½	Alliance & Dublin 10 p. c.	10	16½—17½	..	6 0 0
100,000	10	"	7½	Do. 7 p. c.	10	11—12	..	6 5 0
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105—107	..	4 13 5
100,000	20	27 Nov.	8	Bahia, Limited	20	10—12	-2	13 6 8
200,000	5	12 May	7½	Bombay, Limited	5	6½—6¾	..	5 11 1
40,000	5	"	7½	Do. New	5	4½—5	..	6 0 0
380,000	Stock	26 Feb.	12½	Brentford Consolidated	100	210—215	..	5 14 1
150,000	"	"	9½	Do. New	100	160—165	..	5 12 2
220,000	20	11 Mar.	11½	Brighton & Hove Original	20	40—42	..	5 9 6
888,500	Stock	11 Mar.	5	Bristol	100	95—100	..	5 0 0
320,000	20	13 Apr.	11½	British	20	42—44	..	5 2 3
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	10	19—20	..	5 15 0
51,510	10	"	8½	Do. 7 p. c.	10	14½—15½	+½	5 9 8
328,750	10	"	—	Buenos Ayres (New) Limited	10	7—8	+½	—
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	94—97	..	6 3 9
150,000	20	26 Feb.	8	Cagliari, Limited	20	25—27	..	5 18 6
550,000	Stock	13 Apr.	13	Commercial, Old Stock	100	229—234	-1	5 11 1
165,000	"	"	10	Do. New do.	100	180—190	..	5 5 3
130,000	"	30 Dec.	4½	Do. 4½ p. c. Deb. do.	100	118—123	..	3 13 2
800,000	Stock	30 Dec.	13	Continental Union, Limited	100	221—226	..	5 15 1
200,000	"	"	10	Do. 7 p. c. Pref.	100	190—195	..	5 2 7
75,000	Stock	30 Mar.	10	Crystal Palace District	100	185—195	..	5 2 7
486,090	10	29 Jan.	10	European, Limited	10	19—20	..	5 0 0
354,060	10	"	10	Do. Partly paid	7½	13½—14½	..	5 3 11
5,470,820	Stock	12 Feb.	12	Gaslight & Coke, A, Ordinary	100	213—217	+8½	5 10 7
100,000	"	"	4	Do. B, 4 p. c. max.	100	94—97	..	4 2 5
665,000	"	"	10	Do. C, D, & E, 10 p. c. Pf.	100	247—252	..	3 19 4
30,000	"	"	5	Do. F, 5 p. c. Prf.	100	116—121	..	4 2 9
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	169—174	..	4 6 2
1,300,000	"	"	7	Do. H, 7 p. c. max.	100	153—156	..	4 9 9
463,000	"	"	10	Do. J, 10 p. c. Prf.	100	245—250	..	4 0 0
476,000	"	"	—	Do. K, 6 p. c. Prf.	100	140—150	..	4 0 0
1,061,150	"	11 Dec.	4	Do. 4 p. c. Deb. Stk.	100	114—116	+½	3 9 0
294,850	"	"	4½	Do. 4½ p. c. do.	100	118—123	..	3 13 2
908,000	"	"	6	Do. 6 p. c. do	100	167—169	+1½	3 11 0
3,800,000	Stock	12 May	12	Imperial Continental	100	218—222	..	5 8 1
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4—4½	..	6 13 4
560,000	100	1 Apr.	5	Met. of Melbourne, 5p. c. Deb.	100	107—109	+1	4 11 9
541,920	20	27 Nov.	6½	Monte Video, Limited	20	14½—15½	..	8 7 8
150,000	5	27 Nov.	10	Oriental, Limited	5	8—8½	..	5 17 8
60,000	5	30 Mar.	7	Ottoman, Limited	5	4—5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited	10	2—3	..	—
420,000	100	3 May	6	People's Gas of Chicago—	100	102—105	..	5 14 3
500,000	100	1 Dec.	6	1st Mtg. Bds.	100	103—106	..	5 13 2
150,000	10	15 Oct.	10	2nd Do.	10	8—9	-½	—
500,000	Stock	26 Feb.	15½	San Paulo, Limited	100	275—280	..	5 10 8
1,350,000	"	"	12	South Metropolitan, A Stock	100	218—223	+1	5 7 7
200,000	"	"	13	Do. B do.	100	235—240	..	5 8 4
725,000	"	30 Dec.	5	Do. C do.	100	142—146	+1½	3 8 6
60,000	Stock	11 Mar.	11½	Do. 5 p. c. Deb. Stk.	100	225—230	..	5 0 0
729,331	Stock	30 Dec.	10	Tottenham & Edm'ton, "A"	100	225—230	..	5 0 0
1,720,252	Stock	13 Apr.	8	Chelsea, Ordinary	100	252—257	..	3 17 9
544,440	"	30 Dec.	4½	East London, Ordinary	100	195—200	+2	4 0 0
700,000	50	11 Dec.	8	Do. 4½ p. c. Deb. Stk.	100	136—140	..	3 4 3
708,000	Stock	12 Feb.	10½	Grand Junction	50	96—99	..	4 0 10
1,043,800	100	30 Dec.	9½	Kent	100	255—265	+5½	3 19 3
406,200	100	"	7½	Lambeth, 10 p. c. max.	100	220—225	..	4 4 5
279,700	Stock	30 Mar.	4	Do. 7½ p. c. max.	100	185—190	..	3 19 0
500,000	100	12 Feb.	12½	Do. 4 p. c. Deb. Stk.	100	120—123	..	3 5 0
1,000,000	Stock	29 Jan.	4	New River, New Shares	100	320—330	..	3 13 6
902,300	Stock	30 Dec.	6½	Do. 4 p. c. Deb. Stk.	100	126—129	..	3 2 0
126,500	100	"	6½	S'thwk & V'xhall, 10 p. c. max.	100	145—150	..	4 6 8
1,155,066	Stock	11 Dec.	10	Do. D 7½ p. c. do.	100	133—138	..	4 14 3
				West Middlesex	100	244—248	+1½	4 0 8
				* Ex div.				

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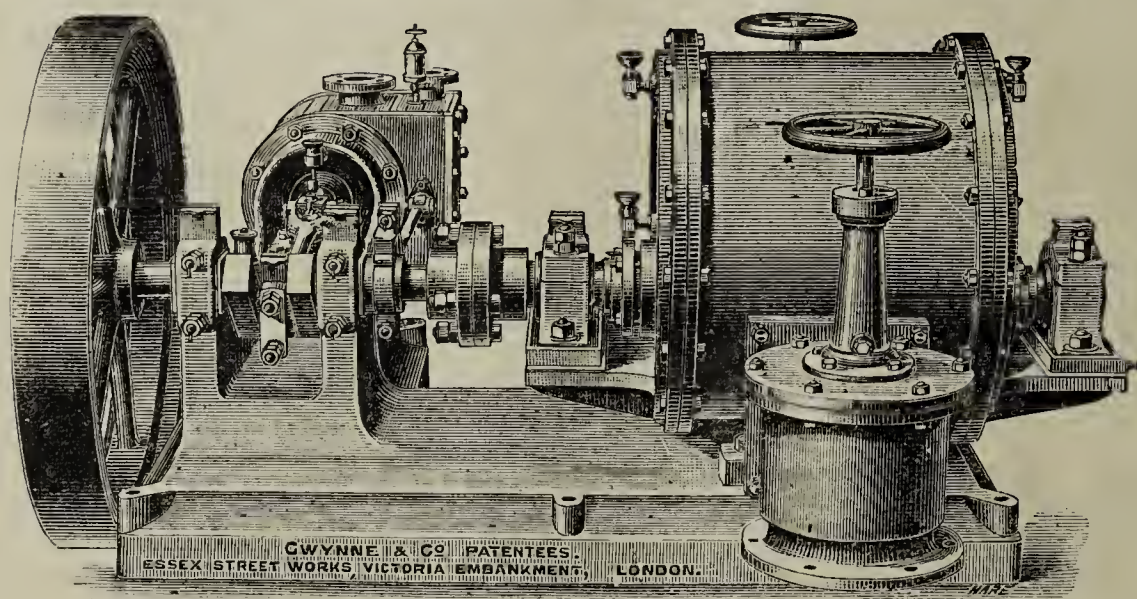
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TO CORRESPONDENTS.

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THE
JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MAY 24, 1892.

The Institution of Gas Engineers' Papers.

In another column will be found the first portion of our report of the discussion upon the papers read at the recent meeting of the Institution of Gas Engineers. We give the whole of the discussions relating to the first day's papers, and the rest will follow next week. As will have been seen by our report of the proceedings in the last issue of the JOURNAL, the first day of the meeting was appropriated to the delivery of the President's Inaugural Address and the reading and consideration of Mr. George Livesey's paper upon profit-sharing, and the four oil-gas

papers by Messrs. Browne, Lewes, Lacey, and Pryce. Before going on to comment upon Mr. Livesey's paper and the discussion which it evoked, we have to repair an error in our review of Mr. Hunt's address. It is a small matter, in itself, and relates only to his and our attempts to trace—in both instances, probably, by recollection, and without reference to authority—the origin of the phrase "decre-
"mental rate of increase" as applied to the business of a gas company. It has been brought to our notice that, while Mr. Hunt was wrong in ascribing the formula to Mr. George Livesey, and also in putting his own interpretation upon it, the contemner of the phrase was not Lord Grimthorpe, as we supposed, but Mr. Matthews, Q.C., the present Home Secretary, who thus quashed, with a contemptuous sneer about "arithmetic gone mad," some elaborate tables relating to the Birmingham gas arbitration which had been prepared by Mr. Price-Williams. The incident is a trivial one; but it goes to show how difficult it is to write history accurately, when events and sayings are put down at third hand.

Mr. Livesey's paper was a very worthy production by the author of the sliding-scale profit-sharing scheme for gas workers; and it will remain upon record as an authoritative sketch of one way in which an industrial copartnership may be built up. The author would himself admit that it might rather be described as the first word upon this subject than the last; and he is not at all likely to claim more for his economic invention than the obvious result that "it works." To make a machine that goes is the first object of an inventive mechanician. The improvement of the output, the reduction of friction, and the simplification of principles come later. Steam motors had already changed the face of the world before Sir Frederick Bramwell drew up the first thermic balance-sheet, to exhibit the duty performed for the fuel expended. So with profit-sharing, as a contribution towards the solution of the modern puzzle of the Sphinx, credit is due in no unstinted measure to the men, whoever they are, who try what can be done while their fellows are still criticizing the order of their proceedings. The discussion, if such it may be called, upon Mr. Livesey's paper went to show what might have been supposed before—that the very idea of profit-sharing has not yet penetrated the minds of such an auditory as the author addressed on this occasion. It is possible that among those engineers and managers of gas-works who said least about the paper, or who remained silent, there may have been some who have thought deeply on the subject of the relations of Capital to Labour, but were prevented, by various considerations, from speaking out. But the general impression created by the speakers was unquestionably that of a failure to realize the nature of the problem, betrayed by a muddling of the nominal question with all sorts of things that have nothing to do with it—sick allowance, pension funds, premiums on working results, and so on. Now, as we understand it, the motive of profit-sharing is this: Under the wages system, the capitalist goes into the labour market and buys a recognized amount of work at the current price. To this transaction the maxim *caveat emptor* applies as fully as to a purchase of eggs. The buyer has to see to it that he gets his money's worth. The seller has no interest in rendering any more value for the price than he can help. The buyer has a motive in buying his labour, which is, to make a little more out of it than it costs him—the difference being his profit. Well, now, in the ordinary way, taking all the buyer's risk of bad bargains, and the burden of keeping his labour up to the mark, the employer looks to make an average profit of (say) 5s. upon every pound he lays out weekly in wages. But suppose that, by enlisting upon his side the labourer's interest as well as his bare toil, the employer might reasonably expect to increase the efficiency of the workman as a money-making agent—what should he pay for this interest? Practically, profit-sharing simply means the employer saying to his man: "If you will work for me, not as a hireling, but as you would for yourself, I will make it worth your while." Does anybody doubt that there is a difference between the hireling and the man who is working for himself? Then the only question that remains is, how to apportion the benefit.

This difficulty appears to be a very dreadful one to anybody who has never cared to face it; but once persuaded as to the desirability of profit-sharing—which is a point as yet far beyond Mr. Livesey's recent audience—there is good

hope that employers may be able to initiate many plans for carrying their conviction into effect, among which the best would soon show themselves by natural selection. Many artificial obstacles were raised, in the discussion upon Mr. Livesey's paper, to the idea of sharing profit with workmen, by speakers who, unlike others, knew well enough the essential distinction between profit-sharing and the other devices of pensions, &c., mentioned, none of which ever secured the interest of the workman. A favourite query of this order of critics is, How does the coal-trimmer or the road-sweeper contribute to the profits of the undertaking in which he is employed? And another is, Why should the workman share profits when he cannot bear losses? To the first question, it would suffice to quote the majestic words of Milton, which sweep away all distinction of quality from a common service—

"Thousands at His bidding speed,
And post o'er land and ocean without rest;
They also serve who only stand and wait."

While to the latter it may be replied that the workman does, as a matter of fact, suffer from the loss of his employers in ordinary cases, even to the extent of total deprivation of his means of livelihood. When, in a less accommodating age than this, the journeymen makers of shoe-buckles starved as a consequence of a shift of Fashion, did they not bear the brunt of the loss? But truly these objections are more dialectical than conscientious. The only real difficulty attending the adoption of profit-sharing is the twofold one of finding the just datum and defining the shares of Capital and Labour respectively. As to this, the most hopeful way is to try something that appears reasonable while waiting for the perfect rule that may be developed by experience.

With regard to the oil-gas papers, there is little to say here; the subject having been so thoroughly ventilated at the meeting. There remains a considerable disagreement between Mr. Browne, of Rotherhithe, and the proprietors of the Maxim-Clark system of carburetting gas by petroleum spirit, as to the efficiency of this material; and Dr. Dvorkovitch has left a very important point open with regard to the possibility of obtaining a valuable residual from oil gas. The discussion upon the general subject was, on the whole, pointed and informing, and quite justified the Council of the Institution in making gas-carburetting methods so prominent a division of the technical work of the meeting.

The Gas Supply of Birmingham—A Lesson to Miners.

THE annual report of the Gas Committee of the Birmingham City Council for the past municipal year shows that the dual undertaking is progressing; and that both the head-quarters works require extension. The balance carried from the revenue to the profit and loss account is £114,170, out of which there remains—after providing for all capital charges—what is called a net profit amounting to £22,144. In order to obtain this sum, which is to be appropriated to the improvement rate for 1891, the Committee have suspended the payment for the year of the usual allocation towards the sinking fund, excusing themselves by referring to "the large sum which was appropriated to this fund from the profits of the previous year." The manœuvre may be a perfectly harmless and justifiable one; but that it should have been done is a good illustration of the elasticity (to call it by no harsher term) which marks the treatment of capital obligations by local authorities. The Committee have decided against undertaking the manufacture of sulphate of ammonia, and they are now inviting tenders for the purchase of their ammoniacal liquor for a period of ten years from June, 1893. It is to be presumed that the Committee have good and sufficient reason for thus deciding against following the course which has been forced upon so many gas-works administrators; but unless purely local considerations alone have weighed with them in this matter, it would be instructive to learn why they prefer to sell their liquor instead of working it up themselves. It appears that the Birmingham Gas Committee—possibly upon general principles—are averse from doing more for themselves than they can help; and they have accordingly renewed their main and service-laying contract with Messrs. John Aird and Sons for another period of five years. One portion of the report deserves the particular attention of labour agitators, by the light it sheds upon the reason why strikes of miners to

force up the price of coals do not succeed. It is stated that the Committee received notice at the time from the colliery-owners supplying coal under the current year's contracts, that they would be unable to continue deliveries during the recent stoppage of mining. It consequently became necessary to purchase additional coal in anticipation of the cessation of supplies; and 12,000 tons of coal were, in fact, purchased for delivery during the fortnight preceding the stoppage, of which 9000 tons were delivered during the time stipulated. For these additional supplies, prices in advance of those given under contract had to be paid; but it should be noted that none of this extra money could by any possibility reach the pockets of the men who by their determination to "play" for a week rendered the expenditure necessary. On the contrary, these victims of a rash experiment had to pay for the lesson of failure; for "on the resumption of work by the miners, the Committee informed their contractors that, having made these additional purchases, they were not in a position to receive, as arrears on the contracts, the coal which should have been delivered during the cessation of work." There is more point in this brief statement, and more instruction, than in all the frothy harangues of all the demagogues whose blatant ignorance ever darkened the counsels of a Trade Union. The report also states that, having regard to the yearly increasing difficulty of getting cannel, the Committee have turned their attention to oil for carburetting their gas, and have arranged for an experiment with carburetted water-gas plant.

Manchester Gas.

THE Manchester gas consumers are dejected, as well they may be, by the persistent refusal of their local masters to do them even an instalment of justice in the matter of lowering the price of gas. They begin to understand how hopeless their condition really is, and must continue to be while the spending departments of the Corporation are able to combine for the purpose of outvoting the Gas Committee. All these interests are against them. However feeble may be the mutual attachment between the corporators who are of the Ship Canal party and their fellows who desire cheap electric lighting, they can sink their differences, and vote as one man, upon the desirability of maintaining the indirect tax upon the gas consumers. Of course, they are all honourable men, as Mark Antony said of the murderers of Cæsar; but they work their will all the same. True to one of the most remarkable tendencies of human nature—which is to talk of feasts when one is starving, and picture to oneself the charms of running water while dying of thirst—the Manchester newspapers are entertaining descriptions of the uses of the natural gas of America, and publishing letters on the subject of the possibility of making fuel-gas in this country. This is all very nice in its way; but it would be a pity if such loose writing upon this topic as usually finds its way into the newspapers, should distract the minds of the gas consumers of Manchester from the point, which is that the only gaseous fuel they are ever likely to get must come from the mains of their own Gas Department. We see that one gentleman, who belongs to the order of those who know so much better than technicians that they are "amazed" at the "persistent refusal" of the latter to follow them in their airy flights of fancy, has written to a Manchester paper stating, as a fact, that "every ton of slack will yield 100,000 cubic feet or more of heating gas, and coke worth at least 5s. From the gas can be extracted, even at the present low prices, 5s. worth of tar, ammonia, and benzol. The cost of slack, labour, and interest upon capital will not exceed 9s. per ton; so that the gas will cost less than nothing, and yet do more work than the coal from which it is produced." The imagination reels before the vision suggested by such a wealth-creating system of fuel-gas manufacture as this individual has in view; but it may be hinted that, as there is nothing like being quite sure of one's ability to make something out of nothing before going into the business on a large scale, the gentleman should try the experiment of taking a week's holiday in London, starting from Manchester with £10 in his pocket, and returning home, after having thoroughly enjoyed himself, with rather more money than he began with. Seriously, however, there is no way out of their trouble for the gas consumers of Manchester except by the City Council elections. The Corporation

have arrived at the point of disclaiming any desire to make a profit out of their nascent electric lighting scheme; and why they should treat their gas undertaking differently is a secret which is locked in the aldermanic breast. It cannot be because the electric light is to be the luxury of the rich, and must therefore be sold at cost price, while gas is, or should be, the light of the poor, and may consequently be taxed to the limit of endurance.

The Tricks of the Exciseman.

THE deeply interesting problem as to whether a gas-liquor still is a "still" within the meaning of the statutes under which the Inland Revenue of the United Kingdom is collected has been mentioned in Parliament; Sir H. Roscoe having addressed to the Chancellor of the Exchequer a question upon the subject, which was so couched as to imply that the action of the Excise authorities in prosecuting the Sunderland Gas Company for keeping a "still" without a licence was vexatious, and unreasonable. Mr. Goschen, in his reply, was able to screen himself behind the highly convenient defence that the question of sulphate of ammonia stills is to be stated in the form of a special case for the consideration of the Queen's Bench Division; and he merely remarked that, in the opinion of the Board of Inland Revenue, these stills are capable of being used for the production of spirit. Of course, since such is the official opinion, it is only right that action should be duly taken upon it; but it is at least noteworthy that the Excise authorities should have required thirty years to consider the question. We must follow the Chancellor of the Exchequer in refraining from pronouncing any opinion respecting the legal right or wrong of the Excise action; but the manner in which this attack has been sprung upon the unsuspecting practitioners of the harmless art and trade of sulphate of ammonia making is at least open to comment. Fancy an ardent total abstainer, who would as soon dream of harbouring an illicit still in his works as he would of keeping a whisky bottle in his desk, hauled up before the local Magistrate upon a charge which, in theory at least, brands him as worse than a smuggler! The clumsy, high-handed way in which the Inland Revenue people treat the community even now is a reminder and an explanation of the bitter dislike with which the "gaugers" were regarded by the public in the old smuggling days, when the "free-traders" were far surer of sympathy from the mass of the population than the agents of the law. Times change, but the exciseman remains; and having no bold "Smuggler Bill," like him of the "Ingoldsby Legends," to circumvent, the gauger fastens upon the gas manager, who is a much easier prey.

General Supply Companies.

GAS undertakings, especially when owned by enterprising local authorities, are expected now-a-days to blossom out into many strange developments. They bear fruit even in the shape of hotels, baths and washhouses, free libraries, recreation grounds, electric lighting and locomotion—indeed, we should fill a column with a mere catalogue of the objects which a prosperous gas undertaking is made to serve in the United Kingdom and on the Continent. In America, the facts are stranger still—only with a difference; for whereas in England we have many local authorities who are said practically to own gas-works, in the States the relationship is changed, and the local authorities there are often owned by the gas undertaking. In all cases, however, it is the gas making which pays, and from which the various developments we have referred to draw their sustenance. From news that comes through an American journal, we learn that what gas undertakings do out of their superfluity, some electric supply companies in the States have found it necessary to do for a living—that is, embark on all sorts of subsidiary businesses so as to make a dividend. There is a good deal of charm about this free sort of commercial adventure, which is as different from the staid experience of a British statutory gas company as was the career of a "letter of marque" from the duty of a Thames steamboat. It requires a truly handy man, an engineer of resource, and a good man of business, to manage an Omnium Supply Company of this type; whereas it has sometimes been made the reproach of a British statutory gas undertaking that it can manage itself. We have never subscribed to the popular error that a gas undertaking can do without good management, even when

it belongs to a local authority; but there can be no questioning the conclusion that if the gas undertakings of the United Kingdom had not had the way to their maximum dividends made so easy by legislation, their owners would have been forced to rely more obviously upon the skill of their managers, which would have been better for the latter in the long run.

WATER AND SANITARY AFFAIRS.

SITTING for two days last week, the Royal Commissioners appointed to inquire into the Metropolitan Water Supply took evidence from witnesses brought forward by the New River and East London Companies. There is now an adjournment until next Monday; to be followed by sittings on the ensuing Tuesday and Wednesday. According to present arrangements, it is probable that the first witnesses at the adjourned meeting will be gentlemen appearing on behalf of the Lea Conservancy Board; after which the Commissioners will proceed to hear others representing the Companies drawing their supplies from the Thames. We hope the Kent Company will not be left till the last. The evidence given by the two Companies connected with the Lea Valley, as to the future development of the supply obtainable from deep wells in the chalk, is so important and so striking in its character, that it seems desirable to have it followed up at once by the reception of evidence from a Company wholly dependent on such a source for its supply. The circumstance that a large portion of the Kent district lies below London does not materially detract from the importance of evidence relative to the underground flow of water in that area, and we must trust that the subject will receive the attention it deserves. In the last annual report of the Local Government Board, Major-General Scott discusses the question of the chalk wells at considerable length. He remarks that "the Kent Company have been most successful in finding water in the chalk." But he says: "It has not been possible to obtain information with reference to the effect of the annual abstraction of this large quantity of water on the level of saturation in the chalk or the flow of springs." Added to this we find the suggestive observation: "There can be little doubt that data exist which would afford valuable information on this most important question." In General Scott's opinion, "the lowering of the level of saturation, the diminution of the flow of natural springs and of streams fed by springs, and increase in the aridity of the surface, must necessarily be in progress." The effect, at present, it is admitted, may be small; but the issue is of such a nature that General Scott concludes by saying: "It is hardly necessary to point out that it is of the greatest importance these matters should be thoroughly investigated." It is in the power of the Commissioners to effect this thorough investigation; and although the Kent Company may be to some extent isolated from the other Metropolitan Water Companies by the exclusive character of its supply, the Directors of the Company can scarcely fail to see that, in the present state of affairs, there is a common bond of interest uniting all the Companies, and rendering valuable every piece of evidence which goes to show the amplitude of the resources available for the supply of the Metropolis without superseding the present system. That such evidence can be given from the Kent district, is what we have every reason to anticipate.

In connection with the foregoing remarks, we would call attention to the statement mentioned in the midst of Mr. Francis's evidence, by Lord Balfour of Burleigh, the President of the Commission, that two artesian wells belonging to the Cheshunt Local Board had been drained by the pumping operations of the New River and East London Water Companies. The extent of the alleged depletion appeared to be a fall of 50 feet out of 150. Mr. Francis was, however, able to quote the Surveyor to the Board, as saying that a new well belonging to that authority was entirely unaffected. The President nevertheless went on to observe that "it was said" many of the rivers in the county were much diminished in volume. We mention these points as showing the apprehension which exists on this subject, though the President merely referred to the statements, and did not in any way endorse them. Mr. Francis was able to bring very positive evidence to

bear, showing that the pumping operations of the two Companies had not exercised any injurious effect. A considerable falling in the level of the water under London was admitted, as also some decrease of water in the upper valley of the Lea; the latter result being due to the increase of land drainage, which, of course, likewise produces floods. Sir Frederick Bramwell spoke of an underground flow of water, at a considerable depth, which was on its way to "a waste exit" lower down the river or into the sea. In like manner, Mr. W. B. Bryan, the Engineer to the East London Company, expressed an opinion that there was an immense volume of water running to waste in a south-easterly direction towards Purfleet and Grays. The idea that deep wells in the chalk must necessarily drain the rivers, is not so absolutely assured as people generally suppose. The subject is well handled in a pamphlet on "The Supply of Water to London," by Mr. J. Logan Lobley, F.G.S., who states that most of the water which has fallen as rain on the absorbent chalk at a considerable distance from a stream "will descend to lower levels than the stream, and so never find its way into it by springs." Hence it follows that a very large amount of water may be taken from the middle and lower beds of the upper chalk, or the chalk with flints, with little effect on the volumes of the rivers of the chalk areas. Viewed in this light, the proposal that the New River and East London Water Companies shall, in the course of the next forty years, draw from their wells 44 million gallons per day more than they do at the present time, need excite no alarm whatever. These Companies can likewise take as much water as they please from the Lea, providing they leave enough for the navigation. The East London Company can also draw 10 million gallons per day from the Thames at Sunbury. If the other Companies can show as good a case as these two, the Commissioners need not be long at their task.

After the lapse of seven years, the Earl of Camperdown has revived his Bill for the regulation of the powers of the Water Companies. The measure has reference to all England; but has no application where the water supply is in the hands of a local authority. The main object of the Bill is to limit the power of cutting off the supply when the consumer fails to pay. It appears that more than a dozen clauses are considered necessary to protect the consumer in case of his having a quarrel with his water company. The Bill, subject to some modification, has passed through the Committee stage in the House of Lords; and will probably meet with the same fate as its predecessor in 1885, when, as Lord Camperdown says, the Bill "was lost in the other House owing to the pressure of business." Of course, if the measure became law, it would cease to operate on the London Water Companies immediately the Metropolitan Water Supply passed into the hands of the London County Council. As the Bill appears to be chiefly aimed at the London Companies, we may presume that Lord Camperdown does not calculate on their early extinction. Legislation on the water question is in a critical state at the present time, and, as affecting the London Companies, is singularly inopportune, seeing that a Royal Commission has the subject in hand. The London County Council has felt the necessity of withdrawing the clause in its General Powers Bill by which that body was to be empowered to continue inquiries and conduct negotiations in relation to the Metropolitan Water Supply, and to take part in promoting Bills relative thereto. Even the London Water Bill has undergone modification, to the extent of providing that no contract entered into by the County Council for the acquisition or taking on lease of any of the powers or undertakings of a Water Company shall have effect unless and until the same shall have been sanctioned by Parliament. There is a little tinge of modesty here; and the amendment has been announced as "important." It might have been called inevitable. The most proper amendment would be the extinction of all the clauses, for, as set forth in the petition presented by the seven associated Water Companies against the Bill, the measure is not conceived in the interests of the public, but as a means whereby the Council may attack the Companies, and depreciate the value of their undertakings. The Bill is an assault on property, and already puts the Companies to a large expense, in addition to what they will have to bear as extensive contributors to the rates. The Select Committee presided over by Sir G. Pease yesterday considered the Bill.

THE INCORPORATED INSTITUTION OF GAS ENGINEERS.

PROCEEDINGS AT THE GENERAL MEETING,

HELD AT THE

INSTITUTION OF CIVIL ENGINEERS, MAY 11 & 12, 1892.

Mr. CHARLES HUNT, M.Inst.C.E., President.

DISCUSSIONS ON THE PAPERS.

In the JOURNAL last week (pp. 896-912), we gave the whole of the papers read at the above meeting. To-day we commence the report of the discussions thereon, in the order in which the papers were taken.

MR. G. LIVESY'S PAPER ON PROFIT-SHARING.

Mr. C. EASTWOOD (Linacre, Liverpool) said the question discussed in the paper was a very important one, and one which was coming more and more to the front. He had some little acquaintance with the subject; and, coming as he did from a place where there had been scarcely any dispute with the men, and where there was in existence almost everything to which Mr. Livesey had referred, he could give some corroboration of his suggestions. In Liverpool they had never had to deal with a twelve-hour shift. For forty years the stokers had worked the eight-hour shift successfully. They found no difficulty in burning off the charges in the retorts in four hours; and they obtained as much work out of them in 24 hours as anyone else. It was simply a question of the heating and arrangement of the retorts. The question, therefore, was not eight hours *versus* twelve, but whether or not an adequate amount was paid for the work done. At Liverpool it was all hand labour—there was not a machine in the place. The stokers' wages were, in round figures, 2s. 8d. per ton; and this included all the labour belonging to the carbonizing department. The men would bring in the coal, put it into the retort, draw the charge, take the coke out to the yard to the slaker, and attend to their furnaces; and the price paid for this was 2s. 8d. per ton. Again, for upwards of 25 years, they had had a savings deposit fund for the workmen. It was an old custom with their men, if they had any savings, to invest them with the Company, who had allowed them throughout the entire time interest varying from 3½ to 4 per cent. These amounts were deducted weekly from the men's wages, but with their consent. When the wages were entered in the wages-book, there was a separate column for the amount any man wished to leave. The ticket given to each man with his money showed the amount so put in the fund for him; and it remained there as long as he pleased. Only recently, at his own station (Linacre), several hundreds of pounds were drawn from the savings fund by some of the men, and invested in the shares of the Company, which were bought by auction, not by allotment as in London. There was no sulking with the men, who had entire confidence in the Company. Only a few weeks previously, one man had left to him a little fortune of £200, which he brought to him (Mr. Eastwood) to invest in the same way. They had therefore gone in the direction indicated in the paper respecting the savings fund, which seemed to him to be the kernel of Mr. Livesey's scheme. Only, instead of profit-sharing, they paid the men fair wages for the amount of work they did; and the men had their profit week by week, and were not dependent upon any other circumstances. What he should like to see was, not that the profits should be shared on the general success of the undertaking, but in proportion to the success due to the stokers in the retort-house. One thing of importance, in connection with this, was that the labour of these men was a very small matter indeed compared with the cost of the material with which they had to work. In dealing with a ton of coal, the question whether or not they produced 10,000 or 11,000 cubic feet of gas from it, depended very much on the way in which it was handled in the retort-house; and the stoker would have more incentive to work if he were paid in proportion to the quantity of gas he made from a certain amount of coal, instead of on the general profits. He had also an inducement to attend to his fire, to save fuel and coal, which he would not understand when he was

dealing with the profits of the concern. He (Mr. Eastwood) rather feared that this wages question was one applying to workmen all over the country. There seemed to be a general upheaval of labour—not confined merely to the gas industry. Whichever way they turned, there was an attempt on the part of the working classes to obtain a larger amount of the profits arising from industrial pursuits. No one could object to that, as this was a free country, where a man sold his labour for what he could get; and if a man said he would not work for an employer for less than 10s. a shift, the employer must pay him this, if he could not do without him, or else bring in machines. But, after all, there must be someone finally to do the work; and as long as this was a free country, one could only get from a man just the amount of work he was disposed to give in return for his wages.

Mr. LIVESEY asked Mr. Eastwood if he allowed his stokers any bonus for making 11,000 cubic feet of gas per ton of coal.

Mr. EASTWOOD said he did not. The coal was weighed out to them. He might say that, in certain retort-houses, the usual weight was 2 tons per man; anything beyond this was paid for at the rate of 1d. per hundredweight. The consequence was the men generally took £1 19s. 8d. per week of seven shifts.

Mr. C. E. BOTLEY (Hastings) said that the paper was certainly one of great importance; and all who had charge of gas undertakings, especially in the South, where the conditions of labour had been very unsettled, would agree that any plan whereby a better feeling between masters and men could be brought about, was most desirable. No doubt the labourer ought to have some share in the results of his toil, and in the value he produced. His (Mr. Botley's) experience was rather different from that of most people. They rarely had any trouble with the men at Hastings; but he could not say that formerly there had been very efficient working. They went on about the same lines until the agitation arose for eight hours' work, and for a rise in the price of labour. The good wages paid by the South Metropolitan Company, and the generosity with which they had treated their workpeople, soon extended their influence towards the South; and he found that unless some steps were at once taken to meet it, there might be trouble. He therefore took the matter in hand before there was a possibility of any difficulty, and consulted the foreman and the men with regard to their desires, to see if any arrangement could be made whereby they could mutually benefit. The first thing they took up was the eight-hour question; and he put it to the men that, if they insisted upon it, he might give it to them. There would, however, be a certain quantity of work to be done; and he could not see that it would be any advantage to them to have the eight-hour shift. Their works were of moderate size, making about 325 million cubic feet of gas per annum—very different from big works like Mr. Livesey's, where there was a large staff of men. He therefore suggested to some of the old stokers, who were quite efficient for doing the work in twelve hours, that, if they had to do it in eight hours, it would no longer be possible for them to perform it, and that it would always be necessary to secure a body of very stalwart, and certainly not old, men. Upon full consideration, they saw the force of the argument; and this was given up. The next thing was to grant them an increase of wages, so as to make the work effective. They therefore considered what would be a fair quantity of work for a man to do; and they adopted a scale under which each man would make a certain quantity of gas. The firemen being reckoned in, each man was to make 27,500 cubic feet of gas per day; and anything beyond this was to be paid for at the rate of 2d. per 1000 cubic feet. In the South, carbonizing would cost about 3d. per 1000 cubic feet. Since then the men worked very well. In many weeks they gained a bonus; and their wages made an average of about £2 a week. They had worked most satisfactorily; and the arrangement was advantageous both to the Company and to the men. If they had in the gang a man who was not efficient, they soon made him efficient, for the simple reason that they all suffered if he neglected his work; and, of course, if there were two or three bad men they all felt it. The question Mr. Livesey had raised was a very wide one with respect to profit-sharing as applied by the South Metropolitan Company. With regard to providing for the men in the future, there was the difficulty that a great many stokers were discharged

in the summer; and the thing was to make an arrangement whereby these men could be secured on the books. He had brought the question before his Directors; but they preferred that the work should be self-supporting. What he did, therefore, was done entirely from the managerial point of view. They had a superannuation fund which was self-supporting—the men paying a certain amount each week; and they had thus been able to provide for many old men. His Board had now promised that, if he met with any difficulty in carrying it out, they would help him; so that the fund was in a better position. They had also a burial fund. By these means, they had secured at Hastings perfect harmony, good fellowship, good work, and mutual advantage.

The PRESIDENT asked Mr. Botley to explain the working of the superannuation fund.

Mr. BOTLEY said the men paid 4d. a week, and were entitled to 12s. a week on reaching a certain age—he thought it was 55. They were not entitled to it unless they were incapacitated for work. Of course, it was to their advantage to remain at work as long as possible; but if they met with an accident before, or were otherwise incapacitated at that age, they had a right to retire. They were only entitled to the benefits after ten years' service; but they arranged to take over all the men, without restriction, to begin with.

Mr. EASTWOOD said all their workmen received a pension when they were no longer fit for work. This, however, was a voluntary action on the part of the Board. There were no regulations about it; but if a man behaved properly while he was in their service, when he was no longer fit for work, he received a pension varying from 7s. 6d. to 10s. a week.

Mr. G. C. TREWBY said they were all much indebted to Mr. Livesey for having brought this subject before the meeting. They knew that his object was to benefit the men as well as to add to the prosperity of the Company over which he presided; but he (Mr. Trewby) could not help thinking the system of profit-sharing was very much like sloping retorts—they required more experience with regard to it. There were one or two matters relating to the details to which he should like to ask Mr. Livesey to refer in his reply. There was a large amount of piece-work done about a gas-works; and he could not see how the way in which the men so paid did their work was likely to influence the prosperity of a company. With regard to unloading coal, in most works this was done at a certain price per ton. In what way could this portion of the work influence the earnings of a company? In many of the works, the men were paid a very excessive rate of wages; and to add a system of profit-sharing to something like 15s. a day, which some of them received, would, to his mind, be going very much beyond the mark. Then take the case of the yard labourers, he did not see in what way they could affect the prosperity of a gas company. It was the same now as it was years ago—either the profit or the loss of a company was made in the retort-house. He could quite understand that the retort-setters were men who ought to be considered, because it depended in a great measure on how the retorts were set in the first instance from the design, and then how the work was carried out, what sort of results were obtained; and they were men who might very well be put on a proper system of profit-sharing. There was no doubt that a great deal of the prosperity of a gas company depended upon the stokers. If the men were on an ascending scale, he could quite see that it would be a very good thing, and there would be no difficulty about it; but Mr. Livesey had now arrived at the point when, as he had shown in his paper, the bonus had gone down from 5 to 2 per cent. Were the men satisfied with this reduction? If he were a stoker, and found, after slaving at the hot work of the retort-house, that the next six months his bonus went down from 5 to 2 per cent., and that men doing other classes of work were receiving a higher rate of wages, or aspiring to it, such as the coalminers—and, of course, dear coal would make dear gas—as he had said, if the stoker found that while coal-miners might be adding 10, 20, or even 30 per cent. to their rate of wages, he, who had to manipulate the coal, had to receive less in the shape of bonus, this would be a condition of things which would require a very peculiar mind to be reconciled to. Mr. Botley had told them about some scheme by which a man could get a certain bonus according to the quantity of gas

yielded per ton of coal or per mouthpiece. This was a very old plan. They started at quite a low rate. Their men had it for a number of years; and when, for some reason or other, they did not get it, they rebelled, and always looked upon it as part and parcel of their wages. If a rate per ton or per mouthpiece were fixed for any description of coal, and if, for any reason, a manager was unable to get this particular coal, and was obliged to use an inferior article, the stokers would turn round and say: "It is not our fault; if you only managed your business properly, or got us the kind of coal we want, we should be able to give you satisfactory results." He did not see how a system of this sort was to hold good for any length of time. Something had been said about the burial fund. This reminded him of what occurred at the Beckton works at the time when Mr. Livesey was in trouble. The foreman there took a great interest in the men, and instituted a burial fund, of which they were trustees, and which had been going on for two or three years in a satisfactory manner, there being a sum of £100 or more in hand. Then the men, having joined the Union, felt it would be a good thing if they could get this money out, and pay it into the hands of the Union officials; and they worried him about it, and requested that the money should be handed over to them. Of course, he could take no notice of the request; he told the men they must proceed in a legal manner. If by any means managers could bind the men to them, it would, no doubt, be very satisfactory; but one could not help seeing the evil effects of the Union, more especially in this case. Here was a sum of money collected and put on one side for two or three years for a special object; but the men, on the spur of the moment, thought they were going to have a great rise in wages, and that, if they could only get this money as sinews of war, it would be far better spent than in burying their fellow-workmen.

Mr. BOTLEY explained that they laid down a standard of the quantity of coal to be carbonized, and of gas to be made, per man. If the men failed to do this, they were not paid; and very often they did not do it. Lately they, like other people, had had a difficulty with their coal, and had to use all sorts; but they did not find any trouble with the men. They knew they could not demand the payment as a right. It was particularly stipulated that their wages were to be a certain amount for making a definite quantity of gas; and if they produced more than this, they were paid in proportion. Many times they did not make the specified quantity because the retorts had been left off, and so on. The coal was weighed out to the men daily, and a balance struck every week.

Mr. METHVEN asked if the stokers were responsible for the fires.

Mr. BOTLEY said there were separate firemen; but they were included with the stokers.

Mr. FRANK LIVESEY said no doubt some day Mr. Botley would discover a method of making more than the stipulated 27,500 cubic feet per man per day; and then there would be the same difficulty as had been found when they paid the men a given sum per mouthpiece. When a certain standard was fixed, it was found, after a few years, that it was quite insufficient, and that the men could make considerably more gas. They always obtained the bonus; and consequently the standard had to be raised, which was very objectionable to the men. Some day Mr. Botley would easily make 30,000 cubic feet per man.

Mr. BOTLEY: I should then alter the rule.

Mr. LIVESEY (continuing) said he could bear testimony to the benefit of the profit-sharing arrangement to this extent—that it was a work of education. The men—the labourers and everybody else—would in time take an intelligent interest in the company's business; and if a man not only brought his powers as a labourer, but also his intelligence, into his work, it would have a great effect in the end. He could not answer Mr. Trewby's question directly, by saying what interest a labourer, or a man who unloaded coal at a certain rate per ton, had in the general work, though the labourer certainly could do something. He did not see his way out of the difficulty of the men who were always working on piece-work; although, no doubt, there were means of interesting them in the scheme. A great many good propositions had been brought forward; and they had been adopted. Mechanics, retort-setters, and fitters had made suggestions which had been very useful; and probably they would not have been offered unless the men had felt they had some interest in making them,

The workman should be paid fair wages to start with; and any profit shared with him should be in addition thereto. One could buy a man's labour, but not his intelligence. This must be the work of education; and, of course, it would take time.

Mr. H. IAGO (Fulham) remarked that Mr. Botley had raised a question which was interesting, in so far as it gave an alternative to Mr. Livesey's plan. He (Mr. Botley) rather suggested that a form of pension or superannuation should be introduced, instead of the profit-sharing system. Mr. Livesey's own figures showed, he thought, a certain weakness in his system, inasmuch as the South Metropolitan men withdrew so large a portion of their savings. They worked more economically, and put more heart into their labour. But this was done at the expenditure of their energy; and the chances were that these men would wear out more quickly than those who saved themselves at the Company's expense. What could be done with men when they were worn out prematurely, as many of them would be, who had withdrawn their savings? They would be placed in this position—that a large number of men would be very inadequately provided for, although they had been paid quite sufficient to enable them, if prudent, to provide for their old age. The system of superannuation which Mr. Botley had introduced, was a very generous one; but he (Mr. Iago) thought he would have to call upon his Directors to help him out of his difficulties, for he did not see how he was to pay his way. Some system which would give to the men a superannuation allowance instead of this bonus money, which went almost as soon as it came in, would probably be the best solution of the difficulty.

Mr. T. MAY (Richmond) said he thought no one but Mr. George Livesey could speak from experience with regard to profit-sharing in gas-works; but he (Mr. May) felt rather inclined to criticize the principles on which the scheme was founded. It seemed to him that to make the selling price of gas the basis of the arrangement was wrong. The men could not practically influence this, except to a very small degree. The prices of coal and residual products were the two chief items which now affected the price of gas; and it seemed to him that it would be hard if, after the men had been working at their best during twelve months to bring about $\frac{1}{2}$ d. or 1d. per 1000 cubic feet reduction in the price of gas, it went up 3d., 4d., or even 6d., because the price of coal had advanced in the market from (say) 6s. 6d. to 13s. If a scheme of profit-sharing were introduced, he thought it should be made on estimates of the working expenses, which would be something the men could control by intelligent labour. He could understand that, in the case of the South Metropolitan Company, this was not applicable at the time the scheme was brought forward because the Company were in a difficult position. They had to meet the moves of the Gas Workers' Union; and probably something different was then necessary. Mr. Livesey gave the men a "nest-egg;" and this, no doubt, had a great deal to do with the success of the scheme. But in ordinary cases, he did not advise this; nor did it seem reasonable. If a scheme could be introduced on the basis he had suggested—viz., of working expenses, or the cost per 1000 cubic feet of gas manufactured—something might be done; but he did not consider that it could be satisfactorily carried out on the selling price of gas, over which the workman had practically very little influence. With regard to yard labourers, mechanics, and others, he thought they should certainly participate in any profit-sharing scheme. Anyone who had direct control of men would know that one man fully earned his wages, while another did not one-half earn them. Some men were persistent talkers and idlers, who might do better if they had some interest in their work; and therefore one and all should, in his opinion, be included in any scheme of profit-sharing.

Mr. C. C. CARPENTER (Vauxhall) thought some of the members were rather going away from the point of the paper, which was profit-sharing. This was quite independent of the two-shift or the three-shift system. The scheme had been designed with the view of winning the sympathy, good-will, and energy of the workmen. Whether there were two shifts or three, managers were equally liable to strikes and disagreements. Mr. Eastwood had been very fortunate in keeping clear of labour troubles; but he (Mr. Carpenter) did not think it was because he

had three shifts. In other places where they had three—as in Bristol, for instance, and other towns farther North—there had been a considerable amount of difficulty. With regard to the profit-sharing scheme itself, a question had been asked as to what way could the workmen do anything to promote the interest of their company, and why were they entitled to share in the profits it might make? There was a very good example of this in their own works. They were working with what they called the old hands, on the eight-hour system, from the time when it was initiated, in June, until the December of 1889. The men during that period kept splendid time, because they felt that, if any cause were given, the Company would in all probability weed out the troublesome ones; and scarcely a man out of the whole three shifts absented himself from work. But in spite of that, the work was never done well; and they could not keep up the yield of gas per ton of coal to the normal quantity they obtained before the eight-hour shift started. This was an instance of how work could be done by men who kept very good time, and on the three-shift system. Now, this system was still in operation at Vauxhall. The men kept equally good time; the only difference was they had their heart and soul in their work. There was a considerable difference, however, between the make of gas per ton then and now. Whereas before the strike they had the greatest difficulty in keeping it up, now it was unnecessary to do anything in the way of maintaining the carbonizing standard. The men made, without the least difficulty in the world, the full quantity of gas they could get from the common coal used in London. This was a very important factor. If one could secure good-will, he would get thereby his value for any money spent in profit-sharing. It had been objected that the scheme ought never to have been based on any standard the effects of which would be variable; but that, if it was desired to give a workman a bonus, it should be fixed at 5 per cent. and be given under all conditions. But this was clearly wrong. If, owing to any outside conditions, the Company were not able to work so successfully at one time as another, the disadvantage should fall equally on the workmen (*provided it did not interfere with the normal standard of wages*), the shareholders, and the consumers. If the men became accustomed to a normal bonus of (say) 5 per cent., there would be no reason for putting their shoulders to the wheel in times of trouble; but if the bonuses were made to depend on the price of gas, the men would know that, when this was rising, they were going to suffer, and they would use far greater exertions than they otherwise would to save and to prevent waste. He had found it so in a great many ways. Any practical man going round the works could see at once, not only in the case of retort-setters, but, to take the case mentioned by Mr. Trewby, labourers and coal men as well, whether they were doing their best. In the time between the granting of the eight-hour shift and the strike, they had considerable difficulty in this way. The men did not take care of the tools—indeed, they seemed to try to break as many as they could. This applied not only to the stokers, but to the men unloading. They knocked things about, and did not care what they did with anything. Now a pleasant feeling existed; and there was nothing of this sort happening. Even a man working piece-work all the year round, in the most monotonous task of filling in coal, could do something to earn his bonus. Mr. May referred to the “nest-egg” as being the cause of the success of the scheme. But this was only given to the old hands; and the new hands (of whom there was a large proportion) were at least as keen as the old ones with respect to the profit-sharing arrangement.

Mr. W. FOULIS (Glasgow) said he could not altogether agree with Mr. Livesey's method of fixing the bonus by the price of gas. There were a great many circumstances which might affect this, over which the men really had no control. The price of coal, residuals, and many other things made it exceedingly difficult to fix a bonus upon such a basis. They had heard a great deal about the effect of the bonus on the work done; but probably this arose not so much from the fact that the men were to be paid on the profit earned, as that there was hearty good-will between the workmen and the foremen and managers. In such a case, the work was much better done than when the men's feelings were not altogether so friendly. It would be difficult to adopt any such system as that suggested in the case of corporations, because they did not always reduce

the price of gas when they made a profit. In Glasgow, they had known that in some years they had written off capital £60,000 or £70,000, which might have gone to reduce the price of gas. This was all profit; and the workmen would have just cause of complaint in a case of this kind. About two years ago, he thought it desirable to try to introduce a method of getting the men to take more interest in their work; and he inaugurated the system of allowing, as a favour, men who were recommended by their foreman as being good steady men, to enter into agreements for any time they pleased—three, four, or six months. The condition was that, if they served the term of their agreement satisfactorily, and did their work well, they would receive at the end of that time a bonus equivalent to a shilling a week. This system had worked so satisfactorily, that the difficulty had not been to get men to sign the agreements, but to prevent any but the very best men obtaining the advantages it offered. The consequence was this, that since the system had been introduced, they had had better and steadier men, more willing workmen, and altogether a much pleasanter state of things. The men who had not been allowed to sign stuck to their work well, so that they might be recommended by their foreman. This system did not go the length of Mr. Livesey's; but it had the effect of producing a great deal of good-will which might not otherwise have existed.

Mr. T. S. LACEY (Pimlico) wished to draw attention to what was probably the real reason why they did not have so much trouble in Liverpool as in London. The men there had the material weighed out to them; and, whether dissatisfied or not, there was never any doubt about their doing the work for which they were paid. In London the system had been nominally piece-work, though actually day-work. The men had been accustomed to putting in a certain quantity of coal with astonishing exactness, considering that it was never weighed out; and when there was no endeavour to shirk the work, the amount put in was as regular as if it were really weighed. When, however, the agitations commenced, the agitators tried to hammer it into the heads of the men that work was a thing to be avoided as much as possible, and that their duty to their fellow-workmen was to increase the amount of work to be done, so as to bring other men in, and to do individually as little as was possible. The result of this was that, although the men were being paid for a certain weight of coal, they did not put it in the retorts. In any system by which men were paid on the bulk of coal carbonized, or the quantity of gas made, it was absolutely necessary that they should do a certain definite amount of work per man.

Mr. J. METHVEN (Beckton) desired to allude to one or two methods of so-called profit-sharing in a somewhat different direction from that indicated by the author of the paper. He referred particularly to Mr. Eastwood's and Mr. Botley's suggestions. It seemed to him, however, that the conditions mentioned by these gentlemen must be dependent upon the locality. What would suit one company could not possibly suit another. At Liverpool the stokers were responsible for maintaining the heat of their fires, putting in the coal, and taking out the coke. In fact, each man had his share in the whole labour of the carbonizing work; and he could understand then that a man might be induced to devote more time and attention to routine. In Mr. Botley's experience, the fires were attended to by different men, although they formed themselves into a gang, and were included in the benefit derived from the extra quantity of gas made. It seemed to him that the suggestions of Mr. Eastwood and Mr. Botley might be more suitable for bringing the stokers within the reach of a profit-sharing arrangement. With regard to the question of the quality of the coal dealt with, it struck him that this difficulty might be avoided if they confined themselves to the quantity of gas made. The quality of coal varied; and in order to bring the gas up to the proper standard of illuminating power, there would be required a certain percentage of cannel, which was quite independent of the work done by the men.

Mr. DENNY LANE (Cork) said he would merely give the result of some experience they had had in Cork, in which they had adopted a method somewhat similar to that mentioned by a previous speaker. Several years ago they had a good deal of trouble with their men, who struck immediately after Christmas. Fortunately, they were able to get in others to do the work. They prosecuted those who left without notice, and succeeded in getting convictions

against them, and especially the ringleaders, who had a tolerably smart term of imprisonment. After this the principle adopted was to pay, not per 1000 cubic feet of gas made, but per ton of coal carbonized. They found it more economical not to produce a large quantity of gas per ton of coal, because they supplied it of good quality—far beyond the standard; and it was better to reduce the production, and so avoid to a great extent the use of cannel, which was very expensive in Cork, owing to the initial cost, and the very small quantity of the residuals obtained. They therefore agreed to give the men a certain sum per ton; and they subsequently made a further advance when they saw labour troubles impending. At the time of the general agitation, the Directors voluntarily added 2d. per ton to the price. Besides this each man was entitled, if he remained with the Company until the end of the season, or until such time as he was permitted to leave by the Resident Engineer, to a premium (once a year, and sometimes twice) of 2d. per ton. Since this system had been introduced, they had not had any trouble. On one occasion, a workman sued the Company for the amount of bonus; but when it was explained that it was given only as a premium, and that he had left without permission, the Court decided against him. So far, so good. But, on the other hand, the disadvantage of the system was that it gave the men a great temptation to overcharge the retorts; and the result was that, although they did not seek for a high production of gas per ton, they obtained less than they should. At some parts of the setting, the retorts might not be so hot as they should be; but the unfortunate thing was the men tried to put as much coal in them as in those which were better heated. The result was that they were at present considering whether they could not adopt a better system. He could not agree at all with the principle Mr. Livesey had put forward, that the wages of the stokers should be dependent on the general profits of the concern. Supposing there happened to be a dishonest secretary who robbed the company, or a corrupt board of directors who paid more for coal than they ought to do, or some great agitation occurred in the town, which forced a company to reduce the price of gas, either by threats of electric lighting or something else—were any of these facts anything for which the stokers could in any way be liable? Some system of paying on the number of tons of coal carbonized, and the quantity of gas produced, would, he thought, be best. In many instances, different kinds of coal had to be used; and in such cases there ought to be a fair allowance made to the men if material less productive than that ordinarily used had to be employed.

Mr. S. GLOVER (St. Helens) said he thought corporations should not be entirely overlooked in this matter; and therefore he should like the President or Mr. Livesey (as the "father" of the profit-sharing scheme) to give them some idea of how he would adapt to corporations this method of payment by result or profit. As Mr. Foulis had pointed out, in a corporation the thing depended on a great many considerations which did not come in, in the case of private companies.

Mr. G. LIVESEY, in reply, said he would try to summarize the criticisms which had been passed on the paper, and which were not so numerous as he had hoped they would be, because it was through criticism that improvement was made. Mr. Iago thought it was a weak point in the scheme that the men had drawn so much money. It had astonished him (Mr. Livesey) that they withdrew so little; for, out of the total amount which was credited to them on the books, and which they were perfectly free to take on giving a week's notice, they left half with the Company. This showed that half the men, at any rate, were thrifty, which was a larger proportion than he expected to find. The principal criticisms which had been urged by Mr. May, Mr. Denny Lane, Mr. Trewby, and one or two others, had reference to the fact that the workmen could not influence many of the most potent causes of an increase or a reduction in the price of gas. Neither could the shareholders, nor the managers, nor anybody else. How could they influence the price of coal? Yet they benefited or suffered as coal rose or fell. Their dividends or salaries were regulated in that way. At any rate, the shareholders' profit depended on many circumstances over which nobody had any control; and he therefore saw no reason why the workman should not have his share in the adversity or prosperity of the company.

Mr. FOULIS remarked that managers would not like to be paid in that way. He should certainly object to having his salary reduced according to the price of coal.

Mr. LIVESEY said probably Mr. Foulis did suffer from this cause. At any rate, managers felt it; for in prosperous times they had an increase of pay, and in hard times they did not, though they often had to do a great deal more work. But profit-sharing was something over and above the normal pay of the employees. Probably the footing on which they stood was more like that of the shareholders, who participated in the general benefit and prosperity of the company; and he maintained that the employees ought to participate in the same way. Mr. Denny Lane and Mr. May had said that the men could not influence prices. This was quite true; but they might do a great deal in other ways, as Mr. Carpenter had pointed out, to forward the prosperity of the business. In fact, the cheerful workman was worth 5 per cent. more than the listless one—

"The merry heart goes all the day;
The sad one tires in a mile, O;"

and the fact of having a cheerful workman compared with such as they had at his works before the strike, was equal to a considerable sum per ton of coal. Mr. Denny Lane made some strong observations about the dishonest secretary, the corrupt directors, and the electric light. But somebody must suffer from these things; and he (Mr. Livesey) did not see why the workmen should not bear their share as well as everybody else. What he wanted to see was that workmen should be treated as partners, and have a direct interest in the prosperity of the concern. If things went badly, if coals rose in price, what did managers, directors, and others do? They tried to counteract the adverse influences by doing what they could in other directions to improve their profits. As to the yard labourers, he quite agreed with Mr. Trewby. He could not point to anything direct; but he was sure of this, as was so well put by Mr. Grey—though perhaps farm labourers were rather different—that a yard labourer who would do his duty conscientiously and honestly, without being watched all day, and took an interest in his work, was worth far more than a man who was determined to do as little as possible, and therefore required constant supervision by the foreman. If a yard labourer felt that when he did an honest, fair day's work, the profits of the company with which he was connected would be increased, and he would get a larger bonus, it acted on him in that way. As to the coal fillers, perhaps they could not do very much; but at any rate, as Mr. Carpenter had pointed out, they could avoid breaking the tools and wasting coal. The plan the South Metropolitan Company had adopted with a good deal of their piece-work was to give it to the men in rotation—not to let any set of men have the whole. As to the plans recommended in place of profit-sharing, he could not agree with them, because they did not go far enough—they were mere palliatives. Mr. Botley and others had spoken about piece-work. He (Mr. Livesey) quite agreed that if a system could be introduced whereby stokers should be paid something extra, in proportion to the value of the work they did, it would be a good thing. But he had been puzzling his brains in vain for twenty or thirty years to find out a system which would work satisfactorily. Mr. Denny Lane paid his men an extra 2d. a ton, which secured them from striking; but they crammed the coals into the retorts, whether they carbonized them or not. He thought Mr. Botley would find in his plan difficulties which far exceeded those which appertained to the very simple system of profit-sharing. As to the question of pensions, he held that, in connection with such a concern as a gas-works, whether it belonged to a corporation or a company, they ought to make provision for their workmen, by calling upon them to appropriate a certain sum per week towards a sick and superannuation fund—the employers contributing a definite amount also, and providing for the men in sickness and old age. But this was a different thing from profit-sharing. They had at the South Metropolitan works a sick fund which was started by his father in 1842; and he also initiated a superannuation fund in 1855. These had been in operation for a long time; but they had not the slightest effect in inducing the men to take more interest in their work, and do it in a more energetic manner. He wanted the men to feel that the prosperity of the concern depended to a considerable extent on the intelligence and energy they might put into it. Mr. Glover had asked whether something of this kind could not be applied to a corporation

He (Mr. Livesey) saw no reason at all why it should not be. Of course, there were difficulties in the way. It might be adapted to the circumstances of one case, but these would not apply without modification in another; and the case of a corporation was not quite parallel to that of a company. With regard to what Mr. Foulis had said, the amounts written off capital, or carried to an improvement rate, were profits to all intents and purposes. If, therefore, a corporation adopted a system of profit-sharing, and if that share was calculated on the price of gas, the workmen would have ground to complain if the price was not reduced. They would have them on the same side as the consumers. But it was impossible off-hand to set out any system of profit-sharing, without knowing all the facts and circumstances of the case. He had, however, no doubt whatever that it could be applied to corporations, and also to companies not under the sliding scale, if there was a will. The difficulty was to move directors and town committees. He was sorry to say that directors, as a rule, were very difficult to move when things were going smoothly, *which was the right time for action*; and probably gas committees were equally difficult to convince. But that something of the sort was necessary, he had no doubt whatever; and it should be done at once if good relations were to be obtained and maintained. Mr. May said it would be better to base profit-sharing on the working expenses; and some seemed to think it should be confined mainly to the stokers. It would be found very difficult to base any system on working expenses. There was nothing like simplicity; and the moment one began to deal with these questions on the basis of working expenses, endless difficulties and complications would be encountered. The system now adopted seemed to be understandable by the men. He did not say they thoroughly understood it, or that all the men, or even a large majority of them, quite appreciated the system. But a considerable number were responding in the spirit he had hoped; for the movement was educative, and so far it had been a great success. As to the men accepting a reduction from 5 to 2 per cent., so far as he could see, they understood the position, and accepted it cheerfully. He asked them, before the price of gas was altered, what they would say in such an event; and the reply was: "Oh, we shall be very sorry; but we shall try to get it back again as soon as possible." Mr. Foulis said he had the good-will of the men with his agreements and shilling a week bonus. No doubt this was so; but he had not their interest. The shilling a week he gave them, obtained their goodwill; but the prosperity of the concern did not come into it at all. If the Glasgow Corporation had a very bad or a very good half year, it did not matter to the men. They had their bonus at the end of the term, whether the concern was prosperous or not. If they were going to give a bonus of a shilling a week—this was getting on to 5 per cent.—why not try to obtain all the good they could out of it? He quite approved of Mr. Foulis's plan, so far as it went; but it did not go far enough.

The PRESIDENT said it seemed to him that Mr. Livesey had made out a very good case for profit-sharing. All other schemes which had been mentioned appeared to be only partial in their effect; and they were not entirely satisfactory, even to those who were trying them. On the other hand, the scheme before them, which had now been in operation for a considerable time, was, as Mr. Frank Livesey so well put it, an education all round. It touched every department of the work, and seemed to bind all together in one common interest. They were greatly indebted to Mr. Livesey for bringing the subject so admirably before the meeting; and he had great pleasure in moving a hearty vote of thanks to him.

This was accorded by acclamation.

THE PAPERS BY MESSRS. BROWNE, LEWES, LACEY, AND PRYCE, ON OIL GAS MANUFACTURE, ETC.

The PRESIDENT said the question of using oil to replace cannel was one of the foremost of the time; and he hoped it would be thoroughly discussed.

Professor FOSTER said he had not had time to read the papers; and having heard but a part of them, he was not prepared to say much upon the subject. One point struck him in the President's address as being important. Mr. Hunt had arrived at some conclusion as to the right use of oil when employed for enriching purposes, and distilled in the usual way—viz., that it was more economical to

distil it in a separate retort, and make a specially rich gas, than to mix the oil with the coal in the ordinary retort. It seemed to him (Professor Foster) that this was a very important question. It ought to be settled at once whether the oil should be distilled along with the coal, so as to have a mixed product (if it might be so called, though he did not know that it was really mixed), or to distil it alone. In making carburetted gas from oil and water gas, the course was perfectly plain. But enriching coal gas was a different question; and they ought to settle in their own minds whether to make a rich gas, and put it into the purified coal gas, or mix the oil with the coal. He had rather a strong opinion on the matter; but, as it was only derived from laboratory experiments, he did not like to urge it at present.

The PRESIDENT said he had perhaps better put Professor Foster right with regard to what he had said in his address. He really showed, by experiments, that mixing the oil with the coal produced a more economical result than making oil gas. He did not advocate this plan of using the oil; but certainly the result showed that whereas, making oil gas, the cost of enriching was 0.86d. upwards per candle unit, by mixing oil with the coal, and carbonizing in the ordinary way, enrichment could be obtained at a cost of only ½d. per candle unit. He suggested that the reason for this might be that the gases being evolved from coal at a somewhat lower temperature than the surface of the retort, might protect the oil gas from being decomposed. He did not know if he was right; but Professor Lewes apparently confirmed this view by his suggestion of the economy of "cracking" the oils in the presence of nascent gases; though whether this was quite the same idea, he must leave the scientific gentlemen to decide.

Professor FOSTER said the questions should be kept perfectly distinct. To make gas from oil and water gas was one thing. There one had a definite object—quantity and economy being prime considerations—and one could direct the plant, and work it in a certain way. But where the use of oil was small relatively to the coal employed, it did seem to be a question yet to be decided whether it was more economical to do this by a separate arrangement, so that one could specifically put in what was required for enriching purposes, and no more, or to mix the oil with the coal. Gas shareholders kept a watchful eye on the profits made in this industry.

Mr. FOULIS said he did not know exactly how the experiments referred to by Mr. Hunt were made; but the system of mixing oil with coal, was that adopted in what was called M'Kenzie's process of manufacturing gas. He must say that the experiments Mr. Hunt was making would need to be continued very much longer before they would influence his mind as to the practicability of carrying out such a system. At all events, he firmly believed that much more certain results would be obtained by making the oil gas separately, and mixing it with coal gas, also made separately; and he believed, on the whole, it would be found more economical. There could be no doubt, he thought, as Professor Lewes had said, that when oil was cracked in the presence of some gas the results were better. It was found, by experiments made in Glasgow, that very much better results were obtained when the oil was sprayed into the retort by a jet of steam. Of course, in every case, the oil was carried in a pipe to the very back of the retort, so that the whole of the oil was vaporized before it came in contact with the hot surfaces. The papers were all exceedingly interesting—bringing the subject nearer to a practical solution than it had yet been; but it did seem to him that two things were very important. In the first place, it was highly necessary to secure an abundance of shale oil at a cheap price, as unless this could be done, their labours were largely in vain: Secondly, unless it was found more profitable to go into the manufacture of water gas, and enrich it, whatever method was adopted for producing oil gas, it was important that it should, as far as possible, be available for manufacturing either coal gas or oil gas. In other words, it would be a great advantage if the ordinary retorts could be used without having a special form. He found clay retorts gave equally good results with iron, if the oil was first vaporized in an iron tube running through them.

Mr. DENNY LANE said there seemed to be some slight discrepancy between the experience of Mr. Foulis and that of Mr. Browne in this respect. The latter gentleman said there was considerable loss of oil by leakage through a

clay retort. But possibly if the retort had previously been used for the distillation of coal, the pores would have become stopped up, and have prevented the escape. It might be possible to have a receiver, like a skip, in front of the retort, to contain the oil until it became vaporized, which would possibly prevent the escape of oil in vapour. In Pintsch's process, they put in a clean iron tray, on which to run the oil, though the retorts were made of iron.

The PRESIDENT remarked that Mr. Foulis was referring to the experiment of injecting oil together with steam into the retort.

Mr. J. METHVEN said he had made some experiments on this subject; and they had convinced him that it was absolutely necessary, in order to obtain an economical result, to have proper conveyors for these oils when cracked up. His earliest experiments were made by mixing oils of different character with coal in an experimental retort; and he was very much disappointed with the low result in illuminating power which he then obtained. Repeated experiments eventually convinced him that there was some mischievous operation going on in the hydraulic main—that one of the hydrocarbons (possibly a heavier one) laid hold of the lighter ones which came off from the oil, and consequently absorbed the light-giving properties of the mixture. He extended his experiment, with the view to forming a conveyor or carrier of these hydrocarbons, which were cracked up in the retort. The oil was injected into the retort by means of steam pressure; and, to make it more effectual, he superheated the steam. Oil gas and coal gas were made alternately in this apparatus, and were mixed in the holder after purification. These experiments gave him better results than the first series; but still they were unsatisfactory—some of the hydrocarbons or light-giving material being lost. The next series of experiments consisted in passing purified coal gas into the ascension-pipe of the retort in which the oil was being carbonized or cracked up; and these gave much the best result. At the first start they put the purified gas into the retort itself. But they found a decided loss took place from the action of the heated iron retort on the gas; and they concluded at once it would never pay. Eventually they placed the connection conveying a measured quantity of coal gas of known illuminating power in the ascension-pipe, where it met the vapours coming from the oil; and the experimental results were exceedingly satisfactory. They were erecting an apparatus at Beckton to make it on a large scale; and he hoped it would have been ready, so that he would have had the figures to lay before the present meeting. But on some future occasion he hoped to be able to do so. He could not help thinking that this was the direction in which they must look for the economical use of oil as an enricher. There must be a conveyor for it. If they cracked it up and put it with the gas in the hydraulic main, the heavy hydrocarbons in the uncondensed gas—the tar, and so forth—would absorb the light-giving constituents of the oil, and a great portion would be wasted; but by providing at once a suitable conveyor, freed from deleterious hydrocarbons, a permanent gas could be made with very economical results.

Mr. W. W. FIDDES (Bristol) said it appeared to him that the question resolved itself into this—that they must crack up these oils separately, that it must not be a simultaneous process with the making of coal gas, for this reason: The President had just mentioned that it was absolutely necessary that none of the tar oil should get in with the ordinary tar, and that wherever the contact of the two gases came in the process of manufacture, one tar would eventually deteriorate the other. Again, it seemed that, with regard to the tar oil, they did not know at present that it was not a much more valuable product than tar from coal gas; and it appeared to him that the first thing to ascertain was the relative value of these, and whether the spoiling of the coal tar would not prevent its being used in the retort with coals, as had been mentioned by several speakers.

Mr. GLOVER said he was disappointed with the Rotherhithe experiments; and the salvation of the whole thing seemed to him to rest with Professor Lewes's paper, which to his mind was the most important contribution to their knowledge on the subject. For some time he had been looking for an apparatus which would provide gas makers with the means of quickly producing gas in large quantity and of high illuminating power. When there was so much talk of water gas being made at a very low price at the


Leeds Forge (they had all heard of the Samson Fox arrangement at Leeds), he went over to look at it—not believing all that was said of it, but to learn how it was worked. There he was very much pleased to find what some would like to see—the holder rising before his eyes. Of course, it was a small holder in comparison with what most of those present used; but in proportion to the apparatus, the holder rose very quickly. There was also the production of a large quantity of gas of scarcely any illuminating or heating power. He should like to ask Professor Lewes whether he thought the production of water gas, the addition to it of some of the producer gas—the gas resulting from the heating up of the producer which made the water gas—and the further addition of illuminating power from oils, would furnish a solution of this difficulty. A solution was certainly being looked for throughout the country. He came from a county whence they had been sending to London large quantities of cannel. But the supply was becoming scarce; and they would soon have to provide themselves with illuminating power from other sources. Not long ago he was in a mine where there was once cannel to the thickness of 6 or 7 feet. But this was exhausted; and other mines were also nearly worked out. He had himself made some experiments in the direction of using oils and tar, and had watched the experiments with the so-called Dinsmore apparatus; and they confirmed the opinion of Professor Lewes, as well as that expressed by Mr. Methven, that this high-quality gas must be made in, or at once introduced into, the presence of a carrier. Whatever success had resulted from the Dinsmore process had been achieved when the tar had been decomposed in the presence of nascent or new-made gas. He had always fought shy of this process, on account of the presence of so much carbon and pitch, which could not be made into illuminating gas; and he should like to ask whether any of the oils recovered from the distillation of coal tar—for instance, the light oil used for syringing into exhausters to dissolve pitchy matter—might be helpful in this direction. It seemed to contain a large quantity of illuminating property in the presence of some carbon. Seeing that they were not going to have so large a revenue from tar in the future, if they could make use of the oils they formed themselves in enriching gas made quickly in the water-gas process, it would be of great benefit. One of the theories they were accustomed to hear about the mixture of gas of high illuminating power with other gas of low power, was being knocked on the head in practice. They used to be taught that to make a very rich gas and a very poor gas, and mix them, would not produce the best result. Possibly, if they wanted to make 19-candle gas, they might make 18-candle from coal and 20-candle from enriched water-gas, and mix the two together; and they would then be using up some of their coke in the producer.

Professor LEWES said gas managers had many heart-breaking jobs at the present time; but Heaven help the man who tried to enrich producer gas up to anything like illuminating gas. In making water gas, they had to deal with two combustible diluents—carbon monoxide and hydrogen; and it was the intensely poisonous property of the former which had given rise to several accidents at Leeds and other places, which was, of course, a great check to its introduction as a diluent. On the other hand, producer gas was simply a mixture of a small proportion of carbon monoxide and a large volume of inert nitrogen from the air; and inasmuch as even 2 per cent. of nitrogen brought down the illuminating properties of coal gas to a serious extent, he left it to anyone to judge what the 66 per cent. present in producer gas would do. He was afraid, therefore, that a mixture of producer gas and water gas would not be practicable. On the other hand, it was asked whether some of the lighter oils from tars could not be used for enrichment. If one could only produce from tars the lighter oils, rich in benzene, at a price which would compete with light gasoline and carburene, no doubt this would be at once effected; but even at present, looking at the deterioration in the price of light oils from coal tar, benzene, and so on, he did not suppose it could be bought in large quantities at less than 1s. 5d. per gallon, whereas light paraffin could be had at 8½d. It was chiefly this which militated against it.

Mr. GLOVER said they sold their tar to a distillery, and bought the oil he had mentioned at 4d. a gallon. This question was forced on his mind by seeing about the streets large boilers containing paraffin, which was being

sold retail at the low price of 6d. per gallon. If it could be sold at this figure, men with distributing mains could gasify it, and deliver it more economically than they could do in its liquid state; and possibly paraffin sold at 6d. per gallon retail might be purchased by them at 4d.

Mr. C. C. CARPENTER said there were one or two points about which he should like a little information. Mr. Lacey gave the cost (from figures furnished by Mr. Wright, of Bromley) of raising the quality of common gas from 15½ to 16½ candles at 1.25 gallons of carburine per 10,000 cubic feet. Mr. Browne, in his paper, stated that to raise gas from 15 to 16 candles required 2.5 gallons of carburine. Mr. Browne probably used the "London" Argand burner in testing. It was therefore evident that one experimenter found it necessary to use double the quantity of carburine to do about the same amount of work. They all knew that doctors disagreed; but so great a discrepancy seemed to require explanation. There was another discrepancy of some importance. Mr. Lacey had given some information as to the augmentation in the volume of coal gas when enriched by means of carburine; and he said the increase was very small—about 0.3 per cent. But Mr. Browne quoted figures showing that one gallon of this petroleum spirit yielded 100 cubic feet of vapour, which was more than three times as much as Mr. Lacey found. Both of these points were very important, as bearing on the question of cost; because some of the advocates for using these light oils said one must not only take into consideration the great improvement in illuminating power, but also the considerable increase in volume of gas sold. He should like to ask Professor Lewes a question with reference to his experiment in passing coal gas through a heated porcelain tube packed with fragments of porcelain. He said that, when this was done, the gas became non-luminous; but when previously mixed with twice its volume of hydrogen, the amount of carbon deposited was only 1-200th of that found in the original experiment. The point not quite clear to his (Mr. Carpenter's) mind was this—that the quantity of hydrocarbon present in the gas was such a very small percentage of the total volume, while there was still a large percentage of hydrogen. He did not quite see how the difference in the two experiments was accounted for; but doubtless Professor Lewes would easily set him right. One small point deserving mention with reference to Mr. Lacey's paper was the ventilating of the oil-tanks. It seemed to him that, instead of ventilating these tanks by a pipe beside the gasholder column, it would be better to take the ventilating-pipe into the district main, and so get the benefit of the vapour in a useful way, instead of wasting it in the atmosphere.

Mr. C. E. BOTLEY said he had not much to add to what he said last year on the subject before the meeting; but one or two points had cropped up on which he might afford some information. He was glad to find that the experiments made by the several gentlemen on the value of various oils accorded very well with his own observations. The quantity he gave, on the average of a number of tests, carried on over a practical working of several years, was 75 cubic feet of 50-candle gas per gallon of oil. This was fairly in accordance with what had been stated. With regard to utilizing clay retorts, he tried them very assiduously for a long time, both vertical and horizontal; but he found there was no possibility of keeping them tight. He had tried them in the way Mr. Denny Lane had suggested, by charging them with small coal or tar; but they lasted only a very short time, as there seemed to be some power in the oil of penetrating the pores of the material. They were therefore finally abandoned. In the manufacture of oil gas, no doubt the time of contact was the most important factor; and also the heat that was necessary. One oil was totally different from another; and this knowledge could only be gained by experience. The system adopted by him was to send the oil into a long -shaped retort, about 6 inches wide and 4 feet long. It was then passed out at the back of the lower retort into the upper one, and went away into the ascension-pipe. In this way he anticipated that, if any oil were not gasified in passing through the first retort, it would fall back, and undergo the process again. The mode of testing the oil gas was very important. In his own case, the principal object was to know the light that would be given in a railway carriage. He therefore took the burner adapted for lighting railway carriages, consuming 1 cubic foot per hour; and this was afterwards calculated out on the

5 feet per hour basis, and the correction made the same as for every other test. In Mr. Browne's paper, there was a remarkable statement which did not accord with his own experience—viz., that he found no difference when the gas was passed through an oxide purifier. He (Mr. Botley) had tried this many times, and found a new oxide purifier depreciated the oil gas very considerably.

Mr. C. GANDON (Sydenham) said he had recently had some experience of manufacturing gas from oil; and, therefore, might add something to the discussion, though he feared he should only add confusion. Mr. Carpenter complained that the papers did not agree in two cases; and his (Mr. Gandon's) experience would make a third divergence, as he had had some conflicting results himself, so that he was not surprised if others did not agree. The papers dealt with two modes of increasing the illuminating power of coal gas—one, by the destructive distillation of the oils; the other, by simply vaporizing them, and adding the vapours to the gas. He had tried both plans. Some twenty years or more ago, he tried various devices for the destructive distillation of petroleum oils, for the purpose of enriching wood gas, and he was successful to a certain extent; but he always experienced the difficulty of getting both a deposit of carbon in the retorts and stoppages in the ascension-pipes and connections. To some extent, this was overcome by working at a certain temperature. There seemed to be a particular point at which these disturbances were reduced to a minimum; but directly this was either exceeded or reduced, the difficulties began—either the pipes were stopped, or there was a large quantity of condensation. It might be said that, if the temperature required was known, it was easy enough to keep to it; but it was extremely difficult to keep any particular temperature constant. He had recently been trying the same thing—using crude Russian oil with an apparatus which professedly came from Russia. He did not think it differed much from what had been described. It consisted principally of an elbow retort; but what virtue there might be in this, he did not know. The idea probably was to combine the two retorts in one, instead of having separate ones as in the Pintsch system. With this apparatus they had obtained very variable results—ranging from 70 to nearly 136 cubic feet of gas from a gallon of oil, according to the heats, and the rate at which the oil was run in. He could not give the exact dimensions of the retorts; but they were about 9 inches in diameter, and from 4 to 5 feet long. The conclusion he came to was that, on an average, it was possible to obtain about 100 cubic feet of 40-candle gas per gallon of oil. They had no apparatus for actually testing the illuminating power—it was only done by a jet photometer; so that he could not give accurate figures. He found that, by mixing 3 per cent. of this oil gas with 97 per cent. of coal gas, the illuminating power was increased by something like two candles. It was difficult to get at the cost; and the figure he had arrived at was more an estimate than anything. But the conclusion he came to was that it cost about ¾d. per candle per 1000 cubic feet. They had also been trying the Clark-Maxim carburetter, of which he could speak highly, as giving satisfactory results. So far as he could get at it, the cost to enrich gas by one candle was about 1¼d. per 1000 cubic feet. This did not seem to agree with the figures given in the papers; but he might say they had only been able, up to the present time, to make two experiments. At first he found that, to increase the illuminating power by half a candle, the cost was 0.96d per 1000 cubic feet. At the second trial, made only two days before the meeting, it cost about 1¼d. per candle per 1000 cubic feet. There was thus sufficient divergence in his own results to account for differences in those of other people. The increase in illuminating power seemed to be maintained at the distance of a mile from where the gas was made. A doubt had been expressed as to whether, the carburine being mixed with the gas in the shape of vapour only, the improvement would be maintained; but his experiments seemed to show that it was.

Dr. DVORKOVITCH said this question of enriching gas by means of oil was one of very great importance. He had made a considerable number of experiments at the Moscow University; and he found there was a very great difference in the results according to the size of the apparatus used for gasifying the oil. He put some figures on the black-board, showing the various results obtained from using a ¾-inch and a 1-inch pipe. With the ¾-inch

pipe he obtained 45 cubic feet of gas, which gave 37 per cent. of tar of a specific gravity '930. In another experiment, with the same heat, but using the 1-inch pipe, he obtained 72 cubic feet of gas with 30 per cent. of tar, of the same specific gravity. The 37 per cent. of tar contained 25 per cent. of products distilling over at 80° to 140° Celsius, and 13 per cent. at 140° to 200°. After re-distilling, he obtained from these two together 20 per cent. of pure benzol. From the second experiment, with the 1-inch pipe, he obtained 24.7 per cent. of crude benzol, and 10.3 per cent. of crude toluol; and after re-distillation of these, he obtained only 18 per cent. of pure benzol. It was very important to ascertain how petroleum could be utilized for enriching purposes; and he was quite sure the only way in which this could be done economically would be by depending upon the residuals produced. The most important question, therefore, must be the tar; and if so large a percentage of pure benzol as he had stated could be obtained, this would go far to solve the problem of expense. The temperature employed to get the 37 per cent. of tar was a dark red; while in the second case, it was a bright red. The first was about 1350° Fahr.; and the other about 1500°. But the most important point was the size of the pipes. He had tried retorts, and found a bad result; so that it seemed necessary to use the smallest possible pipes for carbonizing the oil. This was probably because it was only possible to gasify oil by the surface, not in the centre of the retort, where there were only vapours which spoilt the tar, and gave the gas a low illuminating power.

Mr. A. COLSON (Leicester) asked if he rightly understood that the suggestion was to first of all distil, at a low temperature, for the production of tar, and then to re-distil the tar for the production of benzol, which was to be utilized for the enrichment of gas.

The PRESIDENT said this was not so. As he understood, the benzol was far too valuable to use in that way. It would be sold as a bye-product; and it could be obtained from a cheap oil, which would not only yield this large quantity of valuable residuals, but could also be utilized for enriching gas.

Dr. DVORKOVITCH said he had not ascertained the illuminating power of oil gas made from small pipe-retorts; but it would be very high.

Professor LEWES said the point seemed to him to be this—that, after making the oil gas, there was left the tar of such a value that it could be used as being the real object of the manufacture, still utilizing the gas which came off as a bye-product for enriching the coal gas.

Dr. DVORKOVITCH again explained the difference between the two tars after re-distillation, as showing the alteration due to the use of a $\frac{3}{4}$ -inch pipe and a 1-inch pipe. He had many other figures, having tried $1\frac{1}{2}$ -inch, 2-inch, and 3-inch pipes. So long as it was not possible to obtain valuable tar from petroleum, it would be impossible to enrich coal gas cheaply by it; but when valuable tar was so obtained, the petroleum might be introduced economically. He had worked a long time in Baku; and his impression was that, as soon as a large quantity of petroleum was used in England for enriching purposes, the price would rise from $3\frac{1}{2}$ d., as it was at present, to at least 5d. per gallon. So that it would not be prudent to calculate upon the price remaining always at the present low figure, as advocates of oil gas enrichment seemed disposed to do. In reply to Mr. Denny Lane, he said the length of the pipe employed was about 2 ft. 3 in.

Mr. EASTWOOD said he had listened with much pleasure to the papers and the discussion, because it would be a great advantage to gas managers if they could reduce the quantity of cannel they were now obliged to use. The papers resolved themselves into two—one, the means of making a very rich oil gas; and the other, a method of carburetting gas when made. Experience proved that a rich oil gas could be made which might be substituted for cannel; but he had never yet found any reference to the enriching of ordinary coal gas—say, from 16 up to $22\frac{1}{2}$ candles. Mr. Lacey had referred to enriching it from 20 to $22\frac{1}{2}$ candles. But he (Mr. Eastwood) did not find any allusion to enriching gas from the lower quality up to $22\frac{1}{2}$ candles; and he should be glad to know if any experiments had been made to bring the illuminating power of ordinary coal gas up from 16 to $22\frac{1}{2}$ candles. One matter which had a bearing on Mr. Methven's experiment in conveying gas into the ascension-pipe, was this: Wherever they were

using rich shales, they were never able to get as good results if they put the shale along with the coal into the retort as they did when they put the shale into the retort by itself. They distilled the coal by itself, and the rich shales by themselves; mixing them in a hydraulic main free from heavy tar.

Mr. TREWBY said he had not had time to read the papers; but he should like to make a remark on what Dr. Dvorkovitch had said with regard to the valuable tars from crude oil. It had been for some time a pet idea of Dr. Dvorkovitch that the bye-products obtained from the distillation of tar would go a long way towards cheapening the price of the oil; and he had succeeded in finding benzol in this tar. But he (Mr. Trewby) was bound to say that their own people, who had had samples of the tar, had not been so successful; and he should like to hear from some of the chemists present whether or not it was in consonance with their ideas that such a thing was possible.

Mr. CARPENTER asked if Mr. Trewby had not found any benzol at all.

Mr. TREWBY said only traces.

Professor FOSTER said one point in his mind was the important difference to which Dr. Dvorkovitch referred as being produced by the two pipes. There was no magic in either the $\frac{3}{4}$ -inch or the 1-inch pipe. It was simply a difference of diameter; and he apprehended the reason must be that the result depended upon surface-action, which gave the requisite heat, and caused the vapour to undergo a change. He did not see that there could be any other explanation, except the heating of the gas or vapour passing through the pipe.

Mr. T. MAY asked if the tar of which Mr. Trewby spoke as being tested, was produced in the same way as Dr. Dvorkovitch had mentioned; because the point appeared to be that, using this small pipe, the gas was obtained as quickly as possible, and this kind of tar resulted.

Mr. TREWBY replied that the tar to which he referred was produced in the ordinary apparatus for manufacturing water gas.

Dr. DVORKOVITCH said there was a very large manufactory in Russia, not far from Novgorod, where benzol was produced from Russian naphtha. It was not simply an experiment. This factory belonged to Ragosin and Co., who carried on a large trade in it. He was by no means the only person who had found benzol; many other experimenters having obtained large quantities of it, as well as of anthracene, from Russian petroleum.

Professor FOSTER asked how much per cent. of benzene there was in Russian naphtha.

Dr. DVORKOVITCH said he had the figures taken from the printed report of Ragosin's works in 1884. They showed that 1000 kilograms gave 400 kilos. of 50 per cent. benzol. There was no carbolic acid; but 30 per cent. of anthracene, and 20 per cent. of creosote oil and pitch.

Mr. H. PEATY (Burslem) said that he might contribute a few remarks with regard to the carburetting process. In January last he had a Clark-Maxim carburetting plant put up. The cost was a little less than 1d. per candle per 1000 cubic feet. He could not give the amount produced per gallon, as he included it with the make. The fact remained that they were able to produce an extra candle or two whenever necessary, when the cold weather came, and so raise the gas from $15\frac{3}{4}$ to 17 candles. At present, for the last two or three months, the returns furnished by the Gas Examiner were about 17 candles; while the Corporation never pretended to give more than 16 candles before. They used carburine, which cost just under 1s. per gallon delivered. The great advantage was that a manager was able to bring his gas up to exactly the standard required by his committee or the authorities.

Mr. A. G. GLASGOW said he might reply to the question whether anyone had made experiments with regard to enriching 16-candle gas up to 20 or 22 candles. For two years, from 1888 to 1890, he had charge of the Kansas City Gas-Works. They made there about equal parts of 16-candle coal gas and about 40-candle water gas, which was mixed and distributed as 27-candle gas; producing a very satisfactory flame, free from smoke. The reason why just this proportion was adopted was to get as high a sale for the coke and tar as possible; because they were away from any foreign market for bye-products. They had to dispose of them locally; and their object was to

make the quantity they could sell at the highest price. With regard to the point which had been raised by Mr. Carpenter, as to the discrepancies met with concerning the economy of the Clark-Maxim process, Mr. Lacey had stated that at Bromley $12\frac{1}{2}$ gallons of oil were required to raise 16-candle gas one candle. His (Mr. Glasgow's) own experience figured out, as near as he could get it, that he required, in order to raise 20-candle gas about 3 candles, 1.75 to 2.25 gallons of oil per 1000 cubic feet, or about 0.75 gallon per candle. This was about one-half what was needed at Bromley. At Rotherhithe, the quantity required, if he recollected rightly, was about $\frac{1}{4}$ gallon per candle. This smaller figure was the amount wanted to raise a higher candle power gas, which, of course, would need more oil, as Mr. Browne had very well stated in his paper. The higher the quality of the gas, the more it required to raise it. It was just like mixing hot and cold water; the cooler it was, the more hot water had to be used to raise it to a certain heat. He understood this was the point to which Mr. Lacey had called attention in his curve diagram. The higher the lower candle power gas was, the more of a given candle power had to be put to it to raise it to a given quality. Referring to Table D in Mr. Lacey's paper, taking the average result quoted there, as he understood it, there were 15 gallons added per 10,000 cubic feet, or $1\frac{1}{2}$ gallons per 1000 cubic feet; and the entire increase of illuminating power was 5.13 candles. Dividing this out, he obtained something like 0.29, or about one-third of a gallon per candle power per 1000 cubic feet.

Mr. LACEY remarked that this was when using 15 gallons of oil.

Mr. GLASGOW said it was put in by different increments.

Mr. LACEY said it was not fair to take the 15 gallons, and divide it by the number of candles, or else the curve shown on his diagram would be a straight line.

Mr. GLASGOW admitted that he might have misunderstood it. He went on to say that another question which interested him a great deal was to know where the determination of candle power was made in the case of the vapour, and whether it was observed promptly after it had been started or after some interval of time. The necessity for having some conveyor of the oil when cracking was very important. There was nothing truer than that, in order to get proper efficiency from oil when cracked in a retort, or whenever it was, it must be cracked in a current of gas, which would support it, and carry it away. Otherwise it was apt to fall; and if the retort was not perfectly sound, it would pass through and condense on the outside. In both systems of water-gas manufacture—Lowe's system and that of Tessié du Motay—the oil was introduced with the gas; in the latter, as it went into the retorts it was fixed. At first sight, this would seem to make it necessary to use a considerably larger retort, as about one-third of the gas made from the oil mixture would pass through four times as soon.

Mr. BROWNE said the question of retorts had been alluded to by several speakers. He had very much hoped that he should find it practicable to make his oil gas in clay retorts, for the obvious reason that, if this process could be carried on in ordinary retorts, more people would try it, and they would sooner arrive at some definite conclusion. Mr. Botley had found himself unable to employ a clay retort, whether vertical or horizontal; while Mr. Foulis had been successful with a horizontal clay retort. He thought one could get what was wanted from an ordinary horizontal clay retort, if the oil was sprayed into it; but if it were run in by gravitation, it would go through the retort. Spraying was a costly process. This had led him to the idea that there might be placed in the retort an iron tray, in which the oil could be vaporized before it was gasified. The objection to this was that the process must be a continuous one under these circumstances. They had to settle the question whether the enriching should always go on to the same degree and extent, or be intermittent. If it were intermittent, the retort would have to stand off from time to time, and then it would become leaky, if, in the meanwhile, it could not be used to carbonize coal. Mr. Glover said he was disappointed with the Rotherhithe experiments; and so was the man who made them. The President had alluded to the many discouragements and difficulties met with in making a series of experiments in this direction; and he was glad to find that his results

were not so good as might be obtained. Mr. Glover had said that he thought Professor Lewes's paper put a more cheerful aspect on the matter. Of course it did. He (Mr. Browne) was glad to find that his results might confidently be expected to be improved upon. Turning to the second table in his paper [*ante*, p. 899], it would be found that, with regard to 50-candle gas, the average was 60 cubic feet per gallon; the highest being 76 feet, and the lowest 52 feet. In order, however, that he might not overstate the case for oil gas, he took the yield as being slightly less than his lowest figure—viz., 50 feet per gallon. But he obtained on one occasion 76 feet; the average was really 60 feet. Mr. Carpenter raised some pertinent questions—one as to the great discrepancy between his (Mr. Browne's) results and those given by other gentlemen. A great deal turned upon the burner used. This was with reference to the Clark-Maxim apparatus. In making the latter experiments, he always used an Argand burner. But before enriching the gas, he took it at the uniform height of 3 inches, noted the consumption, and calculated it to 5 cubic feet per hour. He then did the same with the enriched gas. If coal gas were enriched highly, it could not be tested fairly at the 5-feet rate, as the gas would tail over the chimney. On the other hand, if a gas of low illuminating power were tested at that rate, one did not get the illuminating power it was capable of developing. This might be the reason for some of the discrepancies alluded to; and some definite basis must therefore be adopted in making such comparisons. Then Mr. Carpenter referred to his having stated that 100 cubic feet of vapour were obtained from one gallon of .680 spirit, which was a much better rate than Mr. Lacey had given. But the statements made in the paper were slightly incorrect. The figures had been incorrectly copied from a paper recently read by Mr. Clark, giving the result of the Maxim-Clark process; and there Mr. Clark stated that $1\frac{1}{4}$ gallons produced 100 cubic feet, which worked out to 80 cubic feet per gallon of .680 spirit. His own experience confirmed this. If it were true that they obtained 80 cubic feet of vapour from a gallon of spirit, it certainly was extraordinary that he found it took a quart to enrich 1000 cubic feet one candle, whereas others found it required a pint. If the statement that it only took one-eighth of a gallon to raise the gas one candle were correct, the value of the vapour per 5 cubic feet must, as a matter of figures, be 117. If, on the other hand, the statement was confirmed that it took one-fourth of a gallon, the value of the vapour per 5 cubic feet was only 67 candles. Perhaps Professor Lewes would tell the meeting which he thought most likely—whether .680 spirit would produce 80 cubic feet of 117 or of 67 candle gas. Again, with regard to what it actually did take, Mr. Lacey, in Table D in his paper, found that, to enrich 10,000 cubic feet from 15.3 to 17.8 candles, it took 5 gallons, or 1.25 candles for 2.5 gallons per ton; and this was singularly near his own figures. Professor Lewes, in one of the Cantor Lectures delivered by him at the Society of Arts in 1890, stated that the cost of enriching 16-candle gas up to $17\frac{1}{2}$ candles per 1000 cubic feet by cannel was 4d.; and by the Maxim-Clark process, 2.6d. If the $1\frac{1}{2}$ candles were reduced to 1 candle, the 2.6d. would come out about 1.75d. for the .680 spirit; and this was again very near his own result. The only other matter to which he need refer was in connection with the tar or residual oil condensed from the manufacture of Russian oil gas. He had found that the condensed oil had enriching power on coal gas, if the gas were washed with it. The Russian oil, as delivered, had no effect of this kind at all, if the gas were passed through a washer filled with the oil before it was retorted; yet if they subsequently procured the residual oil from the retort, and tried the process again, the coal gas would be found to take up a certain amount of illuminant.

Professor LEWES said Mr. Carpenter, referring to his statement about the deposit of carbon in the porcelain-filled tube, wished to know how it was that, with such a small quantity of hydrocarbons present in the gas, he could have arrived at the result he did. The large portion he obtained was only 0.03 of a gramme; and Mr. Carpenter would understand that as he obtained 1-200th of that only in the second experiment, the quantity of hydrocarbons in the original gas did not require to be very large. In the one case, there was only a very small quantity decomposed; but this happened to be 200 times as great as that deposited

when the diluted gas passed through—showing clearly that some action was going on. Several gentlemen had spoken of the necessity for a conveyor or carrier, or some other vehicle for oil gas, during the cracking; but he would suggest that a better expression would be to call it a “cushion.” It was really a cushion for supporting the oil gas and preventing it being over-cracked. When one had these molecules of heavy hydrocarbons all huddled up together, they were far too apt to be over-broken. The action started and spread through them with much greater rapidity than when they were diluted and kept apart by an inert gas. Probably the most important point to bring out was that, by dealing in this way, they really enlarged to an enormous extent the range of temperature they could use. He defied any man of practical skill to keep retorts within 50° or 60° of the same temperature—he could not do it; and therefore the limit of temperature was too narrow. But if the gas were diluted, this limit was enlarged; and instead of having to regulate it to 50° , he would have a margin of 200° or 300° , which made it a much more reasonable process altogether. With regard to the controversy which had cropped up of clay *versus* iron retorts, he fancied some speakers had been rather at cross-purposes on the subject. Mr. Foulis, whose results everyone knew to be absolutely reliable, found he could use clay retorts, while others could not do so. He imagined that in Mr. Foulis’s case the oil was led down through the whole length of the retort in an iron pipe, before it was discharged into the clay retort.

Mr. FOULIS remarked that this was so.

Professor LEWES said this was totally different from passing the oil in by gravitation. If this was done, the oil went as a liquid practically on to the surface of the clay. In a liquid state, and also at the first moment of vaporization, it had an enormous penetrating force; and he did not believe any clay retort would keep it in. But if they had the retort up to a high temperature, and led the oil down by an iron tube, they never had much of the oil itself getting on to the bottom of the retort; and if they were working at the heats usually employed in cracking oils, all the oil was practically converted into vapour before it reached the end of the iron tube. Then the vapours, in their turn, cracked against the hot sides of the retort. Mr. Browne had given many admirable points in his paper; but he (Professor Lewes) was inclined to quarrel with one small matter, and that was the colour of the gas. He did not think, if Mr. Browne had his gas of a light yellow colour, he was getting the full effect out of it. It ought to be a little darker. Oil gas, to be at its best, was a rich chocolate brown. They must avoid any blackened tint, because directly the gas was a little sooty they were over-doing it; but they must have a good rich brown before they could have high illuminating power combined with a fair yield. The white colour showed that the product was principally vapour, and only a very small quantity of true gas. Where it was a chocolate brown as it left the retort, it had about the maximum illuminating power. Mr. Browne gave him a most unpleasant task in asking him to arbitrate between him and another gentleman as to the cost of enrichment by the Maxim-Clark process; and he quoted some figures from a Cantor Lecture, delivered nearly two years ago, in which he made out the price, if he remembered rightly, to be something like $1\frac{1}{2}$ d. At that particular time, the gasoline employed in carbonizing was costing 1s. 2d. a gallon; but being used in large quantities brought down the price to 8d. a gallon. His own impression was that the cost by the Maxim-Clark process would be about 1d. per candle power; but he did not wish to speak too definitely. Several other points had cropped up in the course of the discussion. One gentleman had found that injecting steam increased the illuminating power. This was really diluting; but it was doing it in rather a costly way. When steam was injected, water gas was being made in a most costly fashion, by letting steam and a heavy hydrocarbon react to give hydrogen and carbon monoxide, which then acted as a cushion, and brought out an increase in the hydrocarbons by preventing over-cracking. Dr. Dvorkovitch had given a very elaborate account of the importance of the residuals—a question into which he should like to go fully. He meant to do so at a meeting of the Society of Chemical Industry in the course of a few weeks; but there was not time to do it then, as it was a problem covering a very wide field. In Russian petroleum there were hydrocarbons of great complexity; and when they had

them breaking up under the influence of heat, they were gradually being broken down and built up again as they went through the length of the retort. An enormous difference was found in the residuals and in the gas obtained, simply because if, after the gas was made, it was kept passing along hot surfaces, some most marvellous changes would take place in the gases themselves—changes which had not been thoroughly and properly investigated. This was the reason for the difference in these tars; and he had not the least hesitation in saying that, from the tars that Mr. Trewby was making from the water-gas producers, he would get practically no benzol, or very little. If, however, oil gas was obtained by cracking the oil alone, then undoubtedly benzol would be had in very large quantities. This was plainly shown by the fact that, in making Pintsch’s oil gas, if they took it just as it was produced, and compressed it into cylinders for railway carriages, they would obtain, for every 1000 cubic feet compressed, nearly a gallon of hydrocarbons, containing 50 per cent. of benzene and toluene; showing that these had been formed in that method of manufacturing oil gas.

Mr. LACEY said the question of cost seemed to be one on which the greatest difference existed. He would point out that he was not responsible for the figures supplied to him by Mr. Wright; but they agreed very fairly with those given by Mr. Gandon, Mr. Peaty, and also by Mr. Frank Livesey. Mr. Wright gave 1.25 gallons for each candle added to 10,000 cubic feet of $15\frac{1}{2}$ -candle gas to bring it up to $16\frac{1}{2}$ candles. He understood it was tested with an Argand burner, in the same way as that followed by the official tester. This was a different system from that adopted by Mr. Browne. In his own case, he found it required 1.74 gallons to raise the gas from 20 to 21 candle power, using the flat-flame 20-candle burner. He did not think that with this burner there was so much difference, by a candle or two, between 20 and 23 candle power, as with the Argand between 15 and 17 candles. Mr. Glasgow seemed to have rather misapprehended the object with which the diagram had been drawn. He (Mr. Lacey) was not surprised to find that the increase in illuminating power was not equal. He merely stated the fact that, as a mere matter of calculation of candles, it ought to be equal; and if it were not, some explanation was required which they had not yet had. The use of steam in injecting oil was of considerable importance. If he understood rightly, Mr. Foulis employed steam in his experiments. He (Mr. Lacey) found that, when he tried to make oil gas without the use of steam, they were much troubled with carbon deposits, and also obtained bad results. He did not say that without the use of steam he might not have arrived at better results; but he found it considerably reduced the deposit. It might be imagined that, when steam was used, it was decomposed into carbonic oxide and carbonic acid; but, as a matter of fact, this did not occur. He had made many tests, and did not find either carbonic oxide or carbonic acid.

Professor LEWES remarked that it was entirely a question of temperature.

Mr. LACEY said they were not produced at the temperature he employed. The use of steam appeared to be to carry the gases forward. If it was decomposed, there must be present either carbonic acid or carbonic oxide; and there was no appreciable amount of either. One gentleman asked if it was possible to enrich 16-candle gas up to 20 or 22 candles. He (Mr. Lacey) had done it, at a certain temperature, in the laboratory. It was a question of the saturation-point of a gas at that particular temperature; and this was his reason for going into the question of the vapour tension of these oils at different degrees of heat. It would be found, taking it on the assumptions he had taken (some, of course, were only assumptions), that there was a distinct limit. It would be found necessary, when the weather was getting cold, to use liquid of low boiling-point; but when the temperature was 60° or 70° Fahr., there was no reason why they should not employ oil of a boiling-point far above that of water to add one candle. When, however, the temperature fell, this gas might not be permanent. The figures given as to the vapour tensions, showed the enormous influence temperature might have on the quantity of vapour that could be held in the gas. One point of some interest which had come up was that of passing oil gas into tar. But there was a slight tendency to mix up the question of the solution of these oils, and their absorption by different liquids, with their

permanency and the deposition of their vapours, which were two entirely different things. Gases of 60 or 70 candle power might stand a very low temperature; but if they were brought into contact with tar or some other oils, a great deal of the lighting power might be lost, and this would be sheer waste. If by over-saturating the gas, the tension became too high, the low-tension vapours tended to be deposited; but there was no necessity to bring these vapours in contact with any absorbent which would simply take them out.

The PRESIDENT said there had been a very interesting discussion; and the members were much indebted to Professor Lewes and the other gentlemen who had contributed so fully to their information. One fact had come out very prominently in the discussion—namely, that in the manufacture of gas from oil the greatest possible attention should be paid to the amount of surface contact. Professor Lewes, in his paper, said he used a retort 4 inches in diameter. Dr. Dvorkovitch advocated tubes still smaller; and it seemed that in this direction they should attempt to perfect the manufacture of oil gas, if it was to be pursued at all. Mr. Fiddes had referred to his experiment of mixing a small quantity of oil with coal, and carbonizing it in the ordinary way; and he objected to it as an impractical process. He was quite right in so doing; but he (Mr. Hunt) did not put it forward as practical. The value he attached to it—assuming, of course, the correctness of the test—was, that it seemed to show that there was an illuminating value in the oil higher than they could at present get by gasifying; and that they should endeavour to perfect this means, so as to arrive at the standard which seemed capable of being obtained by the mixture of coal and oil. He was not deterred by Mr. Foulis's adverse remarks on the process, because he knew that the experiments were very carefully made; and although it was not always easy to explain how the results had been obtained, he had no doubt whatever that the record was accurate. He was confirmed in his view of it by what had fallen from Professor Lewes and other gentlemen who had obtained better results by securing what the Professor aptly termed a cushion for the gas as it was produced. He concluded by moving a vote of thanks to Professor Lewes and to Messrs. Browne, Lacey, and Pryce, for their able contributions.

Mr. CARPENTER seconded the proposition; and it was carried unanimously.

The meeting then adjourned till the following morning, when the two remaining papers—those by Messrs. Paddon and Goulden and Mr. Frank Livesey—were taken. The report of the discussions on these will appear next week.

The Final Step in The Gaslight and Coke Company's Assessment Appeals.—On Monday last week, Sir P. H. Edlin, Q.C., sitting at the Sessions House, Clerkenwell, finally closed the proceedings in the assessment appeals of The Gaslight and Coke Company, which were fully reported in the JOURNAL during their progress from July to March last, by initialling the alterations in the valuation lists in those parishes in which the Company were successful in reducing their assessment. It may be remembered that, when judgment was given in the appeals, it was found that, in the case of many of the parishes concerned, the appellants had not only failed to reduce the assessment, but that this was, as a matter of fact, already too low. As, however, the Court had no power to raise the figure, the old assessment would, in the ordinary course, have stood until the next quinquennial valuation. We now learn that the Company have consented to be rated in these parishes at the higher values fixed by the Court—a decision which Sir Peter Edlin has pronounced to be highly creditable to them.

Death of the Chairman of the West Ham Gas Company.—We regret to record the sudden death, on the 16th inst., at the age of 75, of Mr. John Frederick Nicholson, F.R.C.S., Chairman of the West Ham Gas Company. He had been a Director since 1863, and a member of the Finance Committee for practically the same time; and he had consequently acquired a valuable and intimate acquaintance with the Company's affairs. During his chairmanship of two years, Mr. Nicholson gave unremitting attention to the duties of his office, and spared himself no trouble in carrying them out. He was much respected by his colleagues and the officers. Mr. J. Lister Godlee is Deputy-Chairman. The management of this Company has sustained heavy losses from death during the past year or two. It is scarcely two years since we had to record the decease of Captain Pelly, R.N., the Chairman, followed at no great interval by that of Mr. John Meeson, also a Director of long standing; while Mr. E. H. Thorman, the Engineer of the Company from its formation, and Mr. J. Madge, who had been Secretary for 22 years, have also passed away quite recently.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 982.)

THE revival of business in the Stock Markets has not made so much progress during the past week as might have been expected. In fact, it is not too much to say that there has been a decided lull. Why this should be, is not quite apparent. The snapping of the "nimble ninepence" by realizations had to do with it, to an extent; but beyond this there seems to be something like a recrudescence of cautiousness which keeps speculators hovering on the brink. The result is that prices for the most part have fallen, even of the best class securities. The check is probably only a temporary phenomenon, and it may fairly be expected to be followed by another step in advance. One potent factor remains unchanged, and that is the cheapness and abundance of money. The Gas Market meanwhile has been rather irregular. It was brisk enough at first; but after the first few days it tailed off quiet. Gaslight issues had fully the lion's share of attention; and the "A" stock underwent some slight revulsion after the liberal advance it had effected in the previous week. This was quite in accord with the move elsewhere to realize profits. The tendency was marked from the opening bargain, which was done at 216; and figures gradually lowered until on Friday 210 was reached. The quotation, however, only suffered to the extent of 3 in the aggregate. The secured issues of all sorts were fully active, and good prices were realized, especially for the debenture stocks. South Metropolitan were scarcely so active as they have been recently, but were more than equally firm; and the "B" rose $1\frac{1}{2}$. Commercial were quiet and unchanged. The Company have issued letters of allotment of £35,000 debenture stock at par among the proprietors, to provide capital to meet the requirements of the business. The Suburban and Provincial Companies exhibit the same degree of quiet; and the only move is an advance of 1 in Brentford new. The Continental Companies are a shade easier; both Union and Imperial having receded one point. Changes throughout the rest of the list are few and unimportant. Melbourne debentures are 1 higher; but Buenos Ayres has lost the $\frac{1}{2}$ which it gained the week before. The Water Companies continue steadily to amend; and gains of from 1 to 5 per cent. were effected by various undertakings, as set forth in the list.

The daily operations were: A good deal was done on Monday in Gaslight "A;" but little else was touched. Quotations held good. Tuesday's business was on much the same lines; but Gaslight "A" fell 1. South Metropolitan "B" rose $1\frac{1}{2}$; and Melbourne, 1. In Water, Lambeth $7\frac{1}{2}$ per cents improved 2; and Grand Junction, $\frac{1}{2}$. Gas was very quiet on Wednesday; but prices looked down—Gaslight "A" and Imperial Continental each receding 1. New River rose 5; and East London, 1. But West Middlesex was 1 lower. Gas continued very quiet on Thursday; and the only move was a rise of 1 in Melbourne. Friday was slightly more active; but prices were unfavourable—Gaslight "A" and Continental Union losing 1; and Buenos Ayres, $\frac{1}{2}$. Saturday was almost a blank day; but Brentford new rose 2. Grand Junction Water also advanced $1\frac{1}{2}$.

ELECTRIC LIGHTING MEMORANDA.

The Affairs of the Chelsea Electricity Supply Company—The Bradford Experiment—French Measurement again Denounced—Mr. W. H. Preece on Interior Lighting.

THE ordinary general meeting of the shareholders of the Chelsea Electricity Supply Company has been held, when accounts relating to the second complete year of working of the undertaking were received and adopted. The system of distribution selected by this Company differs from all others in London; and there are other considerations which render the experiences of the venture interesting to followers of the fortunes of electric lighting speculations. The number of lamps (reduced to the 8-candle standard) served by the Company up to the end of the year was 27,500, upon which a gross revenue of £10,172 was received; and the accounts show a gross profit of £1750. Like the other London companies of the same order, the Chelsea concern still has an open capital account, and has found it necessary to issue some first mortgage debentures in order to keep the wheels going. From some expressions dropped by the Chairman (Mr. J. Irving Courtenay) at the meeting, it may, however, be gathered that the Board have reconsidered the resolution at which they had arrived a year ago, to extend the mains into new districts. Consequently, the large increase of income which was expected to be secured in this way has not been realized; but the Board are deserving of praise for their prudent putting on of the brake. They seem to have awakened to a sense of the danger of "outrunning the constable" sooner than some Boards of similar companies; and it will be of the greatest interest to see how they will fare while awaiting the development of the district already occupied by their mains. Confining himself to the prospect permitted by this policy, the Chairman thinks the Company ought to earn £13,000 during the current year; and if they can do so, and

make a profit of $2\frac{1}{2}$ d. per unit, he expects to be able to recommend a 4 per cent. dividend on the share capital, after paying the debenture interest. If the Company can accomplish all this, they will be fortunate indeed.

When, a fortnight ago, we briefly mentioned Mr. J. N. Shoolbred's Society of Arts paper upon the Bradford Corporation electric lighting experiment, we were unable to discuss the contents of the paper, or to state how it was received by the author's friends and rivals in the same line of business. From some disparaging remarks originating with partisans of electric lighting systems differing from that adopted by Mr. Shoolbred, it may be gathered that these interested critics are inclined to dismiss the paper as mere advertisement of the author and of the contractors for the electrical plant supplied, according to his designs, to the Corporation of Bradford. It was not quite so bad as this, however; and we are ready to admit that the number of the *Journal* of the Society containing the text of the paper and the discussion upon it, should be procured and studied by all members of municipal corporations, &c., interested in the subject, who will find therein some instruction and not a little warning. Among other things is to be noticed the statement of accounts relating to the undertaking, which allow it to be seen, on the face, that during the last half year the cost of the Board of Trade unit, as produced at the Bradford station, was only 2.47d. This figure, however, does not include capital or administrative charges of any kind, nor office expenses, nor, of course, profit. It therefore seems fair to classify these accounts among the many similar statements that have been published, which, if they contain the truth, certainly do not express the whole truth, and leave the world as much in the dark as ever respecting the actuality of the financial circumstances of central station electric lighting.

There was an interesting discussion upon the general subject of lighting at the Institution of Civil Engineers last Tuesday, following upon a paper by Mr. A. P. Trotter, which is dealt with elsewhere. It is mentioned here, however, for the purpose of placing upon record the scorn and contempt that was poured, by all the speakers who happened to refer to the matter, upon the nominal "2000-candle power arc lamp." The proper way of describing this well-known appliance is to call it a "10-ampère lamp;" and this is the only term recognized as applicable to it by respectable engineers who speak or write under a due sense of responsibility for the language they use. Yet the "old crusted lie," as Mr. Trotter has called it, appears in the entry of the Brush Company's contribution to the Crystal Palace Electrical Exhibition; and whenever there is a street lighting contract to be snatched, it is paraded in Brush estimates with the greatest assurance. It is used to exaggerate the advantages which electrical touters so lavishly promise to local authorities who do not know better, if they will only abandon gas, and take to electric arc lighting for their streets; but we, at any rate, do not mean to cease from calling attention on all possible occasions to this Anglo-American sophistication, with a view to putting prospective victims of the electrical touters (hailing mainly from the Brush head-quarters) on their guard, until this disgrace to the electric light business is finally dropped as useless.

Mr. W. H. Preece, F.R.S., read a paper yesterday week, before the Royal Institute of British Architects, upon "The Art of the Internal Illumination of Buildings by Electricity." The only thing that should trouble this most prolific discourser on and about electric lighting is the titles of his papers, letters, and speeches; for the matter is always necessarily pretty much the same. People seem willing to take them, however, and when the number of these efforts on the part of the Post Office Electrician is remembered, the marvel is that the author should be so successful as he is in freshening up his stock ideas in order to suit his varying audiences. In speaking to architects, of course, it was necessary to talk about interior lighting. Having quietly effected the alteration of his proposed standard of diffused light, the "lux," into the more practical candle-foot, while retaining the fancy name, Mr. Preece told the assembled architects that the necessary illumination of interiors could be provided for by allowing a consumption of one watt per square foot of floor surface in incandescent lamps applied to this purpose, or allowing one 16-candle lamp, at a height of 8 feet from the floor, per 8 feet square of the floor surface. If anybody but an eminent electrician had propounded such a recipe, it would have been called a piece of "rule of thumb;" but, of course, there is never anything of this kind in the work or counsels of experts in electricity.

Manchester District Institution of Gas Engineers.—The spring excursion of this Institution is fixed to take place next Saturday; and we learn from the Honorary Secretary (Mr. S. S. Mellor, of Northwich) that arrangements have been made for a trip to Skipton, Bolton Abbey, and Bolton Woods. An early start will be made from the Victoria Station, Manchester, so that Skipton may be reached about eleven o'clock. After luncheon, there will be a little formal business, including the election of Mr. G. R. Pickering, of Cheadle, as a member. Conveyances will then take the party to Bolton Abbey, after visiting which they will proceed to Bolton Woods and the Strid. They will return to Skipton to tea; and leave for Manchester about six o'clock. With fine weather, this excursion should be simply delightful.

ILLUMINATION AT THE INSTITUTION OF CIVIL ENGINEERS.

In another column of our present issue will be found the abstract, issued by authority of the Council, of the paper by Mr. A. P. Trotter upon the "Distribution and Measurement of Illumination," which was read before the Institution of Civil Engineers at the ordinary meeting on Tuesday, the 10th inst., and discussed then and at the following meeting. The text of the paper, with the discussion upon it, will only see the light in the published Minutes of the Proceedings of the Institution; and, as these will not appear for some months, we propose to acquaint our readers with the gist of Mr. Trotter's contribution to the scanty literature of this important subject, and the general purport of the debate provoked by it.

The paper is very long, and, at the first glance, of formidable aspect. This is due to the number and apparent complexity of the diagrams deemed necessary by the author for the due treatment of his subject. Essentially, the matter so elaborated is simple; being nothing more than just such another study of the intensity and distribution of the light emitted by street lamps as was set out in elementary style in the series of articles upon "Lighting" contributed by Mr. W. H. Y. Webber to the *JOURNAL* from September to March last. Indeed, Mr. Trotter referred to these articles, which, he said, appeared after the greater part of his paper was written; and there is a marked degree of correspondence between the two authors, who thus independently arrived at similar results by studying the operation of the optical laws which govern the phenomena of artificial lighting. Mr. Trotter introduces his subject by referring to the curious neglect of the practical problems of artificial lighting by writers of optical treatises; from which it follows that those whose business it is to deal with such problems have failed to take account of the laws of Optics in their ordinary work, and have proceeded by empirical rules to obtain the effects they desired. Yet, although they have been ignored, the laws of Optics are not to be disestablished by lighting engineers; and it has been Mr. Trotter's care, as it was Mr. Webber's, to bring technicians interested in the problems of artificial lighting to a sense of the benefit they may derive from a systematic study of such optical laws as properly apply to their work, and to cure the lighting industries of the plague of charlatanry which neglect of science has brought on them.

Mr. Trotter defines and describes the factors of which illumination consists, and adopts the parliamentary standard candle as his unit of light, and the candle-foot, or the light given by one candle at a distance of one foot, as his unit of illumination. He compares this unit with others suggested or in actual use; and he concludes that it is the natural one to employ in conjunction with the system of measurement in common use in the United Kingdom. He gives a method, however, whereby the conversion of candle-feet into French bougie-metres, or contrariwise, may be effected. Unfortunately for the assimilation of illumination measurements to others in ordinary use by engineers, the radiation of light proceeds by geometrical, and not by simple arithmetical progression; and consequently, as Mr. Trotter admitted in replying to the discussion on his paper, the term "candle-foot" is not such a simple expression as the foot-pound or the inch-ton employed in the calculations of mechanical and civil engineers.

To all intents and purposes, Mr. Trotter gave the master-key of all practical lighting problems very early in his paper. He put it in this way: "The nature of the illumination of a horizontal plane by a light radiating uniformly in all directions, is the most simple, and at the same time the most useful and common, problem for outdoor work. . . . The illumination at any point on the plane varies inversely as the square of the distance from the light; that is, inversely as the slant height of the lamp. It also varies as the cosine of the angle of incidence." By reference to a simple figure of a right-angled triangle, the author shows how these conditions are combined in a single expression; for in such a figure, the length of the perpendicular being taken as unity, the cosine of the angle of incidence is measured by the ratio of the perpendicular to the hypotenuse. The resulting formula is $i = \frac{AB \times c.p.}{AC^3}$, where i

is the intensity of the illumination in candle-feet, $c.p.$ the candle power of the lamp, AB the height of the light in feet, and AC the slant distance from the light to the horizontal spot for which i is to be determined. This is the formula which unlocks all the mystery, such as it is, of the distribution of lighting from street or any other lamps; but it is especially useful for the measurement of street lighting. Mr. Trotter himself says that "by the practical application of the cosine law (*i.e.*, of the given formula), the illumination which will be produced by any given arrangement of lights may be determined." He then proceeds to illustrate this principle by drawing some curves, which, with the help of accompanying tables of values of the cube cosines of incidence angles, enable the illumination curves for the combined effect of a number of lights to be determined by the simple addition of ordinates. He has drawn these curves for four different arrangements, showing the effects produced by a number of lamps spaced (1) at a distance apart equal to their height; (2) at a distance equal to twice their height; (3) at a distance equal to three times their height; and, lastly, at a distance equal to six times their height. This last becomes

mere pilot or beacon lighting. Mr. Trotter appears to think that, for securing a passably uniform effect of illumination by street lamps, as distinguished from pilot lighting, the lamp-columns ought not to be spaced further apart than four times their height. It would be instructive to work out upon this rule the comparative cost of lighting a given thoroughfare according to different systems.

Mr. Trotter fully adopts the view expressed earlier by Mr. Webber, that the actual illumination of the road surface is not by any means the only important result procured by street lamps; and that the use of the latter as beacons to mark out the way is of very great value. Mr. W. H. Preece, in the course of the discussion, talked much nonsense about the possibility of the loss of life in the streets of London being due to the fact of the public lamps being upon the scale of pilot lights rather than on that of illumination. But Mr. Trotter frankly declared that the smallest street lights are immeasurably better than none; and it did not occur to Mr. Preece as possible that the glare of the dazzling arc lamps, at 50-yard intervals or more, suspended, as they usually are, at a height which brings them directly before the eyes of drivers of vans, omnibuses, and other lofty vehicles, may be more detrimental to the safe conduct of street traffic than the more equable, if dimmer, pilot gas-lamps.

Mr. Trotter lays down the proposition that "illumination begins to be useful when it is comparable with moonlight." Out of a number of measurements made by the author about the time of full moon, none has ever reached a higher value than about 1-36th of a candle-foot; that is, the light given by a candle at 6 feet. In London, a bright moon, well up in the sky, generally gives about as much light, according to Mr. Trotter, as a standard candle at from 8 to 10 feet distance. This measurement is for direct moonlight, and does not include the effect of the diffused light of the surrounding sky, which is often considerable. Bright as moonlight sometimes appears to the eye, because of its perfect uniformity, it is never otherwise than feeble. In this country, moonlight is never bright enough to render a page of "Bradshaw" legible. Mr. Trotter very wisely says that while in outdoor lighting the illumination of the ground cannot be held to be everything, and the horizontal and angular lighting of objects upon the ground is often the principal consideration, it is nevertheless best to aim at a fair illumination of the ground, as being the most difficult object—and, we may add, the farthest from the light-source. If the lighting is improved by reflection from surrounding walls of buildings, so much the better; but this should not be taken into account when computing the intensity required.

The paper comprises a number of plotted examples of street lighting; the intensity of the illumination being indicated by contour lines drawn at some constant difference, say, of 1-10th or 1-20th of a candle-foot. The effect presented by this contouring is peculiar, and, we venture to say, rather bewildering than helpful. It does not correspond with anything in nature or art; and it is a painful illustration of the misapplication of a device borrowed from one branch of science to another. The author's unhappy idea of contouring his lighted areas is responsible for the false appearance of difficulty imparted to the subject under notice. It may sound horribly unscientific to admit the impeachment that the best street effects in the way of gas lighting have been arrived at by simply putting up a lamp, seeing how it looked, and then adding to the number and power of the lamps until the desired end was achieved; but it is to be feared that the sight of Mr. Trotter's diagrams and contoured plans will frighten many men from attempting to treat lighting problems "scientifically." After all, the effect is the thing; and we imagine that nobody would call a modern Atlantic liner or a battle-ship an unscientific production because it is not evolved as a perfect fruit of the designer's inner consciousness, but represents the net outcome of an infinity of trials and errors.

Mr. Trotter said nothing to the purpose about the lighting of interiors; and his paper therefore failed of a part of its scope. In Mr. Webber's articles it was shown how interior lighting may be computed with reference to a preconceived standard (see *ante*, p. 292); but, although challenged upon the point, Mr. Trotter ignored this problem. The greater part of his paper was filled with an elaborately detailed account of various photometers for diffused light; including an ingenious device of the author's own, which he has used, with much personal satisfaction, in testing various examples of lighting. It is almost a pity to say so, but, in point of fact, Mr. Trotter's labours in this respect have been almost thrown away, for they have done little more than verify the results of very easy calculation.

The paper was discussed by Mr. W. J. Dibdin and Mr. W. Sugg, who criticized the author's photometry. An evening was specially appropriated to the discussion, in compliment to the author's labours, and in recognition of the importance and novelty of the subject; but the good intentions of the Council, who desired to have the matter thoroughly threshed out, were nearly frustrated by Mr. W. H. Preece, who spoke for forty minutes, tired his audience, and said no more than could have been stated in a tenth of the time he occupied by his tedious oration, the main object of which was to lay claim to some credit for having suggested a unit of diffused light in 1882, which the speaker wanted to make out to be the same thing as the candle-foot used by Mr. Trotter. This pretension, however, was exposed by the author of the paper, who showed that

Mr. Preece's "lux," which nobody ever used, is a quantity referable to the French system of measurement, whereas the candle-foot is commonly employed by many technicians who do not take the trouble to name it. It is a remarkable circumstance that while the electricians and the civil engineers were so interested in the subject of illumination that they assembled in such numbers as to nearly fill the lecture theatre of the Institution, not a single representative of the gas manufacturing industry was present. Consequently, besides Mr. Sugg, there was nobody to champion the cause of gas in the face of its enemies. Is it that gas engineers do not take an intelligent interest in these matters? Not so, let us hope; but their interest is plainly of the silent sort, which may be seated the deeper for the lack of surface indication of its presence.

Pumping-Engine Duty.—The standard for comparing pumping-engine duty adopted by the American Society of Engineers is the work done by 1,000,000 heat-units in dry steam supplied to the engine, instead of the old basis of the work done with 100 lbs. of coal.

Southern District Association of Gas Engineers and Managers.—The spring meeting of this Association is fixed for next Thursday, when the members and friends will pay a visit to Tunbridge Wells. The programme of arrangements which the Honorary Secretary (Mr. J. W. Helps, of Croydon) has issued, gives evidence of careful preparation for ensuring a pleasant excursion. The party will leave London by a fairly early train; and on their arrival at Tunbridge Wells, carriages will convey them to the gas-works, which are under the supervision of Mr. A. Dougall, the President of the Association. Having inspected these, they will partake of luncheon provided by the Directors of the Company. In the afternoon there is to be a drive to Penshurst, and after tea the return journey will be commenced in time to arrive in London about nine o'clock.

The Federated Institution of Mining Engineers.—We have received from the Secretary of this Institution (Mr. M. Walton Brown) the programme of arrangements for the general meeting, which is to be held at the Institution of Civil Engineers on the 2nd, 3rd, and 4th prox., under the presidency of Mr. T. W. Embleton. The two first-named days will be mainly devoted to business; the last one, entirely to visiting. The papers to be taken on the opening day of the meeting will comprise one on "Petroleum in Eastern Europe, and the Method of Drilling for it," by Mr. A. W. Eastlake; and Professor Thorpe will conduct some experiments to illustrate the phenomena of coal-dust explosions. Among those set down for the second day, we notice one on "The Coal and Mineral Resources of Peru," by Mr. E. Lane; and another on "The Causes of Spontaneous Combustion, and the Prevention of Explosions on Board Ships," by Mr. M. V. Jones. Visits will be paid to the Crystal Palace Electrical Exhibition, the Tower Bridge, and the St. Pancras Electric Supply Station; and, for the convenience of visitors, the programme includes a short description of the two latter.

Midland Association of Gas Managers.—We learn from the circular which has been issued by the Honorary Secretary of this Association (Mr. C. Meiklejohn, of Oldbury), that the next general meeting will be held on Thursday, in the Board-room of the Rugby Gas Company. There will be more business than is usual on the occasion of the spring gathering of the members, inasmuch as the President (Mr. W. Littlewood, of West Bromwich) will be present and give the Inaugural Address which, owing to indisposition, he was unable to deliver at the meeting in Birmingham on the 10th of March. A paper will also be read by Mr. P. Hutchings, on the "Monier Construction System, and its Adaptability to Gas Engineering Work Generally." This system, it may be remembered, was described in an article which appeared in the JOURNAL for Dec. 8 last year (p. 1035). At the close of the business, the members will visit the works of the Newbolt Cement Company and the Rugby Cement Company (also the gas-works, time permitting); and afterwards take a drive, terminating in a visit to the Rugby Schools. On their return, they will be entertained at dinner by the Directors of the Gas Company.

Gas and Hydraulic Power Supply Works in the Colonies.—Mr. John Coates, M.Inst.C.E., of the firm of Messrs. J. Coates and Co., of London, Melbourne, and Sydney, whose firm have done a large amount of good work in establishing gas undertakings in the colonies, is now on a visit to England. Since Mr. Coates commenced operations at the Antipodes about six years ago, he and his associates in business have put up nearly 30 gas-works in various towns in Victoria, South Australia, New South Wales, Queensland, New Zealand, and Tasmania; and they have now in hand Albany (Western Australia), two works for the Government of New South Wales, and the rising township of Zeelian, in the newly-discovered silver-field of Tasmania. Mr. Coates has also carried out most successfully hydraulic power supply schemes in Melbourne and Sydney. In the business portion of the former city, there are now 15 miles of high-pressure mains; and, as an example of the popularity of the system, the two largest employers of this form of power pay the supplying Company something like £2500 per annum. The Sydney scheme will be larger than that at Melbourne; but there are already 11 miles of mains laid. The capital invested in these various undertakings amounts to about £350,000.

HERRING'S GAS-WORKS CONSTRUCTION.*

MR. HERRING, of the Huddersfield Corporation Gas Department, has collected and reprinted in book form, with illustrations and additions, some articles descriptive of the construction of gas-works which he contributed some four years ago to the now defunct *Gas and Water Review*. Making no pretensions to literary style, the author hopes that his venture in book-making may be justified by the utility of the publication; and we are pleased at being able to admit that there is good reason for his aspiration. Although not by any means a brilliant book, Mr. Herring's work is likely to be found useful within a considerable range, and may be conscientiously recommended to students of gas manufacture. The author is gratifyingly modern, and takes no notice whatever of the steps by which his art has attained to its present position. He starts upon the assumption that the first problem for the student is to design a gas-works for a town of stated size; and he shows how this problem may be solved by observance of contemporary practice in such matters. It is a curious thing to say, but the observation is nevertheless true, that the designing of an ideally perfect and new gas-works is one of the very rarest of gas engineering tasks; and to start with it as though it were a commonplace of the draughtsman's office, is not quite the most "practical" way of opening up the general subject. Our author begins by remarking that he may profitably commence "by assuming that the leading inhabitants of a certain town have determined to form a company for the purpose of manufacturing and supplying coal gas for private and public purposes;" but how often is anything of the kind done? Moreover, we are not sure that Mr. Herring gives us all that is necessary for dealing with this comprehensive problem, supposing it to be propounded; for while he tells us what is the average annual consumption of gas per head of the population in different classes of towns, he is reticent as to what might be expected of similar towns newly provided with gas-works, and is also silent respecting the relation of daily production to yearly output in gas undertakings in various stages of their development—which is one of the first things a designer of brand-new works has to consider. After an introductory chapter—which we strongly advise the author to rewrite and expand for any future editions of his book, rather out of his experience than his imagination—he plunges over head and ears into a mass of matter dealing with ordinary building and engineering construction, as applicable to gas-works, of course, as to any other class of factories; but not much more so. It is all good, however, so far as we have been able to test it, and unquestionably ought to be at the fingers' ends of every competent gas-works draughtsman. Whether it is necessary or desirable to reproduce all this general matter under the title of a handbook for specialists, is another consideration. Having regard to the excessive multiplication of text-books, which is one of the plagues of modern technical education, we do not think such reproduction called for; but this may be matter of private opinion. When Mr. Herring gets into the special chapters which he devotes to carbonization, furnace construction, manufacturing and purifying plant, &c., he is a safe and intelligent guide; because here he obviously repeats what he has himself learnt and tested by experience. He is a very painstaking author, and is laudably anxious to tell all he knows. It would have been better, perhaps, if he had not begun to write upon such a serious scale until he had felt able to pronounce with more authority upon some branches of his subject; but on the whole, he must be credited with the possession and exercise of a good deal of discretion in the work of compilation. He will not lead a student wrong, nor fill his mind with a crowd of superstitions—which is no slight praise. The book is well printed; and the illustrations, if not nearly plentiful enough, are mostly modern. If the author had called his book an introduction to the subject of gas-works construction, we should have had less fault to find with it. But, as it is, it is well worth buying.

Mr. Albert Ford has been appointed, out of upwards of 200 applicants, Engineer of the City of Santos Gas-Works, Brazil, for which position applications were invited in our advertisement columns a few weeks ago.

Masonic.—It will doubtless be remembered that some time since mention was made in the *JOURNAL* of a proposal to have an emergency lodge in connection with the Evening Star Lodge, for the purpose of initiating the son of the W. Bro. William A. Valon, C.E. As, however, Mr. Arthur Valon is only in his twenty-first year, a dispensation had to be applied for, which it has been found impossible to obtain. An emergency lodge will nevertheless be held on the Monday of the Institute week—viz., June 13—at the Freemasons' Hall, Great Queen Street, so as to give provincial brethren an opportunity of meeting the Master. It will also be arranged for the brethren to dine together at the close of the lodge. The Secretary, W. Bro. Magnus Ohren, will send invitations to all provincial members who are known to be masons. Any brother, however, who may not be known as such, on communicating with the Secretary will receive a prompt invitation.

TECHNICAL RECORD.

THE DISTRIBUTION AND MEASUREMENT OF ILLUMINATION.

At the Meeting of the Institution of Civil Engineers on the 10th inst., Mr. A. P. TROTTER, B.A., Assoc.M.Inst.C.E., read a paper on the above subject. It was divided into sections—the first dealing with geometrical principles; the second, with photometers; and the third, with the results of measurements made in the streets and public buildings of London. The following is the abstract of the paper that has been issued by the Council of the Institution.

When light falls upon a surface, that surface is said to be illuminated. Illumination consists of two factors—candle power and distance. The carcel-metre was proposed in 1882 as a unit of illumination. Mr. Preece showed that this was equal to a standard candle at 12·7 inches; and he proposed the name "lux" for the English equivalent. The author took the candle-foot as a practical unit. The illumination of a horizontal plane at any point varies as the cube of the cosine of the angle of incidence of a ray of light falling on that point, when the candle power and the height of the lamp are constant. Curves were given, showing this distribution graphically; illumination being represented as ordinates, and distances from the source of light as abscissæ.

The distribution of the total light on a surface varies as the solid angle subtended by that surface at the source of light. The usefulness of a white reflector depends on the solid angle which it subtends, and not upon its absolute dimensions. The resultant illumination, due to a number of lamps spaced at distances apart, equal to once, twice, three times, and six times their height from the ground, was shown by a number of curves. The distribution of the light of a continuous current arc lamp is peculiar. For angles of incidence greater than 50°, it varies as the fourth power of the cube of the cosine of the angle of incidence. Light falling in a more vertical direction is largely reduced by the shadow of the negative carbon.

The object of street lighting is twofold—to mark out the street with beacons, and to provide illumination. Illumination begins to be useful when it is comparable with moonlight. Moonlight in this country rarely exceeds 1·36th of a candle-foot—that is, a candle at 6 feet; and it is generally between 1·60th to 1·100th of a candle-foot. The distribution of illumination in more general cases was treated geometrically; the variation of illumination due to the varying height of a lamp was discussed; and it was shown that there was no particular virtue in the angle of incidence, the tangent of which is the square root of 2.

Calculated contour curves of equivalent illumination due to two lights, at a distance apart equal to three times their height, and to three lights arranged in a triangle, at a distance apart equal to 1½ times their height, were given, together with curves of illumination due to arc lights spaced in a similar manner. The use of diagrams to which the author gave the name of characteristic curves was explained. In several respects these resembled steam-engine diagrams. The co-ordinates were candle power and area; the area of the diagram was a measure of total light, or power in an optical form. The maximum and minimum illuminations in any example could be seen at a glance; and the shape of the curve showed the quality or regularity of the distribution. Characteristics for a square and for a circular area illuminated by a single light, and for several arrangements of uniformly spaced lights, were given.

In the second section of the paper, the author alluded to the different attempts which have been made to supplant photometers by thermo-piles, radiometers, and photographic methods. The complication of gas-testing apparatus was contrasted with the simple forms of true photometers, such as those of Bunsen, Rumford, and Foucault. A photometer was described in which a shadow was thrown by a mirror upon a screen, and a reflected beam of light was superposed upon the shadow; the whole screen being of an unvarying tone when a balance was effected. In a direct-reading photometer, a rod was placed nearly in the plane of the two lights to be compared. Two shadows were thrown on a screen, and the position at which the two shadows were of the same tone could be read off on a scale. The illumination photometers of Weber and Mascart were briefly described. The author explained that Mr. Preece's photometer of 1883 depended on the measurement of the current of a small glow lamp. The sixth power of the current was approximately proportional to the candle power. The current was adjusted by resistances. The details of this photometer were discussed; and Captain Abney's method of rapid oscillations in photometric measurement was described. Various errors were introduced by this use of a Bunsen screen, and by the colour of the electric lamp at low candle power. In a photometer designed by the author, in conjunction with Mr. Preece, in 1884, a glow lamp was made to approach or to recede from a Bunsen screen. The motion was given by a lever rolling on a cam in such a manner that the illumination could be read upon a uniformly-divided scale. A number of modifications of this photometer were tried during the past winter, and resulted in the construction of an illumination photometer, with which a large number of measurements had

* "The Construction of Gas-Works Practically Described," by Walter Ralph Herring. Illustrated. London: Hazell, Watson, and Viney, Ltd.

been made. Two glow lamps, of $\frac{3}{4}$ and $\frac{1}{2}$ candle power, were mounted in a long blackened box. Either or both could be used at once. Four Lithanode cells supplied the current. A reflecting screen, covered with white paper, threw the light upwards through a star-shaped hole in a horizontal screen of eard-board. The reflecting screen was mounted on hinges, and could be wound up by a fine chain; finally folding quite out of the light. The chain was wound upon a cam; and a hand or pointer was mounted on the axis of this cam, which was so shaped that a nearly uniformly divided scale was obtained. The scale was graduated empirically. Readings were taken when the illumination of the horizontal eardboard screen appeared to be identical with that of the moveable reflecting screen, visible through the star-shaped hole. The range of this photometer is from 2.5 to 0.001 candle-feet.

Measurements were made in the South Kensington Museum, in which illumination of about $\frac{1}{2}$ candle-foot up to $3\frac{1}{2}$ candle-feet were recorded. In the Cannon Street Station, the minimum was 0.025 candle-foot; and the maximum, 0.4 candle-foot. In the Charing Cross Station, the minimum was 0.05; and the maximum, 0.5. Several sets of measurements were made in the City. The result of systematic measurement of part of Queen Victoria Street was given in contour lines of equal illumination. The maximum in an exceptional case was 1.1; ordinary maximum, 0.3; minimum, 0.025. Contour lines were constructed from a considerable number of measurements in Whitehall. The illumination in Great George Street, Westminster, was also measured. The maximum was 0.9; and the minimum, 0.005. Characteristic curves were drawn from these observations; and these enabled the degree and the quality of the lighting to be compared.

The paper was accompanied by an appendix, containing tables of the value of a bougie-metre in candle power at different distances, values of various powers of the eosine, &c.

Softening the St. Helens Water Supply.—Last Thursday the Mayor of St. Helens (Mr. F. R. Dixon-Nuttall) laid the foundation-stone of a building at Thatto Heath to accommodate new machinery for the softening of the water supplied to the borough. The building and plant is being erected at a total cost of rather more than £10,000.

Sutton Coldfield Gas Company.—At a meeting of the Directors of this Company yesterday week, it was decided to wind up the concern, and to accept the offer of the Birmingham Corporation for the mains and distributing plant. The buildings and other works it was also agreed should be sold; and it is believed the whole of the plant and works will realize something like £6000—about £1000 less than the sum for which they were offered to the Sutton Corporation. Reference to this matter is made in the annual report of the Birmingham Corporation Gas Committee, some extracts from which appear in another column.

Tarapaca Water-Works Company, Limited.—The annual general meeting of this Company was held on Monday last week, at Winchester House, E.C.—Mr. R. Harvey (the Chairman) presiding. The report presented stated that the profits for the past financial year were £44,068, which, with £21,983 brought forward, made a total to the credit of the profit and loss account of £66,052. Including the dividend paid on the 6th of April, two others of 5 per cent. each, or 10 per cent. for the year, amounting to £40,000, had been paid, after deduction of which, with the £310 reserved for income-tax, there remained an available balance of £25,742. From this the Directors proposed to write off £1500 from the preliminary expenses, to place £5000 to a reserve fund, and to carry forward the balance of £19,242. In moving the adoption of the report, the Chairman said that the profit was less than last year, owing to political troubles. Although these had made a considerable difference in the receipts, it had not prohibited them from making a very handsome profit. Many circumstances had militated against them; but the greatest of all was the fall in the rate of exchange. Their works had not been injured in any way during the recent war in Chili; indeed, the only loss they had suffered was in the sale of water. From the commencement of the Company, £109,807, or upwards of 25 per cent. of the capital, had been paid in dividends. The branch supply to the mines of Huantajaya, and other separate water deposits on the Pampa, had developed into important sources of income. The motion was carried.

The Progress of the Colne Local Board Gas Department.—A very encouraging report on the working of the Gas Department during the past financial year was presented by Mr. Hartley at the meeting of the Colne Local Board last Friday week. He stated that the gross receipts had been £2153 in excess of the previous year; and the total profit was £1095, as against £592. Coal had advanced 2s. 3d. per ton; but if it had been at the same price as in 1890, the profit would have been £1943. The gross cost of manufacture amounted to £10,012, as against £8656; and interest on loans came to £1837, as compared with £1545. The total receipts amounted to £13,353, as against £11,200. To show the progress of the works during the last three years, Mr. Hartley said the profit was £426 in 1890, £591 in 1891, and £1095 last year. The quantity of gas made was 74,070,000 cubic feet in 1892; 64,662,000 cubic feet in 1891; and 58,373,000 cubic feet in 1890. Wages had advanced from £1857 in 1890 to £2120 in 1892; and the unaccounted-for gas had decreased from 8.7 per cent. in 1890 to 8.3 per cent. in 1891, and 8 per cent. in 1892. The sale of coke had increased from 1805 cwt. in 1890 to 2134 cwt. in 1891, and 3465 cwt. last year. The quantity of coal carbonized in 1890 was 6170 tons; in 1891, 6550 tons; and in the past year, 7538 tons. The quantity of gas produced per ton of coal was 9250 feet in 1890, 9872 feet in 1891, and 9850 feet in the past year. The cost of carbonizing per ton of coal was 3s. 8d. in 1890, 3s. 3d. in 1891, and 3s. 1½d. in 1892. The report, which was considered by the members to be a very satisfactory one, was unanimously adopted.

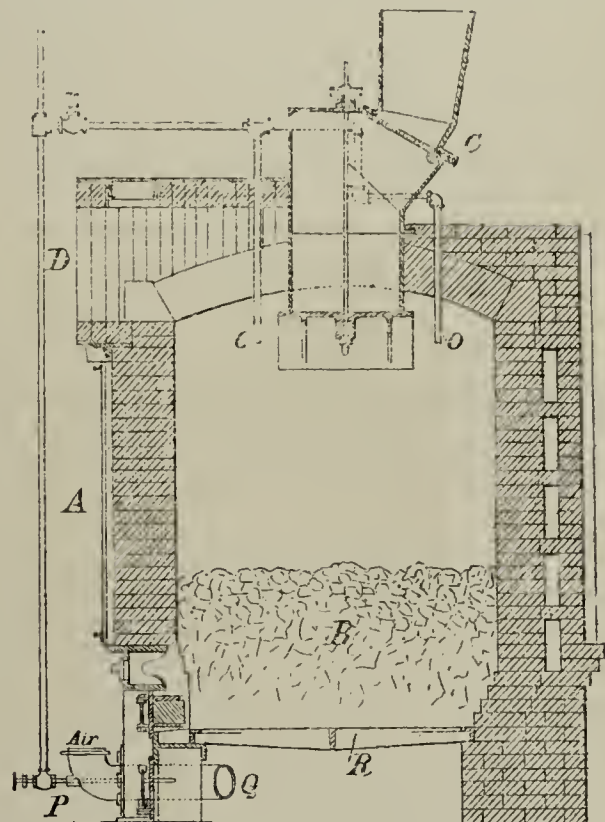
REGISTER OF PATENTS.

Manufacture of Fuel Gas.—Boult, A. J.; communicated from the Chicago Heat Storage Company. No. 3995; March 1, 1892.

This invention relates to the manufacture of fuel gas from coal in a so-called "producer," wherein, according to the generally stated common practice, a coal fire is built on a grate and, when raised to the condition of incandescence, a fresh supply of coal is deposited upon it; and this is repeated whenever that preceding it has, by combustion, been raised to incandescence—the necessary supply of air being meantime passed through the bed of fuel, either in an upward, downward, or other direction.

In the manufacture of producer gas as thus outlined, say the patentees, the great heat to which each fresh deposit of coal is subjected by dumping it upon the incandescent bed in the producer, necessarily induces a sudden distillation of hydrocarbon vapours contained in the deposited coal, which vapours escape from the producer before they have had time to be thoroughly gasified, and are thus, in a great measure, wasted. Furthermore, so much of the resulting gaseous product attains a temperature so high as to tend to destroy, by its intense heat, the metal parts—such as the coal distributor of the producer and the conduit through which the gas is passed to the point of its utilization or storage.

The object of this invention is to provide a proceeding whereby this waste is prevented; and whereby, also, fixed producer gas, with exceptionally high heating capacity, shall be produced, having a temperature so much lower than that of ordinary producer gas as to materially reduce its destructive tendency.



A is a producer comprising a shell containing a grate R to support the fuel B, and below which the supply of air enters through a conduit Q; a steam-injector P being provided as an air-forcing medium. At the top of the producer, is a hopper-device C, by means of which to supply coal to the producer. At opposite sides of the hopper are provided steam-pipes O, of small bore, communicating with a steam supply (not shown). D is the outlet-flue for the gas.

The operation is as follows: The bed of fuel B is blasted with air from the pipe Q; the air-blast being continued throughout the operation of the producer. Also the steam-supply may be used as the air-forcing medium; but it is preferably employed whether so used or not, as it very materially increases the heating capacity of the producer-gas product. On the initial bed of fuel, after it has been raised throughout to incandescence (though it may be before), steam from the pipes O is admitted to impinge against the top of the bed, thereby cooling that portion of it, and causing the formation on the surface-portion of the bed of an ash-incrustation or coating. This materially reduces the conductivity of the bed-surface, and, consequently, its power of conduction and radiation; so that when a fresh supply of coal is deposited upon it from the hopper, it will not be subjected suddenly to a heat so intense as to generate and produce sudden distillation of the hydrocarbon vapours therefrom. On the contrary, it tends more gradually to heat and effect disintegration of the lumps forming the fresh deposit, thereby so gradually to raise the temperature of the latter and distil therefrom the vapours, as to adapt them to be gasified before they can escape from the producer. At the same time the temperature in the producer is so modified by the injected steam, and by the cooler surface afforded by the ash-coating on the upper portion of the incandescent mass, that it reduces the liability of injury to the apparatus, and tends to so graduate the conversion of the combustion products as to reduce them to a fixed gas having comparatively moderate temperature.

The foregoing, involving the impingement of steam against the surface of the initial bed of fuel, forms by preference the first or preparatory part of the process. The continuation of the process involves the supplying, at intervals, of fresh deposits of coal, each of which requires, as the essential treatment for the purpose, that steam be impinged against it before it is heated to incandescence, since if so impinged after it has attained incandescence, the action of the steam would be on the incandescent fixed carbon of the coal only; because, by the time the coal is in the highly incandescent state, the volatile matter has all been released, and it is an especial object of this invention to act upon the volatile matter contained in the coal.

As will be apparent, the patentees remark, the steam absorbs heat from the surface of the fuel bed during its own decomposition, which

is produced by the fuel while burning; since, as is well known, steam, while being reduced to its elements, hydrogen and oxygen, absorbs as much as the same element will again give off on combustion. Thus the oxygen of the steam unites with the carbon of the surface coal as the latter becomes heated by the incandescent mass below it, leaving a surface-ash which is non-conductive of heat. Consequently each fresh charge of coal dumped upon the surface of the bed, finds such surface comparatively cool; and it is, furthermore, separated from the incandescent mass by a light layer of ash. The direct effect of this contact, and of the steamed condition of the deposit, is that the disintegration of the lumps of deposited coal, and the distillation of the volatile hydrocarbon contained therein, are produced in a sufficiently slow manner to enable thorough gasification of the volatile hydrocarbon to be accomplished as the result of the introduction of the steam.

Igniting-Tubes for Gas-Motors.—Shillito, T. R.; communicated from J. M. Grob, A. O. Schultze, and A. V. Niemczik, of Eutritzsch-Leipzig, Germany. No. 8821; May 25, 1891.

In the course of their specification, the patentees say that for years the igniting-tube used in gas-motors has been heated from the outside by a flame, and kept at a very high temperature. It is closed at its outer end, and by its other end is in open communication with the interior of the combustion chamber; or it may be alternately separated from, and placed in communication with, the combustion chamber by a slide, valve, or any other working organ. When the compression of the combustible gaseous mixture takes place, some of it is forced into the tube, and is ignited by the heated surface at the moment the piston reaches the inner end of its stroke. Tubes for this purpose have been made of various metals; but hitherto they have been found to burn away in a short time, or become coated over, or corroded inside, so as to prevent the combustible gaseous mixture from coming in direct contact with the heated surface of the tube. Other materials—such as porcelain or stone—are very liable to fracture. The object, therefore, of this invention is the manufacture of igniting-tubes from "a metallic alloy" of copper and aluminium in the proportion, by preference, of 95 per cent. of copper and 5 per cent. of aluminium.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

The Return to the Eight-Hour System at the Rotherhithe Works.

SIR,—To prevent any mistake about the change from the eleven to the eight hour system at our Rotherhithe station, referred to in the JOURNAL last week, I shall feel much obliged if you will publish this letter.

Immediately after the strike, the men at some of our stations agreed voluntarily to work on the old system of eleven-hour shifts, while at other stations they preferred the eight-hour shifts; and so they have continued to work—the pay in both cases being in exact proportion to the work done. The men do about 20 per cent. more work in eleven than in eight hours, and receive about 20 per cent. more pay.

The work is very irregular; about three times the number of men being required in the winter. Consequently, although work other than stoking is found for as many as possible, a very large proportion have to leave in the summer. Moreover, at that time, owing to the heat of the weather, the work causes a certain amount of distress to the stokers. It therefore occurred to me some months ago that a reduction of hours in the four or five summer months would relieve the men, and at the same time enable the Company to give continuous employment to a greater number of the winter hands. Beyond this, it would allow the men more leisure at the time of year when it would be most pleasant and useful to them, and the Company would retain in its service a larger proportion of expert stokers. The Rotherhithe men were therefore asked last week to make their choice—the voting to be by ballot; and, by a large majority, they decided to take the shortened hours of work, coupled with the lower pay, during the summer, and to return to the eleven-hour shifts and higher pay when the winter approaches. I may add that there was not the slightest action on the part of the men; they made no request for any alteration. There was no agitation whatever; and they seem to have accepted the offer as a boon.

GEORGE LIVESY.

May 19, 1892.

Mr. Hunt's Presidential Address.

SIR,—I am very unwilling to trouble you; but in the course of your indulgent criticism of my address, it is suggested that there is "something like a 'bull' in the presidential argument that if the local authorities get for 4d. per 1000 cubic feet of gas sold something which costs the companies 7d., the difference in favour of the former is probably about 5d. per 1000 cubic feet of gas sold."

Will you allow me to point out that what I did say was that "for every 7d. that it costs the companies for dividend and interest, it only costs the local authorities 4d. for interest charges;" the respective rates of interest being taken as 7 and 4 per cent. Assuming, then, that 1s. per 1000 cubic feet of gas sold fairly represents the average cost to the former, the average cost to the local authorities would be $\frac{1s. \times 4}{7} = 7d.$ nearly; or, as stated by me, about 5d. per 1000 cubic feet of gas sold, in their favour.

There is one other matter to which, with your permission, I should like to refer. I am credited with having ascribed to Mr. George Livesey the origin of the phrase "decremental rate of increase." This is a mistake. I have no concern with the origin of it. I but referred to it as having been adopted by Mr. Livesey to describe his proposed modification of the sliding scale. Let me refer to your own report on this subject. Speaking at Glasgow upon a proposal to reduce the standard scale, "Mr. Livesey" (see JOURNAL, May 19, 1887, p. 169) "suggested it should be called a decremental rate of increase." Farther on in the same report (p. 170), he says: "Let the gas companies, instead of

taking 5s. per cent. for every penny reduction after a reasonable point has been reached, take only 2s. 6d. per cent. for every 1d.; and this was what he meant by a decremental rate of increase. This term was used in the great Birmingham arbitration case by an eminent statistician; and it was undoubtedly quite right, although it puzzled the opposition Counsel, Mr. Matthews, who described it as 'arithmetic gone mad;' for the increase might be 10 per cent. this year, 9 per cent. next year, then 8, 7, and 6. That was truly expressed by the term 'decremental rate of increase.' It was a proper expression; and he should say let the sliding scale go on, but adopt the principle of a decremental rate of increase of dividend in cases where the dividend per 1000 feet is excessive."

It will be seen from this quotation whether or not my reference to the phrase was accurate; and also whether Mr. Livesey is to be regarded as having been in earnest in adopting it, as I maintain, or simply amused at it, as you suggest.

Birmingham, May 20, 1892.

CHAS. HUNT.

SIR,—Referring to your "Review of the Proceedings" at the recent general meeting of the Incorporated Institution of Gas Engineers in last week's issue of the JOURNAL, if there be "fearful joy" on the part of an Editor "in correcting a President in the matter of reference or quotation," you will readily appreciate the *ecstasy* of a reader when an opportunity is afforded for correcting an Editor on the same score; and this is what I venture to do.

First of all, I would remind you that Birmingham did not purchase the gas undertakings of the two Companies by arbitration, but by Bill; and that Sir Edmund Beckett was engaged as leading Counsel for the Corporation in connection with their Bill in both Houses of Parliament. But he took no part whatever in the subsequent West Bromwich arbitration. The late Mr. W. H. Michael, Q.C., was chief Counsel for the Corporation in these proceedings, in which I took a prominent part throughout; and the words "decremental rate of increase" emanated from Mr. Price-Williams, M.Inst.C.E., one of the experts engaged in the case. Those who have copies of the evidence in that arbitration will find the words in the note to Mr. Price-Williams's table on page 272, as follows: "The population of West Bromwich is assumed to increase at the average *decremental rate of increase* which obtained during the last four decades"—the table showing that the rate of increase, 3.53 in the year 1878, would gradually fall to 1.79 in 1902.

I well remember that the able tables and diagrams, through not being understood, caused at first some little confusion and amusement; and it was Mr. Matthews, the present Home Secretary, who was chief Counsel for the West Bromwich authorities, and not Sir Edmund Beckett, who was the author of the words "arithmetic run mad" in relation to the noted phrase. He made use of them in his lengthy and able address to the Arbitrators, when referring to the possible effect of the neighbouring mines upon the profits of the Swan Village works. He said (p. 681 of the proceedings): "I confess it is a difficult question to answer; but I would say even Mr. Price-Williams, with all his diagrams and tables, I do not suppose would be able to show the possible *decrement* of value in a work that any moment may find itself at the bottom of an excavation. I would like to see how he would compound the '*progressive decrement of a possible increment*' to represent that chance—even '*arithmetic run mad*' I think could not arrive at the proper figure for that!"

HENRY HACK.

Saltley, Birmingham, May 20, 1892.

[This matter has been mentioned in our editorial columns to-day.—ED. J. G. L.]

Sale of Shares.—Messrs. Suddards and Stansfield offered for sale by auction yesterday week, at Bradford, stocks and shares to a large value in local companies. The following prices were obtained: £75 of stock in the *Gildersome Gas Company* sold for £120; £300 of 7 per cent. stock in the *Shipley Gas Company* realized £158 per cent.; £140 of "A" stock in the *Harrogate Gaslight Company* produced £322 10s.; £1000 of "B" stock in the same Company yielded £267 and £268 per cent.; £200 of "C" stock sold for £250 per cent.; £2440 of stock in the *Pudsey Gas Company* realized from £186 to £191 10s.; 87½ £10 "A" shares in the *Eccleshill Gas Company* produced £17 10s. and £18 each; 38½ £8 "B" shares yielded £13 17s. 6d. and £14; and 14 £7 "C" shares sold for £12 10s. each.

Exeter and the Electric Light.—A special meeting of the Exeter City Council was held last Wednesday for the purpose of considering a report by the Surveyor on the lighting of the streets by electricity. It stated that, in the area proposed to be lighted, there were, exclusive of side streets, 136 gas-lamps, of which 82 could be dispensed with if electric lighting was resorted to; and their annual cost was £724 11s. To light the area by electricity according to a plan produced would require 56 arc lamps of 1200-candle power each. For simply lighting the main streets and open spaces, only 32 arc lamps would be required. The estimated first cost would be £1680 for 56, and £960 for 32 lamps. A tender had been obtained from the Electric Light Company, who agreed to supply the light for £22 10s. per lamp per annum, the Council providing lamps, posts, brackets, and globes; or for £24 per annum if the Company provided the lamps and globes. For the larger scheme the annual cost would be £1377 12s., against £724 11s. at present paid for gas; and for the smaller scheme £768, against £517 7s. 4d. The Surveyor said he did not see much prospect of a reduction in the cost of electric lighting; but he thought before long communities would adopt it, even at the increased cost over gas. If the posts now used for carrying the wires were accepted for the lamps, the first cost of installing the new light would be considerably reduced. That an increase in the illumination of the main thoroughfares was desirable was, he thought, admitted; and whether the streets were lighted by gas or electricity, there was evidently a demand for more light. Replying to Mr. H. F. Willey, the Town Clerk stated that he had not yet had any estimate from the Gas Company for supplying larger lamps for the leading thoroughfares; and, after some discussion, it was decided to further consider the report on the 8th prox., by which time it is expected an estimate will be received from the Company.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

Monday, May 16.

WATER COMPANIES (REGULATION OF POWERS) BILL.

The EARL of CAMPERDOWN, in moving the second reading of this Bill, said that, with one or two exceptions, it was identical with the measure which passed through that House in 1885, but which was lost in the other House owing to the pressure of business. The Bill had two main objects. The first was to impose upon all companies supplying water at a profit an obligation to send to every consumer a demand-note containing the particulars of the charges made; and the second was to compel the companies, where disputes arose as to the legality of the charges, to abstain from cutting off the water until a decision in their favour of a Court of Summary Jurisdiction had been obtained. As the law stood at present, the consumers were bound to pay the water companies a quarter's rate in advance on the first day of each quarter, without any particulars of the quarter's charge being given; and if such payment were not made, the companies were entitled the next day to cut off the supply. Such a state of the law had given rise to great abuses, as had been proved before a Select Committee of that House some years ago. By clause 4 of the present measure, the companies were required to send to each consumer a demand-note, containing the particulars of the charge, and the consumers were to be allowed 21 days to consider whether they would dispute any of the items of the charge. If within that time they gave the companies notice of their intention to dispute any of the items, the companies were not to be allowed to settle the matter by cutting off the supply until after they had obtained a decision of a Court of Summary Jurisdiction in their favour, and had subsequently to such decision given 14 days' notice to the consumers of their intention to cease the supply. In cases where the consumers did not dispute the items of the charge, the companies were required to give 14 days' notice before they could cut off the supply. The provisions of the Bill would apply in cases where water was supplied to a consumer for both trade and domestic purposes, where the charge for domestic purposes exceeded that for trade purposes; but they would not apply where the charge for trade purposes exceeded that for domestic purposes. By clause 11 the water companies were required to give notice to the local sanitary authority in all cases in which they cut off the supply.

The Bill was read a second time.

Friday, May 20.

WATER COMPANIES (REGULATION OF POWERS) BILL.

To-day the House went into Committee on this Bill.

Clauses 1 and 2 were agreed to.

The EARL of WEMYSS, who had given notice of his intention to move an amendment to clause 3, which would have the effect of bringing municipal corporations within the provisions of the Bill, intimated that he did not intend to press his amendment then, but reserved his right to move it at a subsequent stage of the measure.

Lord HERSCHELL inquired of the noble Earl who had charge of the Bill why it was that the measure was not so framed as to include municipal corporations.

The EARL of CAMPERDOWN said the reason was because they were publicly-elected bodies who were responsible to the ratepayers, who were the consumers of the water, for their actions, and who, if they cut off the water supply improperly, would be answerable to their constituents. Moreover, corporations had no personal interest in supplying water, and derived no profit from its sale; and therefore it was improbable that they would improperly cut it off as private companies were likely to do. No complaints had been made against corporations in this respect; but if they should hereafter act improperly, it would be easy to pass a short Act bringing them within the provisions of the present Bill. He gave his noble friend (Earl Wemyss) notice that, if he should attempt to move his amendment at a later stage of the Bill, he should oppose it.

The EARL of KIMBERLEY remarked that, in his opinion, corporations supplying water should be placed on the same footing as companies.

The clause was agreed to.

On clause 4,

The EARL of CAMPERDOWN moved an amendment excepting from the operation of the clause cases in which water was supplied solely by agreement or by meter.

The amendment was agreed to.

The EARL of WEMYSS said the water companies quite admitted that the details of the charge should be fully stated in the demand-note. He then moved an amendment to the effect that the period during which the consumer would be entitled to object to the particulars of the charge accompanying the note should be reduced from 21 to 7 days.

The EARL of CAMPERDOWN said the point had been carefully considered by the Select Committee to which he had referred on the occasion of the second reading of the Bill; but he would be prepared to go below the limit fixed by the Committee, and reduce the period from 21 to 14 days, if the noble Earl would accept this proposal.

The EARL of WEMYSS assented, and the reduction from 21 to 14 days was agreed to.

The clause, as amended, was passed.

The remaining clauses were agreed to, and the Bill passed through Committee.

The following progress was made with Bills last week:—

Bill read the first time: Bournemouth Improvement Bill.

Bills read a second time: Blackburn Corporation Bill; Electric Lighting Provisional Orders Bills (Nos. 1, 2, and 3); Gas Orders Confirmation Bill; Lanarkshire (Middle Ward District) Water Bill; Rhyl District Water Bill; Rhyl Improvement Bill; Water Companies (Regulation of Powers) Bill; Water Orders Confirmation Bill.

Bills reported: Mold Water Bill; North Shields Water Bill [preamble not proved]; Ormskirk Gas Bill; Southend Gas Bill.

Bill read the third time and passed: Uttoxeter Water Bill.

Bills Royal Assented: Barrow-in-Furness Corporation Water Bill; Bristol Gas Bill; Liverpool United Gas Bill; Oxford Gas Bill; Southborough Local Board Gas Bill.

HOUSE OF COMMONS.

Tuesday, May 17.

THE TAXATION OF SULPHATE OF AMMONIA STILLS.

Sir H. ROSCOE asked the Chancellor of the Exchequer whether he was aware that several prosecutions had been and were being conducted by the Inland Revenue against gas companies, especially that in Sunderland, and against certain manufacturers of the products of coal gas, for infringing an Act passed in 1846 (9 & 10 Vict., cap. 90), making it compulsory for every person keeping a "still" to take out a licence for it, and pay a duty of 10s. per annum, and in default a penalty not exceeding £50; whether stills for the manufacture of gas products had been in use for upwards of 30 years without any attempt to tax them; whether such stills come under the Revenue Act for the prevention of the manufacture of spirits by unlicensed persons; and whether, if the Inland Revenue wished to tax a piece of apparatus which was not used for distilling spirit, he would direct the preparation of an Act of Parliament for the special purpose, instead of permitting an old Act to be used in such cases.

The CHANCELLOR of the EXCHEQUER: There has been a prosecution against the Sunderland Gas Company at the instance of the Commissioners of Inland Revenue for the recovery of the penalty of £50 imposed by the Act 9 & 10 Vict., cap. 90, for keeping a still without a licence. The prosecution was heard on the 6th inst., and dismissed [see *ante*, p. 855]; and a special case is to be stated for the opinion of the Queen's Bench Division, as to whether the still used by the Company is one for the keeping of which a licence is required under the Act. In the opinion of the Board of Inland Revenue, these stills are capable of being used for the production of spirit; but, as the matter is still *sub judice*, I will not express any opinion upon it.

The following progress was made with Bills last week:—

Bills read the first time: Bexhill Water and Gas Bill; Uttoxeter Water Bill.

Bill read a second time: Ipswich Corporation Bill.

Bills read a second time and committed: Glasgow Corporation Water Bill; Swansea Corporation Water Bill; Swinton and Pendlebury Local Board Bill.

Additional Bills referred to the Select Committee consisting of Sir J. Pease (Chairman), Lord F. Hervey, Mr. W. M'Arthur, and Mr. Victor Cavendish: Glasgow Corporation Water Bill; Pontypridd Water Bill; Swansea Corporation Water Bill; Swinton and Pendlebury Local Board Bill.

Bills reported: Bradford Corporation Water Bill; Exmouth and District Water Bill; Gas Provisional Orders Bill [Orders confirmed]; Kilmarnock Corporation Water Bill; Middlesbrough Corporation Bill; Tredegar Local Board Water Bill.

Bills read the third time and passed: Cleator Moor Local Board Gas Bill; Liverpool United Gas Bill; Southborough Local Board Gas Bill.

Petitions against the following Bills were presented:

Ashton-under-Lyne, Stalybridge, and Dukinfield District Water

Bill, from the County Council of the West Riding of Yorkshire.

Gas Provisional Orders Bill (Sutton and Hooton Order), from Ratepayers of Great Sutton.

Glasgow Corporation Water Bill, from Magistrates and Police Commissioners of Partick.

Pontypridd Water Bill, from the Ystradfydwg Local Board [against alterations].

Swinton and Pendlebury Local Board Bill, from the Corporation of Salford and the Little Hulton Local Board.

Western Valleys (Mon.) Water (Gas Purchase) Bill, from the Blackwood Gas and Water Company and the Risca Local Board.

HOUSE OF COMMONS COMMITTEE.

Thursday, April 7.

(Before Mr. CAMPBELL-BANNERMAN, Chairman; Sir W. HOULDSWORTH, Sir H. STAFFORD NORTHCOTE, Mr. R. K. CAUSTON, Mr. S. GEDGE, Mr. P. STANHOPE, Mr. POWELL WILLIAMS, Mr. W. JAMES, and Mr. E. H. LLEWELLYN.)

BIRMINGHAM CORPORATION WATER BILL.

The proceedings on this Bill (see *ante*, p. 852) were continued to-day. Owing, however, to concessions made by the promoters, Counsel representing the Wye Fisheries Board and the Commons Preservation Society were relieved of attendance.

Mr. Howard Smith was called to give the result of certain calculations he had been requested to make. He said the population of the water area in 1955 had been estimated on several hypotheses. It was now 648,000. If it rose at the same rate as the consumption of the water had been estimated to grow, it would then be 2,880,000.

The Mayor (Mr. Lawley Parker), recalled, stated that the rateable value of the borough was over £2,000,000; and the present debt £9,960,000, of which only £1,561,000 was unremunerative. He did not think the scheme would be at all prejudicial to the holders of Corporation stock.

Mr. POPE observed that, on the previous day, one or two members of the Committee had been anxious to be accurately informed about the quantity of water left for other communities, supposing Birmingham were entrusted with the powers asked for. He desired that this question should be absolutely understood; and therefore, with their permission, he would recall Mr. Mansergh.

Mr. Mansergh, recalled, and examined by Mr. POPE, said that, in the districts adjacent to that proposed to be appropriated, there would be

left, at a sufficient elevation for the supply of London, an area with water enough for the supply of 20 million people. The Elan and Claerwen alone would not be sufficient for London. Their watershed, in consequence of its elevation, was almost the only portion of Wales available for Birmingham, and was certainly the most suitable; whereas London would have the choice of lower elevations. In regard to the Wye, the agreement arrived at with the Conservators was that 27 instead of 22 million gallons should be sent down daily. Manchester retained her former sources of supply after acquiring Thirlmere; but in Birmingham the present sources would be abandoned, because it was useless to continue the cost of pumping, especially when the water in the wells was deteriorating. Glasgow took 100 million gallons of water a day, with no obligation to supply anybody on the road.

Mr. T. Hawksley, F.R.S., said he regarded Mr. Mansergh's scheme as a noble and comprehensive one. It was not too large, considered in regard to the probable future requirements either of Birmingham on the one hand or of London on the other. In estimating any increase in water consumption, it was necessary to look forward not only to the growth of population, but to larger individual wants. One was quite as important a factor as the other. As to dual systems of supply, the chief objection to them was that they were irrational. One might put in two pipes; but one could not make them be used for their special purposes.

Mr. G. H. Hill, M.Inst.C.E., Joint Engineer with the late Mr. Bateman for the Thirlmere works of the Manchester Corporation, said Mr. Mansergh's scheme for Birmingham was a very good one, and not in the least excessive. In the case of the Glasgow works, completed 32 years ago, it was thought they would be sufficient for a hundred years; and yet he had lived to see a second aqueduct made to bring 60 million gallons a day more to the city. To suggest a dual supply was, to his mind, ridiculous.

Mr. J. M. Gale, M.Inst.C.E., Engineer of the Glasgow water scheme, expressed similar opinions.

Mr. POPE intimated that he had Sir Frederick Bramwell, Mr. Heap, of Sheffield, and other engineers, ready to give evidence; but he did not think it necessary to call them.

The CHAIRMAN acquiesced.

Mr. S. Williams, County Surveyor of Radnor, then gave evidence in reference to the common rights exercised within the area proposed to be taken; and with his cross-examination the proceedings closed for the day.

Friday, April 8.

This morning, Mr. Williams was further cross-examined.

Mr. POPE having read certain clauses which had been drafted to safeguard the rights of the commoners,

Witness, in answer to questions by the CHAIRMAN, said he did not think the people of the district affected, who were sufficiently intelligent to appreciate the benefits to be derived from the scheme, viewed it with the slightest hostility. He believed, on the contrary, that they were looking upon it as one of the greatest benefits which could possibly have happened to a poor neighbourhood. Many of the sheep farmers had been afraid of their sheep-runs being taken from them, and of the Corporation proving a less agreeable landlord than their present ones. The working classes, however, were strongly in favour of the Bill, because the scheme would provide them with work at their own doors for eight or nine years. As to the community living round Rhayader, he was perfectly satisfied that their feeling ran so strongly for the Bill, now that the Corporation had conceded the clauses just read, that, if necessary, they would petition in its favour.

Dr. A. Hill, Medical Officer of Health for Birmingham, corroborated the evidence of the previous witnesses as to the immediate necessity for an additional supply of water for Birmingham; and he bore testimony to the excellence of the proposed source.

In cross-examination, witness said the sudden change from hard to soft water would not be inimical to the public health. He had made two analyses of the Welsh water—once after rain, and the other in fine weather, and both had shown it to possess all the qualities which it was desirable to combine in a town supply.

Mr. Gray was recalled to answer a few questions put by the CHAIRMAN; and the promoters' case closed.

Mr. PEMBER then addressed the Committee on behalf of the London County Council. He said his clients did not think it necessary to support their position with witnesses, because all they cared to do was to make such comment upon the evidence of the promoters as might strengthen the contention with which alone they were concerned—viz., that the Committee ought to be perfectly satisfied of the pressing necessity of Birmingham before they passed the Bill. The London County Council did not approach this matter in any unfriendly or carping spirit. On the contrary, they would naturally, *prima facie*, have sympathy with a great Corporation doing what they were inclined to think that, some day or other, they would have to do themselves. But they did feel that, under present circumstances, it was needful to emphasize the possibility of their having to go into some such neighbourhood as that of the Elan and Claerwen, and to ask the Committee to consider very carefully the exact circumstances of this measure, the mode of its introduction, and the relation it bore to the Royal Commission on Water Supply which was now sitting, and to the stage at which the question of the London Water Supply had arrived. Their petition submitted that the Elan and Claerwen were well known as one of the possible future sources of supply for the Metropolis, and that no such appropriation of their waters as the Bill proposed should be authorized until the Commission had made its report. There was a certain similarity between the positions of London and Birmingham as to their respective water supplies. Both seemed to have sufficient water for their present requirements. Birmingham had a surplus of 3 million gallons a day; and probably London had something proportionate. He thought he might say, also, having read Mr. Gray's report, and knowing what he did of London, that both cities could increase their present quantity. Both had equal claims to go to Wales; neither had any inherent or domestic claim to the waters of the Principality. If there were to be urged on behalf of either a scintilla of prior right accruing from early projects of appropriation, perhaps it

might be urged on behalf of London; for if Sir Robert Rawlinson reported in 1871 that the district of the Elan and Claerwen was worthy of consideration by Birmingham, it was also true that Mr. Fulton reported four or five years previously upon a similar project for London on a still larger scale. But the future needs of Birmingham paled in importance before the future needs of London. He never heard anybody suggest that London was increasing, in respect of either population or water consumption, at a slower rate than the other great towns of England; and, as a matter of fact, he believed that it was increasing more rapidly than they. The present consumption of water in London was, as nearly as possible, 180 million gallons a day; and the population within the area of supply was 5½ million people. Apply anything like the Birmingham calculations to these figures, and the most remarkable results appeared. By the time Birmingham would consume its 30 million gallons of water a day, London would consume 360 millions; and if it was right that the supply of Birmingham in 1955 should be 67 million gallons, that of London ought to be 804 millions. He was not concerned to say whether or not he trusted these calculations. It might well be that they led to an absurdity in the one case as in the other. But if the promoters looked at the thing in the right way, and if the problem of the next 60 years was difficult and pressing for Birmingham, as they said it was, what must be the difficulty surrounding the problem of the London supply, what must be the need of dealing with that problem immediately? The learned Counsel then proceeded to deal with the figures contained in Mr. Mansergh's table to disprove the urgency of the scheme. Birmingham had, he said, a consumption estimated for this year, of 17½ million gallons a day. He noted that 15½ millions was the first figure in Mr. Mansergh's table; but he passed by this discrepancy, because, at all events, there was a daily surplus of 3 million gallons. Mr. Gray's scheme would carry the consumers on for 20 years, at the end of which time their consumption would be 30 million gallons a day, as shown by Mr. Mansergh's table. It was quite clear, then, that Birmingham could do without any water at all from Wales for this period. This was the usual time for which water engineers were in the habit of looking forward, not for small towns, as had been suggested, but for places like Oldham and Halifax. But, on the showing of the promoters themselves, in 1955, when their supply would amount to 67 million gallons a day, they would need only 37 millions.

Mr. BALFOUR BROWNE: It is 62 millions now, because of the concession we have made to the Wye Fisheries Board.

Mr. PEMBER said he was willing to admit the qualification; but even then the scheme was positively twice too big. That 37 million gallons of estimated supply was only 8 millions in excess of what would be provided by the first instalment of the works. If this part of Wales were to be used at all on a large scale, and London wished to go there, was it not clear that, in case there should be a surplus over and above the needs of London, an arrangement could easily be made by Parliament by which Birmingham could take such a share of it as would represent her real needs at any time covered by the term of Mr. Mansergh's table? If upon the figures in this table the scheme was shown to be twice as large as was needful, how much too big did it appear on a common-sense basis?

The CHAIRMAN: Have you carefully considered the possibility of Wolverhampton and of other large towns within the 15-mile limit pulling at the same cow?

Mr. PEMBER replied that Mr. Mansergh had expressly stated that he wanted the 67 millions for Birmingham and the district; and the Committee had had no evidence from Wolverhampton or any other large town of its desire to take part of this Birmingham water. If there had been such evidence forthcoming, Birmingham would not have failed to produce it.

Mr. STANHOPE pointed out that the South Staffordshire Water Company had not raised any opposition to the scheme.

Mr. PEMBER said that if they desired any of the water they would have been expected to appear in support of the scheme. As to the goodness of the present supply, Dr. Frankland only pledged himself that it was on the verge of being suspicious; and it was significant that this warning as to the quality of the water had come after the determination of the Corporation to go to Wales. He submitted, therefore, on the whole case, that there could be no harm in postponing the matter for two years.

Mr. CAUSTON asked if Mr. Pember had any suggestion to make for the protection of London by clauses.

Mr. PEMBER replied in the negative. He said his own belief was that it would be extremely difficult to frame any.

The CHAIRMAN concurred. London asked that provision should be made "which may not prejudice or affect any future scheme."

Mr. A. T. LAWRENCE then addressed the Committee on behalf of the Hereford Corporation; reaffirming the absolute property of that body in the waters of the Wye. He contended that Birmingham ought to let Hereford put into the aqueduct a main capable of abstracting 650,000 gallons of water a day.

The Committee adjourned until the 2nd inst.

LEGAL INTELLIGENCE.

STAFFORDSHIRE QUARTER SESSIONS.—Tuesday, May 17.

(Before Mr. T. F. TWEMLOW, Chairman, and a Bench of Magistrates.)

The Assessment of the Birmingham Corporation Gas-Mains.

The hearing of the appeal by the Birmingham Corporation against the assessment of their mains at Harborne by the Assessment Committee of the King's Norton Union was resumed to-day. A report of the first three days' proceedings appeared in the JOURNAL for April 26.

Mr. DANCKWERTS and Mr. KETTLE appeared for the appellants; Mr. YOUNG, Mr. PRITCHETT, and Mr. SHAKESPEARE for the respondents.

The CHAIRMAN, on taking his seat, intimated that the Bench were of opinion that there was no great rating principle involved in the case; and as previous cases had decided upon which items deductions might be made, there seemed to be no necessity for any technical lecture on

the principles of rating. It was very desirable that the case should not be unduly protracted; and they would suggest that Mr. Young should call witnesses without proceeding further with his address.

Mr. YOUNG said he would accept the suggestion of the Court.

Mr. R. Clarke, Surveyor to the parish of Birmingham, said that, taking the receipts from Harborne for 1889 at £4035, he estimated the rateable value at 15 per cent. on those receipts, *plus* rates at 5s. 3d. in the pound. The rateable value on that basis for the Harborne portion would be £475; but he thought £400 was a fair figure. This sum was equivalent to 9 per cent. on the receipts of £4529 in 1891.

Mr. W. A. Mason next presented his valuation, and explained on what points it disagreed with that of Mr. H. E. Jones. He said that if the Corporation had charged the maximum price of 4s. per 1000 cubic feet, as they were entitled to do, the net receipts, from the gas undertaking would have been £732,572 in 1890, instead of £435,149, the amount appearing on the printed balance-sheet. He differed from Mr. Jones in the matter of the £2105 profits from fittings, which he thought ought to be included in the receipts. Witness, amongst other items, then sought to reduce the appellants' figure of £322,401 for working expenditure, and instanced the charges made for the Secretary and clerical help. He said that, as the same officials were engaged in keeping the expenditure and capital account and the annuities account, he thought £2000 should be deducted as the expenditure of the hypothetical landlord.

Mr. DANCKWERTS remarked that the witness was theorizing on a matter about which a simple inquiry would have shown he was wrong. The landlord's work he spoke of was done in the Treasurer's office.

Witness (continuing) made deductions which brought Mr. Jones's figure for working capital from £322,401 to £248,628. Passing on to the question of tenant's chattels and working capital, he gave as his figure £250,000, as against the sum of £365,785 put in by Mr. Jones. Various items under this heading were dealt with by witness, who explained in detail where he differed from Mr. Jones as to what should be entered as tenant's capital and what should be put down as landlord's capital—upon which point arose the difference in the total sums. For instance, Mr. Jones claimed £51,000 as the total value of the standing stock of coals for 1890, on the ground that a six weeks' supply was necessary. On the other hand, witness pointed out that the books of the undertaking showed that during 1890 there was never more than £28,086 stock value; and he contended that no gas company kept a six weeks' supply. With reference to the renewal of meters, he could not understand why £11,280 should be required under that head, seeing that for 16½ years the actual amount spent per annum on renewals was £7757. He gave £155,858 as the rateable value of the whole undertaking, as against £79,331 given by Mr. Jones; and he put the rateable value of the mains (*plus* rates) at £104,287, as against Mr. Jones's £27,760. If the appellants' figures were adopted, the undertaking would be insolvent, as the Committee would be £17,978 short of the money needed for annuities, Corporation stock, and bonds. On the basis of witness's calculations, the rateable value of the Harborne mains was £832. Summing up his evidence, Mr. Mason pointed out that his valuation of the works for 1890 was £39,644, and of the mains (less rates at 6s. in the pound), £80,266; or a total of £119,910. He found, taking a number of years, that the average annual profits of the undertaking were £153,343. The tenant's share of that would be £32,500; and the correct rateable value £120,843, as against his estimate of £119,910 for a particular year.

In cross-examination, witness admitted that he had in error deducted discounts from receipts which already had had the discounts deducted. The books were very confusing.

Mr. DANCKWERTS: What problem have you set yourself to solve in these calculations?

Witness: At what rent this undertaking might reasonably be let from year to year; the landlord paying the statutory repairs and the tenant maintaining the plant, chattels, &c.

But the rent ought to be what the tenant could reasonably afford to pay?—No; the rent that might be reasonably expected. One year the accounts might be made so as to show no profits, yet the undertaking might be valuable. My calculation has shown that the tenant paid 66 per cent. of the net receipts to the landlord.

Wednesday, May 18.

On the resumption of the proceedings this morning,

Mr. Mason was further cross-examined, with the object of showing that, starting the year with a capital of £253,077, the hypothetical tenant of the works had, on the witness's figures, at the close of the year only £190,000. He maintained that there was something fallacious in the argument of the learned Counsel; but, at the moment, he could not see where. He had treated the lamps as landlord's property. If, as was suggested, the Corporation supplied the lighting authorities outside the borough with lamps free of charge, they were treating the local authorities most liberally in selling their gas at not a farthing profit, and giving them lamps in addition.

Mr. DANCKWERTS: And, in return, you want to put up our rates?

Witness: Certainly, they ought to be put up; you make plenty out of the customers. Continuing, he said he adhered to his estimate of the tenant's allowance at 15 per cent. on fixed capital, and 10 per cent. on working capital. He contended that no special reserve fund was needed for the renewal and maintenance of meters. A renewal, in his opinion, was the replacement of something destroyed by ordinary wear and tear; and a repair was the replacement of something destroyed by accident. He also contested Mr. Jones's allowance of 40 years' life to gas-mains. He knew of a small works at Tewkesbury where they were 60 years old; and he had heard of them being 100 years old.

In re-examination, witness said that, striking out the fittings, and making other corrections in his figures, his valuation in Harborne was reduced from £832 to £812. Allowing for bankers' interest on overdraft, it came to a level £800—just double the amount of the assessment which the respondents were seeking to uphold.

Mr. W. A. Valon was next examined, and produced a valuation of the gas undertaking made on the published accounts of 1890. It generally corroborated that of Mr. Mason.

Witness having been partially cross-examined, the Court formally adjourned until June 11.

MISCELLANEOUS NEWS.

THE ROYAL COMMISSION ON LABOUR.

Friday, May 13.

(SECTION C.—Present: The Right Hon. A. J. MUNDELLA, M.P., Chairman; the DUKE OF DEVONSHIRE, Mr. M. AUSTIN, Mr. J. C. BOLTON, Mr. T. BURT, Mr. G. LIVESEY, Mr. H. TAIT, and Mr. E. TROW.)

Evidence on Behalf of the Gas Industry.

To-day the hearing of evidence in connection with the gas industry (see *ante*, p. 919) was continued.

Mr. John Higgins, a stoker in the South Metropolitan Gas-Works, was the first witness called. In reply to the CHAIRMAN, he stated that, before going to the South Metropolitan Company, he was employed at the Salford Gas-Works, and had been there about 16 years. He had also been a member of the Gas Workers' Union, though he took no part in its formation. When a strike occurred among the gas workers at Salford in December, 1889, he, with several fellow-workmen, proceeded to London; but before doing so, he telegraphed to Mr. Howard, the Chief Inspector of the South Metropolitan Company, and was told to come. When he arrived he was employed on much better terms than at Salford. He had 5s. 4d. a day, and now he was on a stoking-machine, and worked twelve hours a day (he formerly worked eight hours), getting 1s. 8d. extra. When he went to the South Metropolitan Company, there was a strike on; and he and his comrades were met at the railway station at Greenwich by a large number of the men, and were assaulted by them. The strikers threw bricks at them, and tried to induce them not to go into the works. In several instances they were successful. He, however, went in under the charge of the police; and when once in the works, he did not dare to come out again. Several of those who were inside did attempt to leave; but they were driven back. They were assaulted, thrown down, and one man had his head cut open. They lived inside the works for about seven weeks; and during that time they were supplied with food and lodging by the Company. After the strike, he brought an action against Mr. Ward for slander, and obtained a verdict for £200 damages; but no part of that sum had yet been paid to him. He did not bear the expenses of the action. He was not a member of the Gas Workers' Union; and he had no desire to be one. With regard to what Mr. Ward stated on the previous day about machinery, he approved of it. The machines worked better than the men could do by hand, and no stuff was wasted. They effected a saving of labour, and made the men's task much lighter. They would diminish the number of men employed; but in all other respects the invention was a good and useful one. He had worked the machines for twelve months; and they were doing very well; they were, in fact, the best he had seen, he had travelled all over Salford, Manchester, and other places. Reverting to the question of payment, he stated that, in addition to his wages, he now received a benefit out of the profits of the Company. He was entitled to a bonus; and in respect of this he had received close upon £7—£5 last year and £2 the previous year, for six months. This was a considerable addition to his wages. As regarded the effect produced by the workmen being interested in the profits of the Company, in making them more careful in the use of material, and in improving their habits, as far as he and his fellow-workmen were concerned, they were just about the same—they did not waste, and they exercised care.

Questioned by Mr. LIVESEY as to the basis of his action in the slander case, witness stated that the Company by whom he was employed informed him that, if he were willing to commence an action they would pay the expenses.

In answer to a question by Mr. AUSTIN as to his joining the Gas Workers' Union, witness said it was not the result of voluntary action; he was compelled. Unionists would not work with him while he remained a non-Unionist. As to his coming to London while a strike was going on, he stated that before he started for the Metropolis he heard there was to be a strike.

Mr. LIVESEY: But you knew it was on when you left Salford?

Witness: Yes.

Interrogated by Mr. TAIT, witness denied that the Executive of the Gas Workers' Union informed the men at Salford during the strike there that they had taken a wrong step. He also mentioned that, after he went to the South Metropolitan works, he was intimidated many times, and reported this to the Company.

Re-examined by the CHAIRMAN, witness repeated that he had never in Salford heard it said that the men there struck against the rules of the Union; and he added that the local Organizing Secretary asked the men to come out, and they did so at his request. He (witness) was now in a comfortable situation, and was prepared to continue there. He had learned a lesson concerning membership of the Union; it had caused him to break up a good home.

Mr. W. Thorne, General Secretary of the National Union of Gas Workers, examined by the CHAIRMAN, stated that the Union was formed in March, 1889. He proceeded to give particulars of the strike in Manchester and Salford, to which the previous witness had alluded. The cause of it, he said, was the Manchester Corporation not carrying out an agreement; and the Salford men simply came out in sympathy with the Manchester workers, as in Salford there was no grievance at all. He did not call out the Salford men; as a matter of fact, the Local Secretary did it. But he (witness) did not approve of it. He was in Nottingham at the time; and he went straight to Manchester and Salford and told the Local Secretary that the best thing to be done was to obtain an interview with the Salford and Manchester Corporations, and endeavour to arrange for the men returning to their work. An interview was had with the Salford Corporation; but they would not come to any arrangement, as they had men to take the places of those on strike. During the strike at the South Metropolitan Gas-Works, he (witness) was Secretary of the Union; but he did not know anything of that strike till he had been two or three days in Manchester on the occasion to which he had alluded. But the strike was not decided upon without the consent of the Union. It was authorized, though many of the delegates protested

against it. The grievance was caused by asking the men to sign a twelvemonth's agreement; which would have been very detrimental to them. They did not object to their wages, nor did they to the bonuses, if there had been no compulsion to sign a twelvemonth's agreement. Interrogated as to their disapproval of the agreement, witness said he thought anyone would admit that the engagement was objectionable, as he who accepted it would have no freedom afterwards, and might, during service under it, be compelled to do more work than had originally been stipulated for.

The CHAIRMAN: Is there no advantage, on the other hand, in a man being sure of a twelvemonth's labour on good terms?

Witness: There may be, perhaps, but to the detriment of others, A man who is silly enough to sign an agreement—

Do you think that is a fair term to apply to a man taking a twelvemonth's engagement?—I do think he would be silly in signing himself for a twelvemonth to any person. Continuing, witness said he was aware that some of the best-paid officials in England entered into engagements for more than a twelvemonth; but having better situations than gas stokers, that was a different thing.

If the gas worker is getting full wages, and a bonus in addition, is that not good?—It depends on the condition upon which the bonus is given.

Then the cause of the strike was the condition attached to the bonus—this condition being a twelvemonth's agreement, nothing else?—No.

In further examination, witness gave it as his opinion that the men employed by the South Metropolitan Gas Company did not now work upon so favourable terms as they had done. The greater portion of them worked twelve hours, and had an extra shilling a day for the additional four hours; and the system was one by which the Company obtained an advantage over the men. If the last witness was a driver on a machine, he would not dispute his statements; but so far as manual stoking was concerned, the men were not so well off. Neither would he dispute the last witness's statements as to what he had received under the bonus system. It might be as he had said; but he would not get so much now, he (witness) thought. According to the conditions attached to the bonus, the higher the price of gas, the lower the bonus. Being requested to tell the Commission something about the other principal strikes since the formation of the Union, witness described the Leeds strike as the next principal one, and attributed it to the Corporation not carrying out their agreement. The Union undoubtedly approved of that strike. The next was at the Bristol Gas-Works. It lasted two days, and was settled favourably to the men, who obtained their own terms. He added that, if he had his way, he would compel every man to join the Union.

The CHAIRMAN: How?

Witness: By moral suasion, at the onset.

But jeers and taunts and threats are not "moral suasion," are they?—I do not agree with that; but I say that every man should join the Union, though I do not say it is possible to accomplish this.

Are you aware that the best Unions in England have succeeded in accomplishing great things for their members, and for many non-members, by a reasonable, orderly course of conduct?—I admit that.

In further examination, witness admitted that it was natural that, his Union having been in existence only about three years, workers could only join it gradually, and sensible men would come into it by degrees—they would come into it only when they saw it was a properly conducted Union. Reminded that, in the case of the Manchester and Salford strikes, men were thrown out of work by staying in the Union, and asked if he thought that was the way to propagate Unionism, he still maintained that the workers' business was to join the Union. He said that, in his opinion, they would make more progress if they did so; while if one-half of them were organized and the other not, they were placed at a disadvantage, and one class was set over the other. Being requested to send in to the Commission a written statement of all the strikes that had taken place among gas workers since the formation of the Union, he promised to do so. He then went on to point out that, in cases of dispute, the Union now tried to have them settled by amicable agreement or by arbitration. Membership of the Union cost 2d. a week; and, in addition to that contribution, levies were made when necessary. The first levy was during the South Metropolitan strike. There was no levy at the time of the Manchester and Salford strike; at least, none was authorized.

Higgins was here recalled; and he affirmed that, before the commencement of the Salford strike, a levy of 5d. a week was made.

Witness declared that it was without the authority of the officials of the Union. He next proceeded to show that the Union had endeavoured to avoid conflicts between employers and employed. He first referred to a recent difference at the Bromley station of The Gaslight and Coke Company, through the Company not adhering to their arrangement with the men—the former insisting on having 80 instead of 76 retorts done. But the Union did not think it desirable that there should be a conflict; and the men were doing 80 retorts, though they signed for only 76. Next, there was an unfair treatment of the men at the Company's station at Beckton. Notwithstanding that a notice had been posted up, signed by the Resident Engineer, to the effect that the men would go to work on a certain day and receive 5s. 9d. per day for as many retorts as the machines might be found to be capable of doing, with a reasonable amount of rest for the men, after one machine had gone to be repaired and been returned, the men were required to work at the rate of 5s. 4d., without any explanation at all. He went to the Resident Engineer, and that officer said that, as at other places the men were getting 5s. 4d., he thought the men at his works were not justified in having more. In that case, if the Union chose, there would be a conflict. But they did not choose; they did not think it was desirable, although it was very hard on the men to submit, while the Company were really in a position to pay the 5s. 9d. agreed upon. If the men stuck out for the agreement, it would mean a strike throughout the whole of the works in London; for they could not strike at one station of the Company without doing so at the whole of them.

The CHAIRMAN suggested that this difference should be represented in writing by the witness to the head officers of the Company, and an offer made to submit the matter to arbitration.

Witness said he did not see why they should arbitrate when there

was an agreement, and the Company did not depart from that agreement because of their poor circumstances.

The CHAIRMAN: They have not been very flourishing of late, have they? Has not their reserve fund almost disappeared? Am I right, Mr. Livesey?

Mr. LIVESEY: Yes.

Witness: Well, it is not because the men are not doing their work as well as before.

The CHAIRMAN: I am not saying that.

Witness proceeded to refer to other matters about which there was some dissatisfaction among workmen.

The CHAIRMAN inquired if the Union would not be a good deal stronger in the support of public opinion if they expressed their willingness to refer these questions to the Board of Conciliation.

Witness: When you get a blank denial, what is the good?

Have you made the offer?—No, I admit I have not. But when one gets a blank denial—

That is the more reason you should make the offer. Let an impartial Court decide, and these disputes might be settled. It would be well to try it.—I trust we shall have no cause. I hope The Gaslight and Coke Company will take the matter into consideration, and pay the men as they should.

If they do not, will you refer to the Board of Conciliation?—I may take your advice, now you have said what you have.

Supposing the South Metropolitan Company were to agree to amend their scheme so as to admit of proper notice—say, a month's—being given by the men, would this reconcile the Union entirely to their bonus system?—I do not know that they are not now reconciled.

But you objected, and still object, to the twelvemonth's agreement?—Yes.

Supposing that was modified, how would the South Metropolitan Gas Company stand then in your estimation? Would that not meet all your demands?—If the agreement was only a monthly one, the same as with other companies, I do not know.

A monthly agreement would entirely satisfy your requirements, would it not?—I do not think the Union would object; but it is a question whether it would satisfy the Company.

Witness was further examined to make it clear that a large number of industries had been affiliated to the Union. He said he did not see any objection to a Union which dealt mainly with gas workers governing a large number of other classes of workmen. The officials of the Union did not understand the details of the other trades; but any dispute among these was discussed at a District Council before reference to the officials; and they favoured the amalgamation because the gas workers found that, when they came out on strike, men in other trades were brought to fill their places, so it was better to organize and affiliate these. If the other trades would organize among themselves, it might be best that they should do so; but if there was no attempt at this, the Gas Workers' Union considered that they were justified in organizing them. Asked if he desired to express any opinion as to any subjects of legislation, witness requested to be allowed, before passing on to these, to explain the causes of one or two more strikes of gas workers. There was the one at Barnsley, which was caused by the Company compelling the men to go back again on the twelve-hour system. They kept this strike on about six months; but, unfortunately, the Company were in a position to defeat the men. They played one class of men against the other. They had their agents in Manchester, and got men from there to replace the former workmen.

The CHAIRMAN said the first error was the strike of the Manchester men, because this threw thousands of gas workers on the market.

Witness replied to this that, if the Manchester and Salford stokers had remained at work, those who took their places would have been walking about. He then went on to point out that similar occurrences took place in other towns; and he afterwards expressed the opinion that it was desirable that an eight-hour working day should be established by Act of Parliament. If this had been done in the past, the gas workers would not, he said, have come into conflict with employers so many times; they would have been thousands of pounds in pocket; and there would have been more men employed than at present. Very nearly the whole of the gas workers in London and the provinces were working an eight-hour day; and he thought it would be far better if this plan were legalized. He also sought to show that the idea entertained by many people, that the gas workers, in having their hours of labour reduced from twelve to eight, had the amount of their work correspondingly lessened, was not correct. The reduction of hours had not been attended with any great decrease in the quantity of labour; so that if the eight-hour day were fixed by statute, it would not mean a very large increase of men employed in gas-works. He recognized, he added, that the supply of gas was a monopoly; but his general observation was that, although there was an increase in the price of the labour producing it, its cost had not gone up throughout the country. He next directed attention to the Employers' Liability Act; saying he should like to see it altered. At present a claim under it had to be lodged within six weeks after the occurrence on which it was based; and sometimes the claimant was on a bed of sickness, and could not claim within this period, and so came outside the scope of the Act. The six weeks should be extended to at least twelve months. Then employers were at liberty to contract themselves out of the Act; and it was desirable that neither employers nor employed should be able to do this. In the matter of strikes, they had to complain of the interference of the police. During the South Metropolitan strike, he was knocked about by policemen; and many of their men were severely used, and the Union had to withdraw the pickets. They found that the policemen were really employed against the workmen, and for the benefit of the employers; and in such circumstances, he did not think the workmen had any chance of winning.

The CHAIRMAN asked the witness if he complained of men being protected in passing from a railway station to works where there was a strike.

Witness replied that he did. If men came to fill the places of others, they should do so without the assistance of the police.

The CHAIRMAN: Was it wrong for the police to protect the men from assault who came from Salford to the South Metropolitan works?—They were not assaulted.

Then the police did not interfere?—But the police marched them from the railway station to the works to guard them.

Why did the police require to guard them?—Oh, I do not know. I saw the crowd on the occasion; but it did not follow that the men would be molested. I maintain that the police should not protect any class of men for the benefit of employers.

Then you think the men were not entitled to protection?—I do.

Witness next reverted to the eight-hours question, and stated that, when Mr. Cunningham Graham introduced his Eight-Hours Bill, a vote was taken among the members of the Union; and it was found that the whole of them were in favour of a Bill to make general this length of working day.

In reply to Mr. LIVESEY, witness admitted he had said at Plymouth, shortly after the agreement had been come to with the South Metropolitan Gas Company, that if they had to fight the battle with the Company again, knowing what he then knew, he would advise the men to leave without giving a week's notice. He knew what a serious thing it would be were the gas supply of a great city cut off, and admitted that the employees were responsible to the public. He was also aware that there was a special clause in the Conspiracy and Protection of Property Act, 1875, which inflicts a severe penalty on any person employed by a municipal authority or any contractor for the supply of gas or water who breaks his contract with his employer. Still, if he had known as much then as he knew now, he would have recommended the men to come out without fulfilling their engagements. It was better that a few men be imprisoned than such suffering should be entailed on hundreds of men and women. It would only entail misery on a few; and the others could support and keep their wives and children. With regard to the smaller strikes at Ponder's End and Bromley, he certainly did complain that the South Metropolitan Company sent men there for the purpose of defeating the ends of other men who were resisting the tyranny exercised over the men. He admitted it was natural that, it being generally known that a thousand stokers had left the South Metropolitan works, other people would apply to the Managers of that Company to give them the names of good men. But the effect would only be to starve another set of men in a different part of the country. It was only starving one man to give food to another. As to reducing the number of hours from twelve to eight, he admitted that it implied a reduction of one-third of the work; but it would be impossible for men in gas-works to stand continuous work as could be done in ordinary avocations. On some occasions, before he had been in the factory ten minutes, he had to rush out to get a breath of fresh air. At Bristol, on the occasion of a strike, there was an attempt to bring in new men; but this was successfully resisted by the Union. Cabs and vans were overturned; and the entrance was completely stopped up. The Bristol branch did not ask permission at the headquarters of the Union, but took the matter upon themselves. It did not come up for discussion at subsequent meetings of the Executive; so he could not say that the action of the Bristol people was countenanced.

In reply to Mr. AUSTIN, witness said he considered Unions which had no sick or out-of-work funds were the progressive Unions. He would not say that societies which had such funds were retrograde; but they were not, in his opinion, progressive. The Gas Workers' Union paid nothing but strike-money. On the question of the length of working day, notwithstanding what had been said by the painters, he believed an eight-hour day would be practicable in that trade, and in the carpenters' trade also. The officials might argue to the contrary; but the rank and file did not take the same view. As to the Manchester strike, he would say that if he had known as much at the time it occurred as he knew now, he would have advocated the employment of force. When the policemen and the military force were used against the workers, he considered the latter were justified in meeting force by force. He had admitted that there was no justification for that strike; but, as a worker, it was his duty to do the best possible for the workmen.

In reply to Mr. TAIT, witness stated that, immediately after the Manchester strike, Horrocks was deposed from his position as Organizing Secretary, in consequence of his action, which was considered to have been very ill-advised. Previous to the strike, he had told the Corporation that, if they would allow the men to withdraw their notices, he would use his influence to prevent any strike taking place; but the Corporation still continued importing men into Manchester to take the places of the others. If the Corporation had acceded to the request, the whole of the men would have gone back to work; and he did not think there would have been any more friction whatever. They would have worked with the six non-unionists, although one of them was a foreman. The cause of the strike had originally been a demand made upon the Corporation to have these six men removed; but they were, as the result of witness's action, prepared to give way on this point. Still the Mayor and the officials declined; saying that, as they had sufficient men, those who had struck must leave, and take their chance at the gate. After he returned to London, a report was made that Horrocks was squandering the money; and when the Executive heard this, they said that no money should go there until they had investigated the matter. They despatched people to Manchester; and in the result, they sent down about £250 or £300. This money was distributed among the men. A receipt was, of course, obtained from the District Secretary or the responsible officials; and then they would be responsible for the men getting the money. When the South Metropolitan gas strike was on, they learned that some of the Manchester men came to London to assist the Company. He had heard Mr. Higgins say he was a party to this. Although he was a member of the Union, he assisted in this way to defeat its objects. He left afterwards of his own accord; but if he had not done so, he would certainly have been expelled. Before he made the speech at Plymouth to which reference had been made, he had heard that the Company were employing strangers, in breach of the agreement they had made; but he could not absolutely say whether or not this was so. He did not altogether agree with Boards of Conciliation. Still he thought they might be of some use. He certainly considered that, as there was a law which punished workmen for intimidating one another, the intimidation of workmen by their employees should be stopped. When a strike occurred, he thought it

was quite right to compel non-Unionists to organize; otherwise, they participated in the benefits without contributing. The masters employed whom they thought fit; and the men were equally entitled to say with whom they would work. If, in a gang of men, there were three Union men and one non-unionist, it stood to reason that those four could not possibly work together. There was friction; and consequently the work was not done so effectually as it would be if they were all Unionists. He thought that gas-works, the whole of the Government works, the mines, the railways, and monopolies generally, should first be brought under an eight-hour day. The police improperly interfered with picketing. At Vauxhall, a policeman followed him, trod on his heels, and gave him a punch in the ribs. If he had retaliated, he knew what the consequences would have been. He reported to the Inspector, who merely said that, if the man had done so, he had exceeded his instructions. When the men came up from Manchester to assist in the strike in London, he objected to the action of the police in preventing picketing. They told the men at the railway station to link arms; and in this way they all marched from the station. If these men could have heard the cause of the strike, he believed many of them would have returned. He went round to the Old Kent Road station, and was going to explain matters to them; but he was pushed down the steps.

In reply to the CHAIRMAN, witness stated that there was not an enormous crowd at the railway station—only the ordinary stokers; but as the policemen and the men marched along, of course the crowd grew. He was allowed to go into the railway station, but not on the side where the men were. There was no possibility of the men getting away, if they had not wished to enter the works, because the police were so close on either side that a man could not get out of the ranks if he chose.

In answer to Mr. LIVESEY, witness admitted one man who asked to leave the ranks might have done so. He believed that, if the men had been informed of the principal facts of the case, they would not have come to London. He objected to their receiving police protection, unless they were molested. He acknowledged that, if they had not received that protection at the towns and villages whence they came, as well as at this end, they would not have come. There was nothing to show that the men would have been molested, for the strikers were all perfectly sober. There was not a drunken man among them on the morning of the strike; and he believed that the new men could have been got in peaceably. He considered that to dismiss a man merely because he belonged to a trade organization was to intimidate him. They did not object to employers dismissing men for reasonable causes; but the excuse was made that a man was inefficient, when this was not the reason at all—the real one being that he had made himself obnoxious merely by belonging to a Union. He failed to see why a Magistrate could not, according to the evidence, decide as to whether or not a man had been dismissed properly. He objected to men contracting themselves out of the Employers' Liability Act. In some industries, men were absolutely compelled to contract themselves out of the Act; and he thought they did not get any corresponding advantage.

In answer to Mr. BOLTON, witness said he considered that the present law would be sufficient, if applied equally to employers and employed, to prevent intimidation on the part of the former. If employers of labour were at liberty to say they would employ whom they pleased, workmen had the same right to say they would work with whom they chose. The intimidation to which he referred was specially directed against delegates and collecting stewards. He did not object to masters insuring themselves against liability. He did not care, so long as the men or their families received compensation.

Mr. LIVESEY read to the witness an advertisement which he stated was put in all the country papers, to the effect that the stokers employed at the South Metropolitan Gas Company's works had given notice to leave their employment because a share in the profits had been offered; and having refused this offer, the stokers wished the Company to remove men who had accepted it. The advertisement also intimated that the Company had made arrangements to lodge and feed any new men on the premises, should it be necessary; and that the police authorities would give them the needful protection.

Witness remarked that this was the inducement to the men to come—the food, the tobacco, the beer, and the police protection. The Union also issued bills; but their agents were molested when they went to get among the men in the country. Besides, they had not the same funds that the Company had.

Mr. A. Linton, a member of the Union, was then called; and in answer to the Chairman, stated that he was in the service of the Commercial Gas Company. The eight-hour system came into operation there about the end of July, 1889. The men were receiving the same wages for the eight-hours' work as they had been paid for the twelve; and in some cases an increase. The men were doing more in the eight hours than they formerly did in the twelve. They were stoking fewer retorts, but putting in more coal. They did 216 scoops a day; whereas under the twelve-hour system they did 202. The work was more severe during the eight hours than it was when they worked twelve; still they liked the new system the best, as it gave time for recreation. The effect of the diminished hours had been shown in the financial results of the Friendly Societies. There had been less illness, and consequently fewer claims on the funds. The men were much more sober; and their wives, families, and homes had benefited. In case of disputes, he thought that the trade officials should not wholly and solely settle matters. The men who composed the Boards of Arbitration should be drawn from the ranks of the workers. He complained of the insanitary condition of many gas-works; and said he considered baths and wash-houses should be adopted.

This Section of the Commission then adjourned till the 31st inst.

The Birmingham Corporation Water Bill.—The Select Committee of the House of Commons on the Birmingham Water Bill, the report of whose proceedings is continued in another part of the JOURNAL, have adjusted clauses providing that the Corporation shall grant leases of 999 years to the owners, and 21 years to the tenants, of property in the watershed; making such conditions as may be necessary to secure the purity of the water.

THE METROPOLITAN WATER SUPPLY COMMISSION.

Monday, May 16.

(Lord BALFOUR OF BURLEIGH, *Chairman*; Sir G. B. BRUCE, Sir A. GEIKIE, F.R.S., Professor DEWAR, F.R.S., Mr. G. H. HILL, M.Inst.C.E., Mr. J. MANSERGH, M.Inst.C.E., and Dr. W. OGLE, *Commissioners*.)

To-day the Royal Commission on the Metropolitan Water Supply held its first public sitting at Trafalgar Buildings, Charing Cross, and commenced taking evidence. The first witnesses called were representatives of the New River Company.

Mr. F. Searle, examined by the CHAIRMAN, said he had been Clerk of the New River Company for twelve years. From time to time Acts of Parliament had been obtained by the Company regulating their supply and charges. With regard to the increase of houses in their district from 1851 to 1891, the total was 66,568 for the 40 years. There were no facts to show that the increase had been anything but gradual. Within the last two years, however, there had been a little falling off. The district was now to a great extent built over; and what building there now was occurred mostly in Hornsey and to the north. Turning to the statement made out by the Company, it showed that the average daily supply in 1891 was 32,023,000 gallons. Of this quantity 22,500,000 gallons was derived from the Lea; and the remaining 10,500,000 gallons from the Chadwell springs and wells. For the last 40 years, the average number of new supplies had been 1664; and from that the probable average for the next 40 years could be calculated. An average taken in this way would not be fallacious, because the average increase in the population had a certain ratio to the total amount of water supplied. It would give a fairer idea of the ratio of increase over a long period rather than to take a limited number of years.

The CHAIRMAN: That would give a total demand at the end of the period in question of 70,500,000 gallons. Would the population increase at the same ratio?

Witness: Of course, it is impossible for us to say that the increase will go on at the same rate for the next 40 years; but even if it did (and that would be an outside number), there would be proper means of supply. The average daily consumption of water in 1872 was 24,440,000 gallons; and in 1891, it was 33,000,000 gallons.

If you apply that ratio to the present consumption of 33,000,000 gallons, would it not be fairer to say that in 20 years the increase would be 44,000,000 gallons, applying the same ratio of increase as you have to the 22,000,000 gallons?—No, I do not think that would be the fair answer. There was no reason to suppose that the growth would be so fast as that. We have taken 28.49 gallons per head of the population, on the basis of the figures, as the rate of future consumption. We have a constant supply; but it might be in some cases reduced.

Has not the tendency been to increase the supply per head of the population as there is a growing desire for comfort and even luxury in the use of water?—There has been that tendency; and we have felt the effect of it in having more water-closets and baths in recent years.

What is the most unfavourable state of circumstances in which your Company can be placed, extremely dry weather or long-continued frost?—One is about equal to the other. Both are very bad, either great heat and drought or long and severe frost.

What is the largest number of gallons you have supplied in a single day?—42,000,000. That was in January, 1891, for a single day.

By Dr. OGLE: The 1664 new supplies referring to houses are taken from the Registrar-General's returns. We should regard each separate tenement as a house. Flats let out separately we should treat as separate houses or tenements. That was what was done with the modern blocks of dwellings; consequently the number of new supplies estimated by the Company would not be the same as the number of houses found in the census report. The legal powers with regard to the supply of water from the New River are contained in Acts of Parliament passed in the year 1855 and subsequently.

Mr. Joseph Francis, the Engineer of the Company, examined by the CHAIRMAN, said he had had the management of the wells of the Company for 20 years, and had superintended the construction of the new wells. The printed statement which the Company had sent in gave their available present supply in detail. The supply was 31,000,000 gallons, of which 22,500,000 gallons were from the Lea; the remainder being from the Chadwell springs and wells.

The CHAIRMAN: Can you separate the 10,500,000 gallons, and tell us how much comes from wells and how much from springs?

Witness: During last year we took a daily average of nearly 2,000,000 gallons from the Chadwell springs; the difference, 8,500,000 gallons, was from wells. This quantity includes the entire spring supply.

On what basis is that calculation made?—The 34,000,000 gallons is arrived at by taking what each of the wells can do, and has done for a period of weeks together pumping day and night—taking each well separately, then adding them together, and finding the total of what they can all do. The 34,000,000 gallons was not the maximum quantity that could be taken from the wells; but it was the fair average of what could be obtained for a number of weeks together. We have never taken from each of them a certain quantity which added together made up that figure.

Witness then gave the depths of the various wells and springs from which supplies were obtained by the Company; adding that the policy of the Company had been to use the Lea water, and then bring in the supplies from the wells and springs above. All the wells had been constantly used except that at Cheshunt, with which very little had been done. From Broadmead, they could obtain 1,500,000 gallons by pumping continuously during the 24 hours. This had been done for several weeks together at all times of the year; but principally in the summer or autumn. The quantities were respectively: From Broadmead, 1,500,000 gallons; Amwell End, 1,500,000; Amwell Hill, 3,250,000; Hoddesden, 2,160,000; Broxbourne, 4,500,000; Turnford, 3,750,000; Cheshunt, 750,000; Hoe Lane, 3,350,000; Highfield, 3,000,000; Campsbourne, 3,350,000; and from the remaining well, nearly 500,000 gallons.

Have you ever taken those quantities of water simultaneously from those wells?—No we have never needed it. The figures by no means represented what could be got out of the well by working the engines a little faster. They were all worked at a very safe speed; and that was what was actually obtained.

Do you find that pumping from any one of the wells affects the levels in any of the others?—Only in special cases, and to a very limited extent. With regard to Turnford and Cheshunt Wells—one old and the other new—there was a very decided connection between them; and that was why only 750,000 gallons had been put down for Cheshunt. They were a mile distant from each other; but still there was some connection. Amwell Hill and Amwell Marsh Wells also affected each other. The quantities given above refer to when they were both at work in each case.

For how long can you say those quantities had been taken from the wells?—For weeks together.

Have you ever conducted any experiments to see whether the pumping of water at one point affects the supply at another?—Yes. I have carefully observed the level of the water as it stands in the other wells; and the result has been that they are not affected except in the cases I have mentioned.

Are you aware that complaints have been made to the north of your district, that the effect of your pumping operations has caused depletion of wells of the Cheshunt Board?—I do not think there is any ground for such a complaint. All wells or springs in the neighbourhood which come within the cone of depression caused by pumping are, of course, affected. Those who happen to be in the vicinity must be influenced. In that way the notion has arisen that the Company are affecting the wells generally; but there is no ground for it.

The Cheshunt Local Board have made a statement (it certainly affects the East London Company as much as yours, but I think it right to put it to you), that, having wells within their district, they considered it advisable to be as far as possible removed from the pumping operations of the two Companies. During the last five years, the East London Company have sunk a well at Waltham Abbey close to the Lea; and the result has been to drain two of their artesian wells, and also the artesian well of the Waltham Gas Company. These wells were driven 150 feet into the chalk; and the water does not now rise within 50 feet of the surface.—The level of the water in our wells has not sunk 50 feet, or anything like it; and not long ago the Cheshunt Local Board's Surveyor stated to his Board that the standing water-level in his new well was entirely unaffected by any pumping which the Companies carried on.

They state that the water in the river has been reduced, and that the volume of the natural springs has been diminished. Have you had any complaints of that sort made to you?—Only as to the level being affected in the springs in the immediate neighbourhood of our wells, and within a short distance of our shaft.

Have any of the local authorities in Hertfordshire made complaints of that kind to your Company?—There have been complaints of that sort. Enfield is within the district; but it is supplied by its own Local Board. They have a well for supplying the Great Eastern Railway works, which are entirely to the east of Enfield Town.

They say: "The Board is advised by their Surveyor, that the lowering of the water in the chalk is due to the sinking of wells by the East London and New River Water Companies."—We have only one well at Enfield (at Hoe Lane).

Do you say that, in spite of the pumping which you have carried on, you have never noticed the level of the water in the chalk sinking?—From Turnford northward there has been no lowering of the water-level whatever for the last 15 to 20 years that I have known it.

Sir G. BRUCE: Do we understand you to say there has been a considerable falling in the water-level for London?

Witness: Under London there has been a considerable falling; and that extends north up to Enfield.

Can you tell us to what extent that has been the case?—Under London the falling has been nearly 18 inches in a year; that is, the standing water-level.

Did you check that by your own wells?—Yes. We have wells at Hampstead which we are not using, and where we have the opportunity of measuring the level of the water. The flow of water in the upper valley of the Lea no doubt arose from the increased drainage that went on. The consequence was that the water flowing along the upper part was drawn into the springs. That accounted for the rivers and streams rising lower down now than formerly, because the water was so rapidly drawn off that the upper ground did not get so well saturated.

Mr. HILL: Could the proportion you have given from the wells be relied upon if they were pumping continuously?

Witness: Yes, because I have taken each well with its neighbour on each separate working; and the wells in most cases are not affected by the working of the wells on the other side, except in one or two cases. I have taken what we can get when the neighbouring wells are at work.

Supposing that, with this large amount of pumping, the cone of depression in regard to each well was altered, would it not cause a general depression?—I do not think so; simply a local depression. The harder we pump, of course, the more we lower the water; but in each case it means simply from a little lower level.

That would be the effect of the water in the chalk. In what way would that affect the surface?—I do not think it would affect the surface at all, except within the cone of depression. Of course, it does affect that area.

Is not there great danger then of pollutions from the surface finding their way down to the wells?—In all cases the surface is covered with clay soil and sand; and everything that comes on the surface is thoroughly well filtered before it can get downwards.

Does that apply to the water in the chalk?—You do not find the chalk on the surface. There is always clay or gravel. Inasmuch as the water lying in the chalk is always considerably under the ground, I do not see, even if we did do what you suggest, that it would possibly have the effect of drawing down pollution. The water does not stand on the surface; it is always some feet below.

To what extent do you lower the water in any of these wells by pumping? Supposing you ceased pumping for a week, would it rise?—Yes, in some cases 60 or 70 feet.

Supposing other parties within the watershed were to go on pumping (such as the East London Company and the owners of private wells), you do not think it would have an effect, if you were all pumping from the same underground reservoir?—I do not think that any wells which the East London Company could put in their district would affect the yield of ours at all.

I suppose there is a limit to the quantity of water that goes into the chalk?—Yes, there is a limit; but taking into account the percolation that may be anticipated, and the large area available, there is enough for all.

I do not see how you can rely upon that, when you do not know what the effect of these large pumping operations may be?—We find that what we pump has practically no effect upon the surface level; and therefore it is evident a much larger quantity can be pumped without doing any appreciable harm. From calculations we have made as to what the supply in the chalk is, we feel there is no fear of doing any harm to the water-level in the chalk. The water we pump is on its way to the south-east of London; it does not go into the River Lea at all. If not taken by us, I think it would find its way into the Thames at Woolwich. It would not affect the water in the rivers or streams within the Lea district. There is nothing from which the River Lea water can be polluted. The river is carefully patrolled at night, on Sundays, and at other times; and it is most carefully guarded from pollution of any sort.

Sir A. GEIKIE: You admit the lowering of the water-level under London. To what do you attribute that?

Witness: To the increased pumping that has taken place from under London itself; and to the difficulty which the water has in getting down there. The channels in the chalk which communicate between the upper part of the valley and the basin under London are restricted, I imagine. It cannot get down rapidly enough to those points. There is a relation between the rainfall and the level, which after wet seasons is somewhat higher, and after dry seasons somewhat lower. But it does not flow immediately; and it is difficult to trace the connection except in that general way.

Now, from your statement, it appears that the whole discharge from the Lea has been only from 61,000,000 to 63,000,000 gallons; and that at the present time the water taken amounts to more than 70,000,000 gallons odd—that is to say, the water drawn by the various Companies from the river. Therefore the quantity drawn from the Lea is sometimes greater than the amount it discharges. What I want to know is, what you propose to do when the water discharged by the Lea falls to 61,000,000 gallons, as stated in your table?—Of course, the difference would be made up by pumping from wells, if there were at any time a short quantity in the Lea. But it cannot be correct that 70,000,000 gallons are taken out.

Yes, 70,000,000 gallons; these figures are taken from the Local Government Board reports. Does that include water drawn from the wells?—That is water taken only from the Lea.

What is the condition of the Lea generally?—There is always plenty of water in it. I do not think it is the case, as stated in one report, that the Lea is sometimes reduced to the condition of a stagnant pool. There is plenty of circulation in the water; and there would be no difficulty if it were not for the necessity of flooding—if it were kept free from sewage matters, which always require an enormous quantity of water for flooding purposes.

The CHAIRMAN: Is it not the fact that your Company do practically take all the water out of the Lea?

Witness: We provide for the navigation. That is always provided for. What is the population in the valley of the Lea above your intake?—We have not got the last census returns; but for 1881 it was 111,000. Among that number, there are several towns of above 10,000.

What is the population the drainage of which goes more or less into the valley of the Lea above your intake? I want to know how much of that is rural, and how much is collected into urban districts?—I only have it down to Field's Weir (referring to map).

No; that will not do. I want it above your intake. Perhaps you will supply us with that?—Certainly. Luton is on the intake, 10 miles above. Their sewage is very carefully kept away from the river, and is dealt with on a sewage-farm some distance away. The character of the country above the intake is quite agricultural; and there is a good deal of arable land there. There is no greater difficulty in obtaining a supply of pure water from the Lea than at any former time; and, in fact, we are not only able to keep up to our previous standard, but are constantly improving it. Analyses are made from time to time of the quality of the raw material—that is the water taken at the intake.

Can you say whether the water where you begin to deal with it is better or worse than it was ten years ago?—From observation, I should say it is decidedly better. The Lea Conservancy take great pains to prevent anything like pollution. Their officers stop anything going into the stream which should not pass into it. Great improvements have been made.

Can you mention any place where the system has within recent years been changed?—There is the case of Luton. Ten years ago that was not so well arranged as it is now, and that was due in some measure to the efforts of the Lea Conservancy. It would be possible to store the surface water which now goes down the Lea in the winter months. Though that matter had been considered by the Directors of the Company, no scheme has been put forward; but it is known what quantity of water can be stored. There would be an average of 10,000,000 gallons a day throughout the year.

On what basis is that arrived at?—We take the winter months, and after allowing for what is wanted for the navigation and for the daily use of the two Companies, and dividing the surplus up, it gives that amount for each. I do not see any reason why 365 times 10,000,000 gallons should not be stored in the year.

But that would only be the rate for the winter months?—There are 40,000,000 gallons going down during those six months.

If you are going to store a supply for the summer months out of the surface water, your daily storage capacity must not be calculated upon 10,000,000 gallons, but on 20,000,000 gallons for six months to be kept

over the other months. Have you ever made that proposal to the Directors?—No; we find the sinking of wells a far more easy way of doing it.

At the end of April, for instance, you would have a large quantity in your storage reservoir?—Yes; 3,650,000,000 gallons.

Have you sites where you could store that quantity of water?—Yes; north of Walthamstow there are sites where reservoirs might be constructed.

Have you ever thought of what the cost of making such reservoirs would be?—I suppose it would cost at least £300,000 or £400,000 to make them. That is, of course, a very rough figure.

What would the people lower down the stream say to having a head of water of that kind above them?—There would be no great danger. I do not think it would be reasonable to make the reservoirs of any great depth. There would be no danger of any great head of water; the ground does not suit itself to that.

Sir A. GEIKIE: Could you find any other sites?

Witness: I think that at Sewardstone sites might also be found for reservoirs.

That would necessitate large puddling?—The London clay does not extend up there, so that it would be more expensive to make them.

Your Company have seriously considered the possibility of having to make these reservoirs?—Yes; it has been very carefully considered.

Professor DEWAR: Have you any evidence as to the effect of your pumping? Can you give any definite average area that is affected by it?

Witness: No; I do not think so. You must take each case by itself.

You cannot say, even where the wells are most congregated together, that the surface of the streams is most affected.—No; we cannot reach any definite cone or inclination.

I understood you to say that the wells were affected to the extent of some 60 or 70 feet on the stoppage of pumping for a week?—No; the answer I meant to make was that, when we pumped down to a depth of 60 or 70 feet, the water rose.

Then you must have the same equivalent cone; but you say you cannot give any estimate as affecting the surface?—No; the population seems to be very slowly increasing over this area. Taking the whole area the increase has been by no means rapid; and their demands have been more than met.

With regard to the character of the flood water in the Lea, it has been fully substantiated that it is exceedingly bad, has it not?—No, I do not think so. The worst time of the flood is just at the commencement; and then we take means to shut it off—taking in as little as possible of it. But as soon as the first flush of the flood water is over, the water is not bad. There is a good deal of sand and clay in it; but there is no pollution—all the pollution has been cleared off.

You do not agree with the statement that the extent of the pollution is equal to that of the Thames at the main drainage outfall at Crossness?—The floodwater at our intake is never even anything approaching bad. It has neither smell nor any of the characteristics of sewage; though it is black from sand and soil. There is no necessity whatever for the filtration of the spring water; and the quality of our water stands among the highest in the list usually given, both with regard to organic impurity and the amount of oxidizable organic matter.

That is among river-derived waters?—Yes.

Mr. Ernest Collins, M.Inst.C.E., examined by the CHAIRMAN, said he was employed by the New River Company, in charge of their distributing works, and was responsible for the tables given in the Company's printed statement referring to his employment at the works. In 1872, the yearly average quantity of water per head per day supplied for all purposes (trade and domestic) was 27·10 gallons; in 1881, it was 28·77 gallons; and in 1891, it was 28·49 gallons. In 1872 they had no part of their district under constant supply. In 1881, they had 17,557 houses under constant supply; and in 1891 that had risen to 68,000, out of a total number of 154,568 houses. To put it shortly, the consumption per head per day increased between 1872 and 1881 to the extent of 1·67 gallons; but in the next ten years, it decreased to 0·28 gallon. Between 1871 and 1881, the parish of Shoreditch was the first district which was put under constant supply; and that accounted for the increase of consumption between 1871 and 1881. It was only caused by the bad state of the fittings in the district, and the inability of the Company to get the consumers to put them in order. Subsequently the Company made efforts to suppress the waste; and by this means reduced the consumption very considerably. In fact, they brought it back almost to its previous state. The Company had devoted some time and attention to this suppression of waste, and had 38 inspectors constantly employed in visiting houses for the purpose of checking it. They visited houses during the daytime; and where they found defects, they served notice on the occupiers. But they had great difficulty in getting the repairs carried out.

The CHAIRMAN: Have you any means of testing your mains, to show the extent of flow at night?

Witness: Yes, we can trace wherever there is a flow at night by meters; and when we detect that, we visit the district in the daytime.

Do you think 28 gallons per head per day is a safe quantity to calculate as the amount that will be required in the future?—I think it ought to be taken as the maximum, as far as the New River Company are concerned, for all purposes, trade and domestic.

Is your district one in which there are good sanitary appliances, water-closets, and so on?—Yes; and they are increasing very much. Formerly there was only hand-flushing in houses. But now every house of above £20 a year has its water-closets; and houses of £25 have two water-closets and a fixed bath.

Has that consumption reached its maximum, do you think, or will it go on still more?—With the means we have of checking waste, we can maintain our supply at a fair rate of consumption. You cannot compare London with any other town; the conditions are so different. We have here more baths and water-closets.

By Sir J. B. BRUCE: The Company give a large supply for manufacturing purposes, and have all the termini of the great railway companies on the north of the Thames within their district. About 25 per cent. of their supply goes in this way.

By Mr. HILL: There is a tendency to an increased supply; but it is not necessary to look forward to a much larger consumption than

28½ gallons, because there is great waste going on in the district which can be prevented.

By Dr. OGLE: For domestic purposes 75 per cent. is used.

By the CHAIRMAN: It is the fact that a migration of population is going on from London to the more suburban districts, but not that the further out they go, the fewer persons there are per house. In some parts decidedly the population per house is falling in number; but the day and night populations must be distinguished.

The CHAIRMAN: Taking the census or sleeping population, would not the average per head per house over the whole of your district be lower now than formerly?

Witness: No; I do not think it would.

When you say "a supply," does that mean a house?—It does in some cases. In other cases, it may mean a group of houses. In laying on a block of modern dwellings, we have taken each tenement as a supply.

And if you calculate the same per head as you did 20 years ago, where there was only one kind of supply, is not there room for fallacy?—No; I do not think so.

If I am right in supposing that the number of people per head per house is smaller than it was 20 years ago, it would mean that they were using more water per head, because the average of supply is the same. Inasmuch as the quantity consumed per supply remains pretty much the same, and each person is consuming more, there might be room for fallacy in the calculation?—It might be so.

Mr. Edmund L. Morris, M.Inst.M.E., C.E., examined by the CHAIRMAN, said he had been connected with the designing, manufacture, and working of various kinds of machinery (chiefly engines) for 30 years, and had been Engine Superintendent to the New River Company for 12 years. He had also had charge of the filtering operations. Witness stated what quantities the engines at the wells were capable of raising when working up to their full power. The filtering-beds were, he explained, roughly speaking, large basins constructed of brick, and were in extent from half to one acre. At the centre there was a depression from which the filtered water passed. Along the bottom were laid drain-pipes; over them was laid shingle; and above that 2 feet of sand. Only the upper portion above the sand was in connection with the water from the river; the culverts below running to the suction wells, from which the water was drawn. There were no possible means of communication between the filtered and unfiltered water. All the water had to go through the filtering-beds. After a bed had been at work for a certain period (depending on the clearness and purity of the water), it was cleaned. The water passing from the beds was under systematic daily examination at each station. Every care was taken that the water should be properly filtered.

This concluded the evidence on behalf of the New River Company. On the following day, witnesses for the East London Company were examined; and the Commission adjourned till the 30th inst. The report of the second day's proceedings will appear next week.

BIRMINGHAM CORPORATION GAS DEPARTMENT.

Annual Report.

The report of the Gas Committee of the Birmingham City Council for the year ended March 31 last, has been issued; and from it we learn that the Committee have sanctioned an expenditure of £2300 in the purchase, from West's Gas Improvement Company, of four additional charging-machines for use at the Saltley works. This will complete the equipment of No. 3 retort-house with charging and drawing machinery. An expenditure of £595 has been authorized in the provision of additional railway siding accommodation at the same works. A portion of the retorts in No. 4 retort-house at Swan Village having to be reset this year, the Committee have given authority for the expenditure on capital account of £412 in the reconstruction of their retorts in beds of sevens, instead of fives as at present. The retorts which have been previously reset in this house have been altered in this way, whereby, it is said, an increased production and a more economical working have been secured. It will shortly be necessary to reset some of the retorts in the adjoining retort-house, when it is proposed to take the opportunity of effecting a similar improvement in that house. In order to meet the requirements of the increased manufacture at the Windsor Street works, an expenditure of £1900 has been authorized in the purchase of two larger locomotive engines than those hitherto employed, and in strengthening the railway viaduct. The smaller engines formerly used have been sold for the sum of £600. Proceeding, the Committee remarked that, on receipt of a notice from the colliery-owners supplying gas coal under the current year's contracts that they would be unable to continue deliveries during the recent stoppage of the miners, it became necessary to purchase additional coal in anticipation of the cessation of supplies. About 12,000 tons of coal were bought for delivery during the fortnight preceding the stoppage, of which 9000 tons were forwarded within the time stipulated. For these extra supplies, prices in advance of those given under contract were paid. On the resumption of work by the miners, the Committee informed their contractors that, having made these additional purchases, they were not in a position to receive, as arrears on the contracts, the coal which should have been delivered during the cessation of work. Having regard to the yearly increasing difficulty of obtaining the supply of cannel coal required for the purpose of maintaining the illuminating power of gas to the standard, the Committee report that they have made inquiries as to the processes now in operation in other large gas-works in the country for the purpose of carburating gas with oil. They have also made inquiries as to other processes now coming into use for the employment of oil in the process of gas-making; and they have entered into an arrangement with the Gas-Oil Syndicate for carrying out an experiment at Windsor Street, at the cost of the Syndicate, of a new carburetted water-gas plant for which they hold the patents. The rearrangement and enlargement of trunk mains which has been in progress during the past two years will be completed in the current year. In carrying out these alterations, it has been found possible to make a saving on the original estimate of

£22,580; and the Committee have authorized an expenditure of £6100 on the work now required—making the total cost of the work £20,630. The contract with Messrs. John Aird and Sons for main-laying and service work having terminated on March 31 last, the Committee, having regard to the necessity of the careful performance of the work for the safety of the public, and to the satisfactory way in which it has hitherto been done by Messrs. Aird, have renewed the contract with them for a further period of five years from that date. Referring to the Bill promoted by the Corporation of Sutton Coldfield for the purchase of the Sutton Coldfield gas undertaking, the Committee state that it has been withdrawn, not having received the sanction of the ratepayers. The Directors of the Gas Company have now renewed their offer to the Committee of their mains and distributing plant within the parish of Sutton; and this offer is under consideration. Messrs. P. Spence and Sons have informed the Committee that it would be a convenience to them to know what arrangements the Corporation propose to make for the disposal of the ammoniacal liquor produced at the gas-works after the expiration of the contract with them on June 30 next year. In connection with this subject, the Committee have carefully considered whether they should themselves undertake the manufacture of sulphate of ammonia. They are of opinion that, if they can obtain satisfactory tenders for the purchase of the ammoniacal liquor, they should not extend their operations in this way; and they are now inviting tenders for the purchase of the liquor for a period of ten years from June 30, 1893.

The Committee submit the balance-sheet and statement of accounts for the year ended March 31, 1892, showing a net profit amounting to £22,144. No appropriation has been made from the profits of the year to the sinking fund for the redemption of loans and annuities, having regard to the large sum which was appropriated to this fund from the profits of the previous year. The Committee recommend that the balance of net profit shall be appropriated to the improvement rate of 1891; they have informed the Finance Committee that they hope to be able to pay to the improvement rate the sum of £25,000 out of the profits for the year ended March 31, 1893.

The following are the principal items (shillings and pence omitted) of the revenue account, preceded by those of the previous year:—

Expenditure.			
1890-91.	Manufacture of gas—		1891-92.
£250,594	Coals	£271,044	
3,582	Purifying materials and wages	6,442	
4,790	Salaries at works	4,726	
52,725	Wages at works	56,916	
75,092	Repairs and maintenance	76,471	
			£415,601
	Distribution of gas—		
12,238	Salaries in light office	£12,137	
16,353	Repairs, maintenance, and renewal of mains and service-pipes	16,693	
6,196	Repairing, renewing, and refixing meters	6,366	
			£35,197
2,561	Lighting and repairing public lamps	2,757	
17,952	Rent, rates, and taxes	15,129	
8,188	Management	8,675	
	Law charges, bad debts, expenses on loans and annuities, &c.	2,507	
1,509			
£451,786	Total expenditure	£479,870	
131,246	Balance carried to profit and loss account	114,170	
£583,032		£594,041	
Receipts.			
£423,058	Sale of gas	£453,086	
154,913	Residual products	135,496	
1,953	Rents	1,928	
2,180	Fittings	2,370	
925	Discounts and transfer fees	1,159	
£583,032		£594,041	

Included in the total receipts from the sale of gas are the following items: Common gas, 1,282,370,500 cubic feet, at 2s. 7d. per 1000 cubic feet, £165,639; ditto, 555,318,500 feet, at 2s. 5d., £67,100; ditto, 1,997,238,800 feet, at 2s. 3d., £224,689; and public lighting and under contracts, £11,614.

STAFFORD CORPORATION GAS SUPPLY.

Annual Report.

In the last issue of the JOURNAL, a brief notice appeared of the annual report and accounts of the Stafford Corporation Gas Committee, which were presented at the quarterly meeting of the Town Council in the previous week. A copy of the report has since come to hand; and we are therefore now able to give some further particulars concerning the operations of the department during the year ending March 25 last.

The report states that the quantity of gas sold and the profits made during the year were greater than in any previous year since the Corporation acquired the undertaking. The large increase in the sale of gas referred to in the previous report has been more than maintained, as was anticipated; the quantity made this year being 112,123,000 cubic feet—an increase of 9,294,000 feet, or 9.04 per cent.; thus evidencing increasing prosperity in the borough. Although coal has been somewhat easier in price, the market for residual products has suffered from severe depression; so that the prices realized from this source have been much less per ton than in the preceding year. The coal carbonized amounted to 12,595 tons, being an increase of 1311½ tons. The sum received from the sale of gas was £14,449—being an increase of £1103; and it was paid as follows: £12,413 from quarterly consumers, £812 from fortnightly consumers, and £1223 for public lighting. The residual products realized £4143; being £2345 for coke, £1062 for tar, and £736 for sulphate of ammonia. The total receipts for the year amount to £19,121; and the expenses to £11,939—the gross profit being £7182, out of which there has been paid £2936 for interest on loans, £1579 for repayment of loan, and £172 for income-tax; leaving a net profit of £2495, which added to £20 brought forward, makes the sum of £2516 to be dealt with. The Committee recommend that £500 be added to the reserve fund, that £1500 be paid to the district fund in aid of the district rate, and £500 to the borough fund for the account of the Bath Committee

to completely equip the baths without further charge upon the rates), and that £16 be carried forward. This will make the reserve fund £1636, loans repaid £16,606, and a total sum of £21,600 paid in relief of the rates. Referring to the extensions and improvements at the works, the Committee remark that these have been vigorously prosecuted during the year. The large gasholder has been telescoped; so that its capacity is now doubled; a new retort-house has been erected, and will be ready for work next winter; new coal-stores have been built alongside the retort-houses; and an improved washer-scrubber has been erected. A bridge has been built over the river; and the railway siding has been completed, and, now that it is in full working order, will effect a very considerable saving in future operations. Other extensions and improvements are in progress, and will be finished during the current year. The works will then be as complete as modern engineering science can make them. For these results the Committee will be mainly indebted to their excellent Engineer (Mr. J. F. Bell), whose special services, they say, deserve recognition at the hands of the Council—the continued and increasing success of the gas undertaking being so largely the result of his labour and ability. With respect to the future, the Committee recommend that no charge shall be made for meter-rents; and, in order that the relief so given may be equitably apportioned between large and small consumers, that the sliding scale of discounts be extended as follows: To consumers whose consumption is under 10,000 feet per quarter, 2½ per cent., as at present; over 10,000 feet, 5 per cent.; over 50,000 feet, 7½ per cent.; and over 100,000 feet, 10 per cent. This will cost the department about £700 per annum, and will be equivalent to a reduction of nearly 2d. per 1000 cubic feet on present prices. The Committee feel they are quite justified in making these recommendations, and that the result will be a substantial increase in the consumption of gas, as heretofore, owing to the reduced price, which will now bear favourable comparison with most towns in the kingdom.

In moving the adoption of the report at the meeting above referred to, Alderman W. H. Peach said he had never submitted a report with greater pleasure since he had been Chairman of the Committee. He alluded at length to some of the details in the report, and remarked, with respect to the proposal as to the baths, that he believed it would generally commend itself to the ratepayers. After consideration as to the meter-rents, they had decided to recommend a sliding scale in the way of discount, as set forth in the report; and they had done all they could to encourage the use of gas instead of steam power for engines. The report was adopted.

GEORGETOWN (BRITISH GUIANA) GAS COMPANY, LIMITED.

The Half-Yearly General Meeting of this Company was held last Tuesday, at the London Offices, 30, Gracechurch Street, E.C.—Mr. ALFRED WILLIAMS in the chair.

The SECRETARY (Mr. S. Wood, A.C.A.) read the notice convening the meeting; and the Directors' report and the statement of accounts (of which a summary appeared in the JOURNAL for the 10th inst.) were taken as read.

The CHAIRMAN, in moving the adoption of the report and accounts, said the shareholders would have observed that the Directors on this occasion recommended a little less dividend than usual. This arose partly from the loss of a portion of the public lighting, which had been given over to the Electric Lighting Company. Although the Directors might, out of the accumulated funds, have paid the ordinary dividend, they thought it wise policy not to do so; but to wait and see what the effect of the loss of a part of the public lighting would have upon the revenue. He hoped they would soon return to the usual payment.

Mr. C. GANDON seconded the motion.

The CHAIRMAN, in reply to Mr. Hartley, said that 315 of the public lamps had been taken from the Company as from Jan. 1, 1892; and they had 194 left. The electric light was now in operation. Regarding the private consumption of gas, their last return was very nearly what it was for the corresponding period of 1891—in fact, the difference was scarcely worth notice. As to the cost of the electric light, in comparison with gas, he could not at present commit himself to figures.

Mr. GANDON observed that the Electric Lighting Company had only been in full operation since the beginning of the year; and so it was impossible for anybody to say yet what the cost would be.

The motion was then carried unanimously.

On the proposition of the CHAIRMAN, seconded by Mr. R. BERRIDGE, a dividend was declared on the preference share capital at the rate of 8 per cent. per annum, and on the ordinary share capital of 6 per cent., both less income-tax (excepting upon those dividends payable to the local shareholders).

The retiring Directors (Captain H. Thurnburn and Mr. R. Berridge) were re-elected; and Mr. Manwaring was appointed Auditor in the place of Mr. Berridge, who resigned on his elevation to the Board.

The next business had reference to the appointment of Mr. Wood as Secretary, on the election of Mr. Alfred Lass as a Director. It appeared, from statements made by the Chairman and Mr. E. K. Blyth (the Solicitor), that, as the Company is constituted under the laws of British Guiana, the Board have the power to appoint a Secretary, but the shareholders should fix the salary and the terms upon which he is engaged.

Mr. MAGNUS OHREN moved a resolution to the effect that the arrangement made with Mr. Wood for carrying on the secretarial duties be upon the same terms as those on which the previous Secretary held the office—viz., £100 per annum salary, £100 for office and clerk, with the addition of £20 for every 1 per cent. paid on the ordinary share capital over 5 per cent.

Mr. BLYTH seconded the motion, which was agreed to.

A special resolution was then passed, expressing the shareholders' warm and cordial appreciation of the services rendered to the Company by Mr. Lass during the many years he held the office of Secretary.

The proceedings concluded with votes of thanks to the Chairman and Directors, and to the Secretary (Mr. Wood), the Local Secretary (Mr. F. A. Conyers), the Engineer and Manager (Mr. T. B. Younger), the Auditor (Mr. Magnus Ohren), and the Solicitor (Mr. Blyth).

MOSSLEY CORPORATION GAS SUPPLY.

A Loss on the Past Year's Working.

At the last Meeting of the Mossley Town Council, the report of the Auditor on the accounts of the Gas Department for the past financial year was submitted.

It stated that, after charging the profit and loss account with the ordinary provisions in respect of the sinking fund, and with the interest on loans, there was a loss for the year of £272. The price of gas had remained the same during the year; while the total rental showed an increase—the difference in the result arising mainly from (1) increased cost of repairs and maintenance of plant; (2) increased cost of the repairs of mains and services; (3) reduced amount received from coke. The total consumption had been 74,233,900 cubic feet, as compared with 72,786,000 feet; and the percentage of unaccounted-for gas had been 12.25, against 13.97, or a decrease of about 1½ per cent., which might probably be still further improved as they began to receive the full benefit of the completion of the change in the mains and service-pipes. In moving the adoption of the report, Alderman Buckley called attention to the loss on the year's working. This, he said, had arisen from expenditure of an extraordinary character, which had been taken out of the revenue. The repairs had been heavier at the works, and the item for labour was greater than in the previous year; and, in addition, there had been a considerable outlay on mains and service-pipes. Next year their position would be more satisfactory, as the leakage had been considerably reduced. Then, the Committee had received £276 ros. less for coke; and there had been an increased charge in the establishment account of £89. The total of the items referred to amounted to £1507; but against this sum there was the increased price received for tar, &c. But for these items, the gas would have been produced for about 2s. 6d. per 1000 cubic feet, instead of a little more than 3s. 1d. He thought, if they could bring the establishment charges down to a decent figure, they would be able to make a fair profit next year; and he also believed that, as they had not now a large stock of coke on hand, they might raise the price, for there was no reason why they should charge 2d. per ton less than Ashton and Stalybridge. Mr. Marland seconded the motion. Mr. Sykes considered the Auditor's report a very unsatisfactory one; as it appeared that they were losing upon the small consumers at the rate of 1½d. per 1000 cubic feet. A lengthy discussion ensued, in the course of which Mr. Mitchell charged another member of the Council (Mr. Jones) with having made some very insulting remarks regarding the Chairman of the Committee and the Gas Manager; and, in his reply, Alderman Buckley said the charge which had been made could be proved by reliable witnesses, and if the two gentlemen alluded to were advised by him, Mr. Jones would get into serious trouble. The report was adopted.

THE DISPUTE AT THE LONGWOOD GAS-WORKS.

Intimidating a Workman.

On two or three occasions recently, references have been made in these columns to a dispute between the Directors of the Longwood Gas Company and some of their old workmen, who were discharged on the 1st ult. on the grounds that they were incompetent, and not doing the right amount of work. Since then pickets have been stationed near the works; and it has been necessary, for the protection of the new hands, to have police officers on duty at the works night and day—indeed it is said that it has been unsafe for any of the men to leave the works without being accompanied by a constable. One of the new employees who seems to have particularly displeased the discharged men is Mr. J. J. Merrell, the son of Mr. R. Merrell, Manager of the Mossley Gas-Works; and a few days ago the ringleader of the pickets, a man named John Walker, had to appear at the Borough Police Court on the two charges of persistently following Mr. Merrell with a view to compel him to refrain from his work, and of using violence towards him, so as to intimidate and keep him from following his employment. The complainant was represented by Mr. Sykes, who stated that Mr. Merrell resided between Mossley and Greenfield. On the 30th ult., he left the gas-works accompanied by a constable, who went with him to the railway station. Arriving there, Mr. Merrell purchased a ticket; and Walker, in the presence of a man named Cane, also came on the platform and called Merrell a "blackleg," and used other not very complimentary terms towards him. Complainant entered a compartment and Walker entered the next one. When the train stopped at Golcar, defendant got out, and went to the door of the compartment in which Mr. Merrell was seated, and commenced using the most violent threats to him. He not only employed threats, but practically he attempted to use violence; for he tried to strike him through the carriage window. After the train started again, defendant hooted him. This was the intimidation of which he complained; and he expressed the hope that, if the Bench found the case proved against Walker, they would make an example of him. Mr. Merrell gave corroborative evidence; and then four or five police officials testified as to the condition of affairs at the works. On the whole, they considered the pickets had behaved very well. No witnesses were called on behalf of the defendant; but Mr. Wright, who appeared for him, contended that, when the case was stripped of all the outside elements, the evidence as to intimidation became very small, and that with regard to following was almost nil. The Bench, having considered the matter in private, inflicted a fine in the first case of £5 and £1 rs. 6d. expenses; and in the second case, one of £5 and 10s. costs. Mr. Sykes asked the Magistrates to fix default. The Magistrates' Clerk replied that this was a case for a distress warrant if the fines and costs were not paid; he asked Mr. Wright if he knew anything about payment. Mr. Wright (after consulting with Mr. Cockayne, the Local Secretary of the Gas Workers' Union) said he had no suggestion to make. The Magistrates' Clerk remarked that a distress warrant would be issued.

The Wenham Company, Limited, have been again entrusted with the gas lighting at the Royal Opera House, Covent Garden, for the season.

ELECTRIC LIGHTING FOR MANCHESTER.

Local Government Board Inquiry.

Last Tuesday, Mr. S. J. Smith, one of the Inspectors of the Local Government Board, held an inquiry at Manchester into an application by the Town Council to borrow £150,000 for purposes of electric lighting. Sir John Harwood was first called upon to give evidence. He said the Corporation had had the question of electric lighting under consideration for the last ten years at least; and in 1890 an Electric Lighting Order was obtained from the Board of Trade. In fixing upon the area of supply, the Gas Committee had been guided by their own knowledge of the requirements of the city; but they had also received suggestions from the citizens. Dr. John Hopkinson had been employed by the Corporation to carry out the work. He himself thought that the money now applied for was little enough, and that it would have been better to borrow £200,000. The site which had been secured for the generating station was regarded as very suitable. The contracts which had been already let and others which would be given out shortly amounted to £78,000. Inquiries for the light had been received from persons outside the compulsory area; and if the circumstances and the probable consumption made it appear desirable, the Corporation would extend the area, and give every facility they possibly could to induce people to use the light. Of course, they were not seeking to make a profit out of the scheme in any way; they were only wishful to develop the resources of the city. Mr. Brooks, the Chairman of the Gas Committee, confirmed the evidence of Sir J. Harwood. Dr. Hopkinson, who was next called, said the district to be lighted extended to something like a mile, and this necessitated the employment of reasonably high pressure. The best system for this was the five-wire one, which gave a high pressure, and at the same time enabled them to supply ordinary lamps, and to turn them out separately. There was sufficient room at the generating station for additional machinery as the demand increased. In reply to the Inspector, who inquired whether it was proposed to light the street lamps with electricity, Dr. Hopkinson said the lighting of the streets was not at present contemplated; but no doubt something would be done in that way. As Sir J. Harwood had stated, the contracts already and about to be let amounted to £78,715; and the cost of the site and such additional works as might be from time to time required was set down at £71,285—making a total of £150,000. This amount, he thought, would very soon be spent, and in all probability more would be needed in the future. The inquiry then closed.

EXHIBITIONS OF GAS APPLIANCES.

Last Tuesday, Mr. E. C. Milligan, the Chairman of the Buxton Local Board Gas Committee, opened an exhibition of gas appliances in the Town Hall. In the course of the address delivered by him on the occasion, he referred to the great progress that has been made of late years in the application of gas, especially for domestic and culinary purposes, and said that at the present price in the town (2s. 6d. per 1000 cubic feet net), its use was cheaper than coal. The exhibits were by Messrs. Richmond and Co., Limited, of London and Warrington; and Mrs. Golding, of London, gave practical lessons in cookery during the exhibition, which remained open till Friday. The arrangements were admirably carried out by Mr. G. Smedley, the Gas Engineer to the Local Board. Under the auspices of the Chelmsford Gaslight and Coke Company, an exhibition of gas appliances from the same firm was opened by the Mayor (Mr. John Taylor) in the Corn Exchange yesterday week. The proceedings commenced with a brief address by Alderman W. W. Duffield, the Chairman of the Company; and the Mayor having declared the exhibition open, Mr. E. W. T. Richmond discoursed upon "Gas as a Domestic Servant." The cookery demonstrations were given by Miss May Morrisson. A five days' exhibition of gas-stoves manufactured by Messrs. R. and A. Main, of London and Glasgow, was opened by Alderman T. T. Sedgwick in the Corn Exchange, Darlington, last Tuesday. Free lessons in cookery were given each day by Miss Burden. The same firm have been exhibiting at Middlesbrough and Newcastle-upon-Tyne, with Miss Burden's co-operation as demonstrator. The exhibitions were carried out by the firm's representative (Mr. J. A. M'Lay). At Gateshead, on Tuesday last, an exhibition of cooking and heating appliances, manufactured by Messrs. John Wright and Co., Limited, of London and Birmingham, was opened in the Town Hall in the presence of a large attendance of the general public. Owing to its success, it is to remain open until Thursday this week. Practical lectures on cooking by gas are being given every afternoon and evening by Miss Shaw, of the Nottingham School of Cookery. The same firm also held an exhibition at Middleton, commencing on Wednesday afternoon. At the opening proceedings, the Chairman of the Corporation Gas Committee (Mr. G. Booth) presided. In addition to the gas-stoves of various descriptions, which were ranged round the room, there was a good display of the Wenham Company's regenerative lamps. A course of lectures was delivered by Miss Haxsmith. During the past week, a successful exhibition of Messrs. Richmond and Co.'s "Model" ranges was held in the Public Hall, Rochdale. On Thursday evening, a lecture was delivered by Mr. E. W. T. Richmond on "Gas as Fuel." Lectures on cookery were given by Miss Owen and Miss Smedley. The Brentford Gas Company have authorized the firm to hold a series of exhibitions in their growing districts; and during last week another exhibition of the series was held at the Lyric Hall, Ealing, and was very successful. It will be continued this week. The Davis Gas-Stove Company, Limited, have been busy holding exhibitions lately. At the Albert Hall, Portsmouth, they displayed their well-known gas-stoves from the 10th to the 20th inst.; Miss Ellen Johnston delivering lectures on cookery twice daily. At Aberavon, where they had the co-operation of Miss M. A. Rotherham, they held an exhibition from the 10th to the 13th inst. In the Corn Exchange, Hereford, the firm opened an exhibition of their gas appliances last Thursday, and will continue it till to-day; Miss Ida Cameron giving demonstrations in cooking by gas twice daily.

THE STANDARD OIL TRUST OF AMERICA.

In view of the prominence given, at the recent meeting of the Incorporated Institution of Gas Engineers, to the subject of the use of oil for the production and enrichment of coal gas, the following article, contributed to the *Forum* by Mr. S. C. T. Dodd, Solicitor to the Standard Oil Trust of America, detailing some points in the history of the Trust, and of the petroleum trade generally, will doubtless prove interesting to our readers:—

The main purpose of this article is to show how one Trust decreased prices. The discovery of petroleum by boring through rock strata was made in 1859. As it was soon obtained in large quantities, the question arose of its utilization and of finding a market for its products. A number of manufactories were erected for refining the crude article; but for many years the product was poor and dangerous, and the enterprises were not financially successful. A few persons, who afterwards became well known in the trade as Standard Oil men, entered into partnership, and erected a refinery at Cleveland. It was not until January, 1870, that their business became sufficiently important to justify the formation of a corporation for the purpose of carrying it on. They then organized the Standard Oil Company, with a capital of \$1,000,000. This Company continues to manufacture petroleum products at Cleveland; its capital now being \$3,500,000. But the business in which these persons were interested could not be confined to the city of Cleveland. To hold and increase their trade, these men early saw that more than a local business must be done. The supply of petroleum came from Pennsylvania; and in that State it was essential that corporate agencies should be established. They allied themselves with other persons engaged there in the same industry, and either organized corporations or purchased the stocks of corporations already organized, in order to carry on business in that State through corporate agencies. A Standard Oil Company was founded in Pittsburgh for the same purposes as the one started in Cleveland; and the stocks of these two Companies were eventually owned by the same persons. These individuals thereafter continued actively, individually as well as through the agency of several corporations, to extend and increase their petroleum business. They established agencies in different States for the sale of their products; and when the business of such agencies became of sufficient importance to warrant it, they organized corporations according to the laws of the proper States, in order that the industry might be carried on under corporate agencies. They located manufactories at the sea-board for the export trade, which rapidly became enormous. They began the manufacture of crude materials, barrels, cans, paints, glue, acids, &c., necessary in their business; and in some cases organized corporations for the purpose of such manufacture. They became particularly interested in the matter of transportation; and the stockholders of the various companies, as individuals, constructed pipe-lines for carrying petroleum to the seaboard at the expense of millions of dollars, and held their interest as partners until corporations were established. It was the aim of these men to open markets for American petroleum. In order to introduce it into home and foreign markets, their energies and capital were directed to the making of safe and efficient illuminating oils, and to the cheapening of the manufacture, not only of the products of petroleum, but also of all the materials used in its manufacture and transportation. On the 2nd of January, 1882, the number of persons thus associated in carrying on the oil business in its different branches through the agency of corporations organized by themselves for that purpose was 40. They owned the entire capital of 15 corporations, and part of the stocks of a number of others; the latter being principally small companies engaged only in trading in oil. Of the stocks thus held, nine persons owned a majority; and, in consequence, they could cast the controlling vote in each corporation. These persons entered into an agreement by which all their stocks were placed in the hands of the nine persons owning the majority as trustees. The trustees issued certificates showing the extent of each person's interest in the stock so surrendered, and agreed to endeavour to have the business of the several corporations conducted for the best interests of all concerned. It will readily be seen that this Trust did not unite competing corporations, for the corporations were largely organized as contributory agencies for the same business. The stocks were owned by persons who had long been united in building up and carrying on this business; and the voting power was then held, and continued to be held until the dissolution of the Trust on March 21, 1892, by the persons named as trustees by right of absolute ownership of a majority of the stocks. One effect of this Trust is apparent in the fact that during the ten years of its existence, the number of persons holding its certificates increased from 40 to 2000. Every clerk, agent, and employee in the various corporations, who could save a few hundred dollars, purchased Trust certificates, and thus became interested in the business and profits.

Until 1872, but little progress had been made in the oil business. The methods of transportation and manufacture were expensive; and the product was poor, even at the high prices obtained. The business of refining was not financially successful. It was about that time that the men in control of the Standard Oil Company began to enlarge their business, to enter into association with refiners at other places, and to use the greater capital, experience, and instrumentalities thus obtained in improving and cheapening the methods of manufacture, the quality and cost of the products, the system of transportation, and in opening markets in foreign countries. The effect upon the business was soon apparent. In 1872 refined oil at wholesale averaged 23.5 c. per gallon. The output was about 248 million gallons, and the value of the exports at that price, \$34,000,000. The improvement in production and price from that date has been gradual and marked. In 1890 the output was 13,027 million gallons; the average price, 7.3 c. per gallon; and the value of exports at that low figure, \$51,500,000. The reduction in price between 1872 and 1891 was 16.2 c. per gallon, which shows \$215,000,000 per annum saved to the public by reduction of price. Crude petroleum averaged \$4 per barrel of 42 gallons in 1872, and \$0.87 per barrel in 1890; so that \$99,000,000 of this annual saving is attributable solely to the reduction in the crude product, consequent upon its enormous production. The remaining \$116,000,000 per annum of saving is the result

solely of cheapening the price of the manufactured products. This reduction has been accomplished in various ways. At first, oil was barrelled and transported from the wells to the refineries or railroads in waggons, and then by rail to the seaboard. The system of transporting by pipe-lines was introduced prior to 1872; but it was expensive and inefficient. The Standard interest systematized and enlarged the local system, and continued the lines to the principal cities of the seaboard. Thousands of tanks were erected to hold the surplus production, and as much as 1500 million gallons of surplus oil have been stored in these tanks at one time. Pipe-lines have been built to New York, Philadelphia, Baltimore, Buffalo, Pittsburgh, Cleveland, and Chicago; and a network of feeding lines reaches from the wells to connect with the main lines. If these lines were laid continuously, they would encircle the globe. When the producer of oil puts down a well, he notifies the pipe-line company, and immediately a line is laid to connect with his well. The oil is taken from the tank at the well, whenever requested, into the large storage tanks of the Company, and is held for the owner as long as he desires it. A certificate is given for it, which can be turned into cash at any time; and when sold, it is delivered to the purchaser at any station on the delivery lines. A new oil-field was discovered last summer near Pittsburgh; and in three months the production was 70,000 barrels per day. Yet pipe-lines and storage-tanks were built so rapidly that this enormous product was handled with scarcely any waste. The lines to New York deliver to the refineries at Long Island City and Bayonne 1,250,000 gallons per day. This is manufactured into a great variety of products; the principal one being illuminating oil. Some of the illuminating oil is barrelled for local trade, some is shipped to other points in tank-cars made for the purpose, and some is placed in tin cans boxed in pine for the Oriental markets; but the greater part is pumped directly from the refineries into steamers carrying oil in bulk, and thus shipped to European ports, there to be pumped into huge tanks for further distribution by tank-cars and tank-waggons. The capital invested in these pipe-lines, tank-cars, and tank-steamers is more than \$50,000,000. By this system, oil can be placed at the seaboard and on tank-steamers at less than the cost of a few miles of waggon transportation under the old system. The importance of this method of transportation cannot be over-estimated at the present time. In Russia, wells pour forth petroleum in almost unlimited quantities, and its price at the wells is less than 5 c. per barrel. Their system of refining and marketing is copied from the American. The capital employed is large, and Russia is striving for the markets of Europe and the East. They already dispose of 1200 million gallons of the crude product per annum. Were it not for our pipe-line system, our tank-steamer system, and our cheap methods of refining and of manufacturing all necessary materials, we could not hold the export trade for a single year. This system could not have been built up without a combination of persons and capital.

The actual cost of refining has been reduced since 1872 about 66 per cent. This has been accomplished partly by the discovery and use of better processes and better machinery, partly by the elimination of the waste once incident to the business, and partly by the refiners manufacturing for their own purposes and cheapening the cost of the materials used in manufacturing oils. Residuum was formerly used for fuel; now it is made into paraffin wax and lubricating oils. Naphtha was once little better than a waste product; now, as a component of gas, it lights the great cities of the land. Sulphuric acid is largely used in refining, and formerly cost \$1.25 per 100 lbs.; the Standard manufactures its own at a cost of 8 c. per 100 lbs. In 1872 barrels cost the trade \$2.35 each; the Standard manufactures them now at a cost of \$1.25 each. As 3,500,000 barrels are used per annum, this item of saving amounts to \$4,000,000 per year. Tin cans are now manufactured by the Standard at 15 c. less per can than they cost in 1874. As 36 million cans are used per year, this saving amounts to \$5,400,000 annually. Thus I might speak of paint, glue, tanks, stills, pumps, and pipes. Almost everything used in the oil business is manufactured by some of the corporations which were created for the particular purpose. While the price of oil has thus been lowered, competition has not been destroyed, but it is vigorous and effective. Thousands of workmen and persons of small capital are sharing the profits of the business; the wages paid are above the average; and American petroleum is holding its place in foreign markets. Association was necessary to accomplish these results, as it is to accomplish any great business end.

The Hemsworth Water Provisional Order.—At a meeting of the Hemsworth Union Board of Guardians last Thursday, a communication from the Local Government Board was read by the Clerk, relative to the Authority's application for a Provisional Order to empower them to obtain water from Dewsbury. The Board intimated that Sir Richard Webster, whose opinion had been taken on the matter, had advised that the Dewsbury and Heckmondwike Water Board had no power, under their present arrangements, to sell to other districts as proposed, so that the Order would be left in abeyance.

Gas-Meter Testing in Manchester.—The Official Inspector of Gas-Meters for Manchester (Mr. J. Urquhart) has just presented to the City Justices his report for the year ending March 31 last. He states therein that in the twelve months he tested 11,346 meters, as compared with 10,675 in the previous year; being an increase of 671. The fees charged amounted to £408 19s., against £406 15s. 7d.—a gain of £2 3s. 5d. The small advance is owing to the meters tested being of a uniformly smaller size than usual, for which lower fees are charged. The Inspector's cash statement of revenue and expenditure shows a net loss of £301 19s. 7d. on the year's work. This is less by £30 19s. than the loss in the previous year. Of 11,346 meters tested, 485 were rejected; being equal to 4.27 per cent., against 4.26 per cent. in 1890-91. This total consists of 50 new wet meters, or 1.06 per cent., 137 old ones, or 3.08 per cent., 6 new dry meters, or 0.48 per cent., and 292 old ones, or 30.48 per cent. of the entire number tested. Rejected wet meters show an average of error, in excess of the legal limit, equal to 4.5 per cent. if fast, and the same if slow. In the case of dry meters, the average excess is 2 per cent. if fast, and 8 per cent. if slow.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Perth Gas Commission are the first of the large gas-owning bodies in Scotland to publish the financial results of their past year's working. Their year closes on April 30; and within three weeks they are able to announce their balance, which is very smart work. The total revenue was £18,859, of which £17,316 was from gas. The total expenditure was £17,010; leaving a balance of £1848. Out of that sum, £1000 requires to be placed to the sinking fund, £100 is taken to liquidate bad debts, and £52 to make up the deficit which arose upon the previous year; and there is left a net surplus of £695. The revenue is £2026 greater than it was in the previous year, which is accounted for by the increase of 6d. per 1000 cubic feet of gas that was put on a year ago. There has, however, been a disappointment in the matter of residuals, which were expected to produce £1900, but have only realized £1084. The expenditure side is the most satisfactory; for whereas it was estimated that the surplus would be £364, it is actually £695. The total expenditure was only £342 higher than it was in the previous year. So far as can be seen, the whole of the saving in the outlay has arisen upon the coal account. The estimate for coal was £8389; and the actual outlay was £8034. Should the Commissioners be able to secure their coal contracts at a lower rate this year, there does not seem to be any reason why they might not find it within their power to grant a reduction in the price of gas.

The Directors of the Stonehouse Gas Company, Lanarkshire, have appointed Mr. Walker, of Duns, Manager of their works.

Messrs. Hanna, Donald, and Wilson have secured the contract for the construction of a new gasholder at the Wishaw Corporation Gas-Works.

Gas companies having now worked their financial year, are beginning to hold their annual meetings. The shareholders of the Strathaven Gas Company met this week. The report of the Directors to them was that the working for the year had resulted in a profit of £44, which was a long way short of previous years. The Company fortunately possesses a reserve fund; and, like other companies of much larger dimensions, it was resolved to draw upon it in order to pay the customary dividend of 7½ per cent.

The Stonehaven Gas Company held their annual meeting on Monday. The profit for the year was £357, which was £277 less than in the previous year. The customary dividend of 2s. 6d. per share was paid. This year there is to be some expenditure on the works; and this, with the price of coal, makes it doubtful whether the Company will be able to go on without raising the price of gas. In the year just closed, the Directors have had considerable encouragement; the sale of gas having been much higher than in any previous year.

The Burntisland Gas Commissioners have entered into contracts for the supply of coal for the present year at an average price of 19s. 5d. per ton. Last year the average price was 21s. 2½d. per ton. The coal is selected with a view to producing gas of 26½-candle power.

The Corporation of Glasgow have already got into a small trouble, which may, however, be a source of annoyance to them again, over their electric lighting station. The Deputy-Town Clerk was on Wednesday summoned to the Central Police Court on a charge of allowing black smoke to issue from the furnaces at the electric lighting station in John Street. In imposing a fine of 40s., the Magistrate gave expression to the reminder that the Corporation, who were endeavouring to have the penalties for smoke nuisances increased, should be the first to set an example to others. Of course, it is easy to give a magisterial rebuke, and no one will say that it was undeserved in this instance; but it is quite another matter to find a remedy. The electric lighting works are new; and the plant is, in the matter of extent at least, in a large measure experimental. It is likely that, if the business gets consolidated, so will the plant; and experience will teach how many things may be done which are not very well understood as yet. Meantime, the Corporation are, under this conviction, obliged to desist, or to stand the risk of being fined again.

In Glasgow at present the Corporation are considering the question of taking over the tramways; and in connection with it, the subject of motive power is being taken up by some. The horse is not liked by anyone; neither is the steam tramway locomotive. The cable system is objected to by many, on account of the third line of metal in the street. As for electricity, except at Leeds it has not shown itself to be a reliable and profitable source of motive power. Councillor Crawford, of Glasgow, has been to Dresden inspecting a gas motor for tramways which is being experimented upon there. He seems to be favourably impressed by it. I do not know what the Dresden motor is like; but I recollect that some four or five years ago Mr. J. M. Turnbull, of Rose Street, Edinburgh, read a paper before the Royal Scottish Society of Arts, in which he described a continuous oil-gas plant which he recommended as suitable for both the lighting and driving of such vehicles as tramcars, launches, &c. Mr. Turnbull, however, does not seem to have followed up his invention.

The Glasgow Town Council, sitting as Water Commissioners, transacted some important business on Wednesday. They first of all agreed to fix the rates for water for the current year the same as they were last year—viz., 6d. in the pound within the city, and 10d. outside, with a public water-rate of 1d. in the pound. Satisfaction was expressed that, notwithstanding the large outlay upon the works connected with the augmentation of the water supply—£120,000 having been added to the capital account during the past year—it had not been found necessary to raise the rates. The next item of business consisted of claims by the County Councils of Perth and Stirlingshire, amounting to nearly £900, as compensation for outlay upon roads in the districts where the extension works are going on, caused by the extra traffic to and from the works; and these, subject to adjustment, were agreed to be paid.

Professor Kennedy seems, so far, to have secured all the patronage which is going in Scotland in the matter of electric light consultation. He was in Aberdeen last Saturday inspecting the town with a view to giving his advice to the Corporation Gas Committee as to how they are to proceed in the introduction of their installation. The Professor, like all the others of his class, has a system—in his case, it is the

low-tension three-wire system—and he finds it to be suitable for the district he is advising upon. It was so in Glasgow and in Dundee; and now, as expressed in an interview he had with the Gas Committee, he finds that Aberdeen and Glasgow, so far as a system of electricity is concerned, are much in the same position. Aberdonians usually get credit for shrewdness; and this quality was conspicuous at the interview. They were not content with Professor Kennedy's statement of the situation; but wanted to know whether he thought a Corporation installation would be likely to pay working expenses. His answer was very guarded. He thought that, looking to the size and number of the shops within the area scheduled, and their clean and tidy appearance, proprietors would not hesitate to take the electric light because of its being so much better and cleaner for their goods. This being so, the installation should be in the hands of the Corporation, and they should charge a less price than was authorized by their Provisional Order. It will be observed that he did not answer the question; but that in the opinion he gave, he favoured the installation having the city rates behind it, which, to those who can read between the lines, ought to be evidence that he does not think an electric lighting installation would pay in Aberdeen. A curious part of his opinion was that he did not favour street electric lighting in a town like Aberdeen. Why? one is tempted to ask. What is the difference between Aberdeen and (say) Glasgow or London in that respect? The Gas Committee asked him to furnish them with a report as to the most economical site, the system of supply and distribution, and the cost; and perhaps in his report he may state why he thinks the Corporation of Aberdeen should not have the advantage of the advertisement which street lighting is supposed to be.

The Dundee Gas Commission met on Tuesday to consider Professor Kennedy's report upon the plans for their electric lighting station. The document was gone over minutely; and the Commissioners are now advertising for tenders for the work. It is intended to proceed first with the laying of the street mains, as these will take more time than the other parts of the work. The work is divided into six different contracts—boilers, steam-piping, steam-engines, dynamos, accumulator batteries, and street mains.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, May 21.

Sulphate of Ammonia.—The depression of the market is precipitated by the collapse in the price of nitrate; and spot parcels are now difficult of sale. Consumers seem to have withdrawn entirely, leaving the field to the dealers, with obvious results. The shipments, especially from here, furnish evidence of demand, but which has been satisfied by speculative sales some time ago. Had such a state of things supervened in the earlier part of the year, it might have been a source of danger; but, with the smaller production and fewer parcels offering, the consequences need not be serious. The quotations are now generally below £10; but whether £9 17s. 6d. or £9 15s. is the correct figure according to real transactions, it is not easy to ascertain. Nitrate has fallen to 8s. per cwt. on spot—cargoes off coast being actually offered at 7s. 9d.; and buyers seem disinclined to grant even this figure. It is generally anticipated that nitrate will come lower still.

LONDON, May 21.

Tar Products.—There is a little better feeling in this market; and business in benzol has been done at 1s. 7d. for 90's. Crude carbolic acid has also been in better demand; and buyers seem now disposed to book their requirements for a considerable period ahead. Anthracene is quiet at last week's rates; but considerable business is reported as having been done. Creosote is slightly better—some important railway contracts being on the market; and this, with the lessened production, will no doubt stiffen the price. Pitch maintains its position. Prices: Tar, 10s. to 13s. Pitch, 27s. to 30s. Benzol, 90's, 1s. 7d.; 50's, 1s. 3½d. Toluol, 1s. 2d. Solvent naphtha, 1s. 2d. Crude benzol naphtha, 30 per cent., 8d. Creosote, 1d. Naphthalene salts, 20s.; pressed, 45s. Carbolic acid, crude, 60's, 1s. 1d.; 70's, 1s. 4d.; crystals, 5d. Cresol, 8d. Anthracene, 30 per cent., "A" quality, 10½d.; "B" quality, 7½d.

Sulphate of Ammonia.—This article seems to go from bad to worse; and £9 17s. 6d., less the usual discount, appears to be its present value, and for June delivery even lower prices are mentioned. Gas liquor (10-oz.) is quoted at 5s. to 6s. 6d.

Serious Gas Explosion at Richmond.—Last Wednesday morning, a shop in Kew Road, Richmond, which was in the occupation of Mr. Deeks, a grocer, was wrecked by an explosion of gas. It appears that some workmen in the employment of the Gas Company were engaged putting in a new and larger service-pipe from the main. Two were outside, working in a trench, and the third—a gas-fitter, named Cook—was at the back of the shop, and had a portion of the floor up. He asked for a light, and a candle was given to him by Mr. Deeks, jun., who requested him to be careful. The words were hardly out of his mouth before the explosion occurred. Considerable damage was caused to the shop and its contents; and Cook was severely cut and burned about the head.

Fatal Accident at the Bournemouth Gas-Works.—Last Saturday week, Mr. Harfield, the County Coroner, held an inquiry at Bournemouth into the cause of the death of John Hansford, who was killed on the previous day at the gas-works. It appeared from the evidence that between 10 and 11 o'clock in the morning, a horse was drawing a waggon of wet sand; and it was the duty of the deceased to stand and drop the tail-board as the waggon reached the tip. The horse's foot touched the deceased; and he stumbled and fell across the rails, and was instantly run over—one of the wheels resting on his back. He was at once extricated and taken to the hospital, where he died. The Resident Medical Officer (Mr. Wickham) stated that an examination of the body showed that the lower ribs had been broken, and there were also signs of severe internal injuries. The jury returned a verdict of "Accidental death."

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—A steady slackening off in the demand generally is the report throughout the coal trade of this district; and although the best qualities suitable for house-fire purposes remain fairly steady at late rates, there is a weakening tendency in prices as regards other descriptions. Common round coals continue in only limited inland demand, for iron-making, steam, and general manufacturing purposes; whilst for shipment, inquiry is still very indifferent, and lower prices are being taken to effect sales. As regards inland sales, although list rates are nominally unchanged, colliery proprietors give way to meet customers, and steam and forge coal at the pit mouth scarcely averages more than 7s. 9d. to 8s. 3d.; whilst for shipment, steam coal is offered at from 9s. 3d. to 9s. 9d. per ton, delivered at the High Level, Liverpool, or at the Garston Docks. The depressed condition of the principal coal-using industries is necessarily causing exceptional anxiety with regard to the course of prices when the approaching renewals of gas coal and locomotive fuel come forward. It will be remembered that last year there was a substantial giving way in prices, as compared with those obtained in the previous year; and if the reported renewal of one of the large railway contracts could be taken as indicating the probable course of prices, it would seem likely that still more substantial concessions will have to be made this year. Although there is no absolute official information to the effect, there is an apparently well-authenticated report in the market that this contract has just been renewed on the basis of 7s. 3d. per ton at the pit—representing a reduction of 9d. per ton upon the price obtained last year; and this is regarded as not foreboding any very satisfactory outlook for colliery proprietors in respect to the renewal of the other contracts which will shortly come forward. With regard to engine classes of fuel, although the re-starting of the mills throughout Lancashire is necessarily moving away larger quantities, there is no improvement so far as prices are concerned. Some of the colliery proprietors are holding firmly to late rates; but there are low sellers in the market, and plentiful supplies generally. At the pit mouth, burgy averages 6s. 3d. to 6s. 9d.; best slack, 5s. to 5s. 3d.; with common sorts offering at 3s. 3d. to 3s. 6d. per ton.

Northern Coal Trade.—There is more coal now offering in the North, several of the non-associated collieries having been opened at reductions on the rate of wages, whilst others are likely to follow; and it is evident that the end of the long strike is near. This increase of local coal has been followed by a slight ease in the price; and generally there has been a tendency to sell, whilst buyers needed concessions. Best Northumbrian steam coal is quieter than it has been, in consequence of the increased output of Durham coal; and now the price for prompt delivery may be put at from 11s. 6d. to 11s. 9d. per ton, f.o.b. But for forward delivery much lower rates are offered. Small steam coal is easier; and about 7s. per ton represents the highest current quotation. Gas coal is now rather difficult to quote; there is a small production from some of the Durham pits, and Scotch coal is freely offered. But for forward contracts—that is, for delivery after the general commencement of the Durham pits—quotations are now being made at from 8s. to 9s. per ton, f.o.b. A few weeks, however, will be needed to allow the tendency of the trade and the probable prices to show themselves. Household coal is flat. For Yorkshire supplies, as high as £1 per ton has been paid; but these will soon be out of the market, it is quite expected. Bunker coal is dull and likely to decline. Coke is still scarce, though a few ovens are already at work after a long stoppage. Gas coke is steadier in price, many of the stocks having been exhausted; whilst the production now is generally very small, and will decrease for the rest of the month.

Scotch Coal Trade.—The prolongation of the Durham strike, coupled with the fact that the miners in Scotland are very strictly adhering to the advice given to them to restrict the output, keeps up an appearance of activity all round. The demand is quite equal to the supply; and coal-owners are unwilling to take forward orders, not knowing what troubles may be in store for them. There is an impression that the miners will not stand any more reductions; and when the North of England coal market again comes into competition, which must be soon, there may be complications, as it is likely that the demand in Scotland will fall off, and it may be necessary to try a further reduction of wages. Gas coal is in demand, which is probably another reason why coal-owners are showing a disposition to stiffen their prices for long contracts. For immediate delivery there has been little fluctuation in prices. The figures quoted per ton are: Main, 7s. 6d. to 7s. 9d.; ell, 8s. 6d. to 8s. 9d.; splint, 8s. to 8s. 6d.; and steam, 10s. to 10s. 3d. For the previous week, the shipments amounted to 184,035 tons—an increase of 14,000 tons over the preceding week, and of 29,839 tons over the corresponding week of 1891; while for the year they have been 2,474,415 tons, an increase of 317,710 tons.

Fatal Accident at the Birkenhead Water-Works.—A terrible accident occurred last week at the Wirral Water-Works, at Birkenhead. It appears that a number of men have been employed for some considerable time at the well at the works, which is upwards of 200 feet deep and about 40 feet in circumference. On the day of the accident, two men, named William Jones and Benjamin West, proceeded to descend the well in a tub fastened by three thick chains, and attached to a wire hawser, which was connected to a steam winch. When about 80 feet down the well, the winch by some means got out of order; and this caused the tub to jerk and sway about, and then strike a girder in the wall. The shock was so great that West was precipitated headlong down the enormous cavity. Meanwhile Jones managed to recover himself, and held fast to the tub till he was hoisted to the surface, when it was found that he was only slightly injured. The Water Engineer (Mr. W. A. Richardson) and his assistant (Mr. Nash) were sent for, and were quickly on the spot. The body was not recovered for about two hours; and when it reached the surface, it was found that his head was fearfully bruised and cut in several places, and also his chest. A medical gentleman examined the body, and pronounced life extinct.

Odessa Water Company.—The water-rents of this Company for the year 1891 amounted to £52,952, against £50,941 for 1890, and the miscellaneous receipts to £5186, against £3313; leaving a balance, after meeting interest on debentures and all charges, including drawn bonds, of £12,662, against £8555 for 1890. This balance includes the profit of £1472 on exchange.

The Proposed Purchase of the Mexborough and Swinton Gas-Works by the Local Authorities.—A conference took place last Friday between members of the Local Boards of Mexborough and Swinton as to the desirability of purchasing the local gas-works. The question was fully discussed; and there appeared to be a general opinion that it might be in the interests of the two townships to effect a purchase if the price asked for the concern was not prohibitive, taking into consideration the years that the works have been in operation, and the substantial outlay that would be needed in order to put the gas-mains, &c., in a more satisfactory state. It is understood that the Directors of the Company will consider the matter; and that it will then come up for further debate between the Local Boards.

An Electric Lighting Scheme for York.—At a special meeting of the York City Council held last Tuesday, a report was presented from the Streets and Building Committee on the subject of the proposed introduction of an electric lighting scheme. The Council have already obtained a Provisional Order for the purpose, which will lapse if the powers contained therein are not exercised before August next. Mr. Crompton, the Electrical Engineer of the Corporation, prepared an estimate for an installation for £10,000; but as the area was extended by the addition of other streets, the figure was afterwards raised to £12,000. The Council have had applications for 2700 lights; and they themselves will require about 2500 more. The Committee recommended the Corporation to borrow £15,000; and, after a long discussion, this was agreed to—not, however, without some opposition. It appeared to be the opinion of certain members of the Council that it would be preferable to hear what electric lighting contractors would be prepared to do before coming to a decision; but an amendment expressing this view, and referring the report back to the Committee, was lost by 15 votes to 8. The Council will therefore retain control of the scheme.

The Supply of Water to High Levels.—In the Queen's Bench Division a few days ago, Justices Day and Charles had before them a special case stated by the Justices of Barnstaple, in reference to the construction of the Act under which the Barnstaple Water Company carry on their operations. It was the result of certain proceedings taken by the Company against a consumer in March last, as reported in the JOURNAL at the time (*ante*, p. 500). The consumer's premises were situated between two reservoirs belonging to the Company—one called the Raleigh, and the other the Pickard Down reservoir. They were above the former reservoir, and could not possibly be served by gravitation from it, but only by pumping; but the Pickard Down reservoir was above the level of the premises, and water could be supplied by gravitation in the usual way. But the Pickard reservoir was filled from the Raleigh reservoir by pumping; and as the Act of Parliament under which the charges were made provided that one-fifth more than the rate authorized to be charged should be levied on all premises where the water could not be supplied by gravitation, the question arose whether the owner was liable for this extra rate. Another point was that at the time the Act was passed in 1888 only the Raleigh reservoir was in existence. The words of the Act provided that the extra charge should be made in cases in which the Company supplied water at a pressure greater than that afforded by gravitation, either from the then existing reservoir or from any other reservoir. This, Mr. Asquith, Q.C., contended, on behalf of the Company, made the respondent liable. At the conclusion of the argument, it was stated that Mr. H. F. Dickens, Q.C., who had been retained for Mr. Tucker, the consumer, was engaged in another Court, and was unable to reply. Mr. Justice Day said he could not help that. He had come to the conclusion that the appeal must be allowed, with costs; but as the case had not been argued from the other side, he would give leave to further appeal.

The West Bromwich Gas Undertaking.—The Secretary of the West Bromwich gas undertaking (Mr. T. Hudson) has just issued his report for the year ending March 31 last. It states that the borrowing powers of the Corporation with respect to the undertaking are for only £174,955; but application has been made to the Local Government Board for an extension of them, to enable the Gas Committee to carry out certain projected improvements in the works and plant. The amount spent on capital account during the past year was £1300. The total expenditure on this account is now equivalent to £8 1s. 3d. per ton of coal carbonized, or £806 2s. 7d. per million cubic feet of gas made. The report states that the year just closed was one of much anxiety, owing to the continued high price of coal. As a result of this and other increased expenditure, the profits of the undertaking for the year were again much lower than formerly. The sales of gas showed a slight increase; the income from private consumers and from public lighting being £25,823, or £283 more than in the preceding year. This increase is stated to be entirely due to new consumers; the number being upwards of 100 in excess of the previous year, and these almost entirely small consumers, supplied at 2s. 8d. per 1000 cubic feet—a fact no doubt due to the abolition of the deposit system. As mentioned in the JOURNAL last week, the total quantity of gas consumed was 203,780,700 cubic feet—an increase of nearly 2½ millions. The income from coke and breeze was £8177—a rise of £399, due entirely to increased production. The revenue from gas-fittings and stoves was £1451—an advance of £38; but the increased expenditure more than covered this. The total income for the year from all sources was £37,799—an increase of £728. The total expenditure is £29,289—an addition of £1484, caused chiefly by increased expenditure on coal, and also by a larger amount having been expended on maintenance, repairs, and renewals. The net cost of raw material was £14,377—an increase of £964. The wages amounted to £3140; and the expenses of management were £1062. The balance of income over expenditure was £8510—a decrease of £755. The amount in hand at the commencement of the year was £9247, out of which £1000 had been employed in the relief of the general district rate.

Artesian Wells in Spain.—Eight artesian wells have been opened by the Salonica Water Company, five of which are already in working order, and supply together 5,364,000 gallons of water in 24 hours. The contract of the Company compels them to furnish only 2,200,000 gallons of water per day to the town.

Compensation for Injuries to a Coke Filler.—In the Queen's Bench Division of the High Court of Justice on the 14th inst., before Mr. Justice Grantham and a common jury, a labourer named Barrable sued Messrs. Hillman and Co., carmen and contractors, for compensation for injuries suffered in an accident which happened on April 17 last year. The plaintiff was working a machine for filling sacks with coke at the Commercial Gas-Works, Wapping. The defendants had a contract to cart coke from the works to St. Katherine Docks; and it was said that a servant of theirs backed a van against the plaintiff's machine, knocked it over, and crushed three of the fingers of his left hand. The defendants denied that there was any negligence on their part; and asserted that the plaintiff showed want of care in standing where he did. It was also said that the carman was at the time acting under the direction of William Hawley, a fellow-servant, in the course of their ordinary employment. The jury gave a verdict for the plaintiff for £15.

The Bradford Corporation Water Supply and Lead-Poisoning.—A conference of Medical Officers of Health for the out-townships deriving their water supply from the Bradford high-level service was held last week to consider the prevalence of lead-poisoning in the out-townships, and the best means of preventing it. A series of resolutions to the following effect were unanimously approved, after a discussion lasting for more than two hours: That a lead-contaminated drinking water supply is a grave danger to public health, and that wherever plumbism develops in such a supply the local sanitary authority should regard it as an imperative duty to take all possible precautionary and preventive measures, regardless of expense; that where possible the character of the water should be modified, so as to reduce the plumbo-solvent action to the lowest possible limit, and that the use of lead service-pipes and fittings should be discouraged; and that the constant use of filters, such as the animal charcoal ones, should be adopted by householders. A strong opinion was unanimously expressed that the Bradford Corporation should be urged to so treat the high-level supply as to render the water no longer plumbo-solvent. An inquest was held at Wyke a few days ago on the body of Alfred Shackleton, whose death was caused, according to the medical evidence and the finding of the jury, by lead-poisoning produced by drinking water supplied to the inhabitants of Wyke by the North Bierley Local Board, and purchased from the Bradford Corporation.

Preston Corporation Water Supply.—The Borough Engineer of Preston (Mr. Hudson Reah) has recently prepared a lengthy report on the subject of the water supply of the town, in the course of which he makes a number of recommendations. He says that it is absolutely necessary that an additional supply main should be laid from the reservoirs into the town; and he proposes that a 36-inch main (to which the existing 24-inch, the 16-inch, and the 14-inch mains will be connected) be laid, and connected with the present valve-house and screens at the west reservoir at Grimsargh, and also with the middle reservoir, where a new valve-house and screens would have to be constructed. This would very largely increase the supply, but not greatly the pressure; and to meet the numerous and increasing complaints as to inadequate pressure, Mr. Reah recommends that the proposed main should be continued to Alston reservoir, where a valve-house and large screen and straining appliances would have to be erected, into which the water from Alston reservoir would pass through an iron pipe. The scheme, however, would interfere with the working of the reservoirs at Grimsargh, as, owing to the higher altitude of the Alston reservoir, the water would be unable to flow out of the Grimsargh reservoir when that at Alston was being used. There are, however, two ways of dealing with the Grimsargh reservoirs—that is, either to make two water districts in the town, the one to be supplied by the 26-inch main and the Grimsargh reservoirs, and the other by the proposed new 36-inch main and the Alston reservoir, the mains being connected so that either would be available; or the town could be kept in one water district, as at present (which would be much the cheaper and easier to work), and the Grimsargh reservoirs, with the 26-inch main kept as a reserve, and used in case of accident to the Alston main, or at times when the higher pressure was not needed (as at each week-end), or at any other time it was deemed desirable. Mr. Reah also asks that the inadequate storage be also considered. The Langden and Hareden brooks yield an average daily supply of over 3,500,000 gallons; and the estimated daily yield of the Cowley brook is 1,500,000 gallons. During the very hot, dry weather of 1887, 4,168,775 gallons of water were sent into the town in 24 hours from the west reservoir at Grimsargh. This was exceptional; and the average daily quantity was, he estimates, about 3,000,000 gallons. A considerable quantity of water is available if there is proper storage. The storage capacities of the Spade Mill, Alston, and Grimsargh reservoirs totals to 253,390,354 gallons. As he considers large storage accommodation absolutely necessary, Mr. Reah recommends that 27½ acres of land belonging to the Corporation at Alston be cleared; and a reservoir capable of holding 275,000,000 gallons constructed. In order that water might be supplied to the town, certain alterations in the existing culverts would be necessary. The gross revenue from the water-works for the twelve months ending March 31, 1891, was £19,850; and the cost of constructing the various works recommended in the report is £95,500. It is interesting to note that the total capital cost of the water-works up to March 31, 1891, was £341,516, of which £21,291 has been provided out of the surplus revenue. The amount borrowed is, therefore, £320,225; and of this there has been repaid £28,227—leaving the sum of £291,997 owing on water-works account on March 31, 1891. A reference was made by Alderman Maynard to the subject of the extensions at a recent meeting of the Council. The cost of the works, he said, would necessitate no addition whatever to the rates, nor any application to Parliament. The Local Government Board would give them permission to raise the money; and the interest and sinking fund would be paid out of the revenue derivable from the water. There would be sufficient revenue; and, therefore, the rates would not be called upon.

The Mansfield Water Question.—Mr. T. Hawksley has been selected by the Mansfield Town Council to report upon the water-works schemes which have been laid before them.

The Purchase of the Calverley Water-Works by Local Authorities.—The Farsley Local Board have decided to confirm an agreement entered into with the Pudsey and Calverley Boards with respect to the purchase of the Calverley District Water-Works Company's plant and undertaking.

The Kirkleatham Water-Mains Arbitration.—Mr. Henry Law, the Arbitrator appointed to fix the price to be paid by the Kirkleatham Local Board to the Stockton and Middlesbrough Water Board for the purchase of the pipes, mains, &c., in the district to be taken over by the former, has re-stated his award at the sum of £8006. The arbitration and subsequent proceedings in regard to this matter were noticed in the JOURNAL for Jan. 26 and Feb. 9 last.

The Carriage of Petroleum in Bulk through the Suez Canal.—Sir F. Abel and Mr. Boverton Redwood, who have, at the request of British shipowners, been investigating the subject of the transport of petroleum in bulk through the Suez Canal, have issued a report, in which they express an opinion that, even with the strict enforcement of proper regulations, the passage of tank steamers laden with oil must involve risk to other shipping using the water-way. The high temperature of the atmosphere on the Canal during a large part of the year, and also of the water itself, is, in their opinion, likely to increase considerably the risk arising from an outbreak of fire and of explosions of a mixture of petroleum vapour and air on board the vessel. In the case of the escape of petroleum through leakage, collision, or grounding, the prevailing high temperature, and also the necessary employment on the Canal of many lights, some of them gas-buoys placed in the water, would make ignition of the floating oil almost certain. The regulations issued in regard to this class of traffic by the Suez Canal Company are considered inadequate in various ways, and especially in respect that the Company take no responsibility for their enforcement. With proper stipulations as to the construction of tank vessels, and rigid regulations affecting them during their passage, the authors admit that the risk might be to some extent reduced.

Paraffin Lamp Accidents.—Early in the morning of Monday, the 9th inst., a fire broke out in New John Street, Birmingham, which did little damage to property, but by which six men were more or less seriously injured. It had been caused by the ignition of the oil vessel of a paraffin lamp. Nobody was in the room at the moment, and the flames were first seen by a passer-by, who forced an entrance, and threw the lamp out into the street. It fell among the crowd which had gathered; and the blazing oil was scattered, as if from a bomb, upon the faces and hands of six men and youths, four of whom were treated for burns at the General Hospital, and two by the Fire Brigade. On Wednesday, the 11th inst., Dr. Danford Thomas held an inquiry at the Marylebone Coroner's Court into the circumstances attending the deaths of Mary Ann Flood, aged 40 years, wife of a jeweller, and Avis Bradley, aged four years, daughter of a tailor, both of whom lost their lives in a fire which took place at 50, Union Street, Marylebone, on the previous Saturday night. Flames being noticed at the window on the second floor of the house in question, the premises were entered, and the deceased woman was found lying on the floor. She was removed to the Middlesex Hospital, where she died. James Knightly, Engineer of the Metropolitan Fire Brigade, said he went into the room and found the deceased child lying face downwards on the floor, dead. It had in one hand the brass burner of a paraffin lamp. He examined the room, and found that the lamp had been taken down from its place (no doubt by the woman), and that the fire had been caused by the lamp exploding or being upset. The medical evidence showed that in both cases death had resulted from suffocation and burns. The jury returned a verdict of "Accidental death."

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

For Stock Market Intelligence, see ante, p. 963.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon invest. ment.
£			p. c.					£ s. d.
GAS COMPANIES.								
590,000	10	13 Apr.	10½	Alliance & Dublin 10 p. c.	10	16½-17½	..	6 0 0
100,000	10	"	7½	Do. 7 p. c.	10	11-12	..	6 5 0
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105-107	..	4 13 5
100,000	20	27 Nov.	8	Bahia, Limited	20	10-12	..	13 6 8
200,000	5	12 May	7½	Bombay, Limited	5	6½-6¾	..	5 11 1
40,000	5	"	7½	Do. New	4	4½-5	..	6 0 0
380,000	Stock	26 Feb.	12½	Brentford Consolidated . . .	100	210-215	..	5 14 1
150,000	"	"	9½	Do. New	100	162-167	+2	5 10 9
220,000	20	11 Mar.	11½	Brighton & Hove Original . .	20	40-42	..	5 9 6
888,500	Stock	11 Mar.	5	Bristol	100	95-100	..	5 0 0
320,000	20	13 Apr.	11½	British	20	42-44	..	5 2 3
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	10	19-20	..	5 15 0
51,510	10	"	8½	Do. 7 p. c.	10	14½-15½	..	5 9 8
328,750	10	"	—	Buenos Ayres (New) Limited	10	6½-7½	-½	—
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	94-97	..	6 3 9
150,000	20	26 Feb.	8	Cagliari, Limited	20	25-27	..	5 18 6
550,000	Stock	13 Apr.	13	Commercial, Old Stock . . .	100	229-234	..	5 11 1
165,000	"	"	10	Do. New do.	100	180-190	..	5 5 3
130,000	"	30 Dec.	4½	Do. 4½ p. c. Deb. do.	100	118-123	..	3 13 2
800,000	Stock	30 Dec.	13	Continental Union, Limited .	100	220-225	-1	5 15 6
200,000	"	"	10	Do. 7 p. c. Pref.	100	190-195	..	5 2 7
75,000	Stock	30 Mar.	10	Crystal Palace District . . .	100	185-195	..	5 2 7
486,090	10	29 Jan.	10	European, Limited	10	19-20	..	5 0 0
354,060	10	"	10	Do. Partly paid	7½	13½-14½	..	5 3 11
5,470,820	Stock	12 Feb.	12	Gaslight & Coke, A, Ordinary	100	210-214	-3	5 12 1
100,000	"	"	4	Do. B, 4 p. c. max.	100	94-97	..	4 2 5
665,000	"	"	10	Do. C, D, & E, 10 p. c. Pf.	100	247-252	..	3 19 4
30,000	"	"	5	Do. F, 5 p. c. Prf.	100	116-121	..	4 2 9
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	169-174	..	4 6 2
1,300,000	"	"	7	Do. H, 7 p. c. max.	100	153-156	..	4 9 9
463,000	"	"	10	Do. J, 10 p. c. Prf.	100	245-250	..	4 0 0
476,000	"	"	—	Do. K, 6 p. c. Prf.	100	145-150	..	4 0 0
1,061,150	"	11 Dec.	4	Do. 4 p. c. Deb. Stk.	100	114-116	..	3 9 0
294,850	"	"	4½	Do. 4½ p. c. do.	100	118-123	..	3 13 2
908,000	"	"	6	Do. 6 p. c. do	100	165-169	..	3 11 0
3,800,000	Stock	12 May	12	Imperial Continental	100	217-221	-1	5 8 7
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4-4½	..	6 13 4
560,000	100	1 Apr.	5	Met. of Melbourne, 5 p. c. Deb.	100	108-110	+1	4 10 11
541,920	20	27 Nov.	6½	Monte Video, Limited	20	14½-15½	..	8 7 8
150,000	5	27 Nov.	10	Oriental, Limited	5	8-8½	..	5 17 8
60,000	5	30 Mar.	7	Ottoman, Limited	5	4-5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited	10	2-3	..	—
People's Gas of Chicago—								
420,000	100	3 May	6	1st Mtg. Bds.	100	102-105	..	5 14 3
500,000	100	1 Dec.	6	2nd Do.	100	103-106	..	5 13 2
150,000	10	15 Oct.	10	San Paulo, Limited	10	8-9	..	—
500,000	Stock	26 Feb.	15½	South Metropolitan, A Stock	100	275-280	..	5 10 8
1,350,000	"	"	12	Do. B do.	100	220-224	+1½	5 7 2
200,000	"	"	13	Do. C do.	100	235-240	..	5 8 4
725,000	"	30 Dec.	5	Do. 5 p. c. Deb. Stk. . . .	100	142-146	..	3 8 6
60,000	Stock	11 Mar.	11½	Tottenham & Edm'ton, "A"	100	225-230	..	5 0 0
WATER COMPANIES.								
729,331	Stock	30 Dec.	10	Chelsea, Ordinary	100	252-257	..	3 17 9
1,720,252	Stock	13 Apr.	8	East London, Ordinary . . .	100	196-201	+1	3 19 7
544,440	"	30 Dec.	4½	Do. 4½ p. c. Deb. Stk. . . .	100	136-140	..	3 4 3
700,000	50	11 Dec.	8	Grand Junction	50	98-102	+2½	3 18 5
708,000	Stock	12 Feb.	10½	Kent	100	255-265	..	3 19 3
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max.	100	220-225	..	4 4 5
406,200	100	"	7½	Do. 7½ p. c. max.	100	187-192	+2	3 18 1
279,700	Stock	30 Mar.	4	Do. 4 p. c. Deb. Stk.	100	120-123	..	3 5 0
500,000	100	12 Feb.	12½	New River, New Shares . . .	100	325-335	+5	3 12 4
1,000,000	Stock	29 Jan.	4	Do. 4 p. c. Deb. Stk.	100	126-129	..	3 2 0
902,300	Stock	30 Dec.	6½	S'hwk & V'xhall, 10 p. c. max.	100	145-150	..	4 6 8
126,500	100	"	6½	Do. D 7½ p. c. do.	100	133-138	..	4 14 3
1,155,066	Stock	11 Dec.	10	West Middlesex	100	243-247	-1	4 1 0

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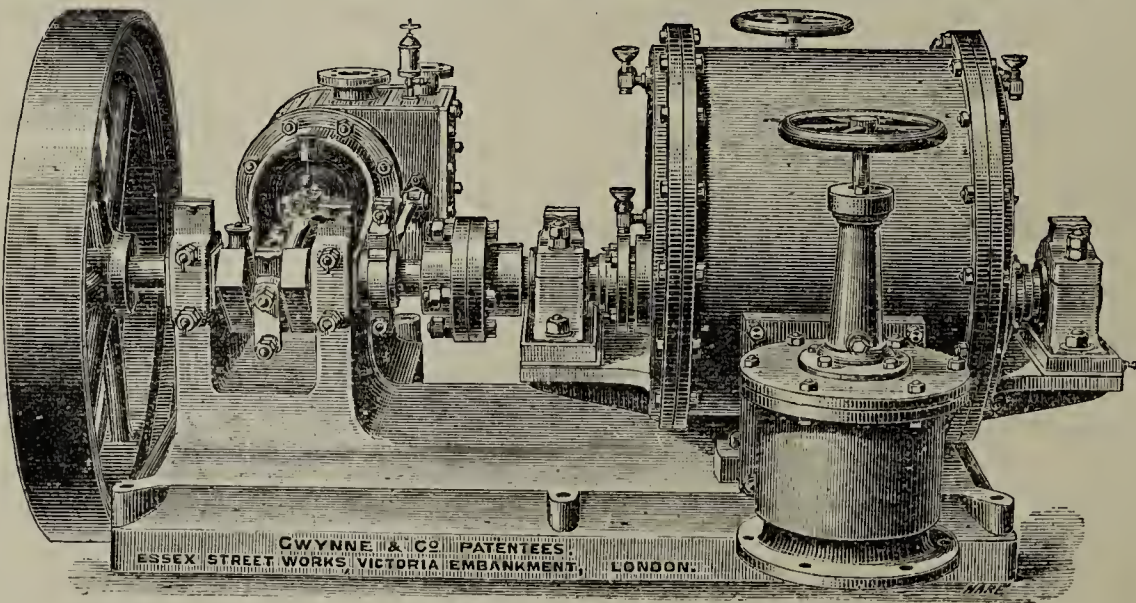
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THE

JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MAY 31, 1892.

The Result of the Gasholder Patents Litigation.

THE judgment of Mr. Justice Kekewich in the notable suit of *Gadd and Mason v. The Corporation of Manchester* was delivered, somewhat unexpectedly, last Thursday. It will be found at length in another column. Its effect, as summed up by the learned Judge himself, is that the plaintiffs' case failed, and the defendants win, with costs to be taxed on the higher scale. Before proceeding to deal with the merits of the matter, we desire to express that natural sympathy with, and commiseration for, the losers, which must be experienced by all impartial spectators of such a well-contested action. The plaintiffs did their very best to win, in the honest belief that they were justified in their proceedings by having both law and right on their side. The case was conducted throughout with consummate skill and perfect temper; and the spite, as of rival tradesmen, which sometimes embitters actions of the kind, was wholly absent. The result is a very serious one for the losers; for the costs of the six days' hearing and

of the preparation of the evidence must be heavy. There is this to be said, however—the plaintiffs, while losing their 1888 patent and their suit, do not sacrifice anything more. So far as we can understand the matter, they had not made any use of this patent, and did not appraise its commercial value at any considerable figure. They only work their earlier spiral guiding patent, which was not in question at all in this suit. Their special business interest, therefore, in gasholder guiding remains unaffected. It would have been very different if the real defendants—Messrs. Ashmore, Benson, Pease, and Co., Limited—had lost the day; for it was their business interest which was at stake. They actually deal in the specialty in gasholder guiding which Messrs. Gadd and Mason only claimed to have included in a hitherto unworked patent; and consequently the result of defeat would have been very much more serious to them, from the business point of view. As it is, Mr. Pease's patent remains untouched, even if it is not in a stronger position legally than it previously occupied; and Mr. Pease's firm can go on their way rejoicing in the liberty of making and selling as many wire-rope guided gasholders as they can find customers for, while Messrs. Gadd and Mason must turn for comfort and solace to the proceeds of their spiral guiding patent.

This consideration leads us to the natural reflection that Messrs. Gadd and Mason would have been much better advised if they had not attempted to interfere with Mr. Pease. We say this, not in the spirit of one who is wise after the event, but upon the broad question of what is right, fair, and reasonable as between man and man. It is difficult to see why the plaintiffs in this case should have undertaken to play the part of "dog in the manger" to Mr. Pease, by taking proceedings against the customers of his firm. Surely, there was, and is, room enough in the world for both these specialists; and it is hardly conceivable that Messrs. Gadd and Mason would have suffered, either in cash or in credit, if they had acquiesced from the first in taking the line which has now been forced upon them—leaving Mr. Pease alone, as he was not interfering with them. We have no desire to exasperate the losers' chagrin by moralizing upon their discomfiture to the text of "serve them right." But it is impossible to shut one's eyes to the facts that Messrs. Gadd and Mason were the aggressors; that they went out of their way to endeavour to stop somebody else's business; that they strained to the breaking-point their privileges as patentees; and that disaster has overtaken their attempt to grasp too much. Well, if they have blundered, they must pay the penalty. "Whoever plays at bowls must expect rubbers;" and for those who put the law in motion for their own ends and come to grief there is but slight sympathy felt in this work-a-day world.

Regarded generally, as a lesson in patent law, this action and its result are most instructive. As we have already had occasion to point out, the nature of these proceedings rendered it necessary for the plaintiffs to satisfy the Court that their patent was good, and that the defendants had infringed it. The infringement was not denied, if the plaintiff's patent could be maintained; but it was contended for the defence that the patent was bad. Three points were relied upon to this effect: First, it was argued that a contemporary inventor—Mr. James Terrace—had published, by letters to various people, who in turn disclosed their contents to others, one form of the invention patented by the plaintiffs, and had consequently rendered it impossible for them to obtain protection for the same thing. This part of the case was separated from the rest. It was agreed that Mr. Terrace's device was identical with one of the plaintiffs' arrangements, and that if Mr. Terrace had published it, in the legal sense of the term, the plaintiffs' patent would be wrecked upon this point alone. But, although Mr. Terrace's conduct, in bestowing his confidences in various and sundry quarters where they were not at all desired, was peculiar, the Court held that his communications did not amount to legal publication. We pause here to draw attention to the trouble and expense which Mr. Terrace entailed upon others by these futile disclosures, and their fruitlessness in regard to his own interests. No man is justified in intruding his notions in this way upon strangers, especially if he has grounds for supposing his correspondents to be personally interested in the subject. Mr. Terrace's communication with Mr. Gadd was particularly

inexcusable; and it is only fair to Mr. Gadd to allow that he did his best to extricate himself honourably from an exceedingly awkward position. It is to be feared, however, that regard for the interest of others will not operate powerfully enough with some prospective patentees to hinder them from forcing their crude ideas upon the notice of men whose position makes them a target for this kind of sport. It is therefore more to the purpose to lay stress upon the consideration that by every such communication the would-be patentee gravely imperils his own chance of obtaining a valid patent. The way to protection is open to all at a reasonable price; and the inventor must take his own risk. It is not competent for him to obtain the opinion of the world upon his notions before "backing" them, so to speak, by payment of the fee needed for provisional protection. After this affair, a prudent engineer will refuse to receive, under the seal of confidence, any communication from a stranger dealing with the subject-matter for a prospective patent.

The second count of the defence was that the plaintiffs had not preserved due conformity between their provisional and complete specifications, inasmuch as the latter had been expanded in order to make it embrace methods of attaining the patentees' object which do not come fairly within the meaning of the terms of the provisional specification. This is the most instructive feature of the proceedings, for outsiders who are or may at any time be situated similarly to the plaintiffs and defendants in this case. The position may be explained thus: The law permits—we will go further, and say it even encourages—an inventor to obtain protection for his invention while it is yet immature, and offers to extend this protection to any natural developments of his idea which may be found necessary or desirable in the course of those trials of the general arrangement which the interval between the lodging of the two specifications is expressly granted to facilitate. But the provisional patentee is not the only person in the world for whom the law has consideration—a fact which the individual is rather apt to overlook while the frenzy of the inventor is full upon him. The law looks sharply after developments of inventions provisionally protected, especially when, as frequently happens, the order of ideas represented by the invention is occupying the minds of many men, and discovery, having its goal in sight, as Justice Kekewich remarked, is hurrying on from all directions with rapid strides to a clearly-perceived end. The first discoverer of a new field may be allowed a considerable range in the selection of his particular claim. But "first discoverer" and "exclusive proprietor" are not the same; and the law is not lightly won over to make the terms synonymous. The "early bird," in the person of the first inventor, usually wants not only his own, but all the worms that can be picked up in the field upon which he has pitched; but the public who are not inventors incline to the opinion that right as well as law are in favour of giving others a chance. At any rate, to drop metaphor, there is good sense as well as good law in the position taken up by the Courts, and now re-affirmed in the clearest way by Justice Kekewich, which is that the matter of a complete specification must be contained in the provisional specification. It is not sufficient that a competent expert can aver that the provisional specification "adumbrates" something which, with later knowledge, the patentee includes in his complete specification. Knowledge grows and spreads fast and far sometimes. There is quite enough as it is, for the public good, of lucky first patentees triumphantly pointing to words and phrases in their provisional specifications to which, in the light of later results obtained by other workers, they are able to ascribe meanings which were not in their minds when the document was drafted. That this is so is notorious. But it is exceedingly difficult to establish the contention in specific cases; for when discovery is going forward from day to day, it is hopeless to fix the meanings of words from one period to another. Callow inventors, and patentees of no small experience as well, are all the better for being reminded of the fact that the patent laws exist primarily for the benefit of the whole community. This is a lesson in generalities; and there is another in regard to detail which may well be mentioned with it, which is this: All means of attaining the same end are not equivalents for each other; and the difference between development and evolution, although undefinable, is apt to come out into overwhelming prominence when

the analytical mind of a Chancery Judge is set upon the question of "non-conformity." So Messrs. Gadd and Mason lose upon this crucial point; and, what is even more conclusive than the result when taken without circumstance, they have been defeated through the testimony of their own principal witness.

Upon the third point at issue—the so-called paper anticipations—Mr. Justice Kekewich prudently declined to enter, in view of the effect of his judgment upon the second head of the case for the defence. But what he said about this branch of the proceedings makes at least as much for the defendants as it does for the plaintiffs.

The Final Papers at the Gas Institution Meeting.

IN the present issue of the JOURNAL, we give our last instalment of the proceedings of the Incorporated Institution of Gas Engineers at their recent meeting. It comprises the discussions upon the two papers of Messrs. Goulden and Paddon and Mr. Frank Livesey, both of which were valuable in themselves, and the occasion of some very instructive debate. We do not intend to make any comment upon the water-gas paper or the observations which were more or less based upon it. As with the oil-gas and carburetter papers, we think that the matter had better be left where it stands, for everybody interested in the subject to study for himself. The temptation to criticize some of the statements of various writers and speakers is strong; but the process of the elucidation of the truth is so tedious and painful, and so likely to be as greatly helped by some men's blundering as by other men's carefulness, that we shall even stand aside and see the matter threshed out in the various experimentalists' own way. One thing at least may be said here, and it is that, in the course which the British engineers who report to the Institution have set for themselves, the experience accumulated in such portentous bulk by their American brethren is of little or no use to them, either as guidance or warning. Water gas is a commercial product in the States; with us it can hardly be conceived as anything more than a special preparation, offering, under certain conditions, a definite amount of assistance to the coal-gas maker, but not to be sold on its own account. Moreover, it has to be made, if at all, from materials different in many highly important respects from those employed for the purpose in America. There the manufacture of water gas has been created for a purpose, or rather for several purposes, hardly one of which applies to the conditions prevailing here. We have neither the Standard Oil Company nor the Lowe patent whereon to base an artificial success for carburetted water gas; and neither our prices nor our statutes permit of our playing with methods of gas manufacture as the Americans do. They have simply gone on increasing the dimensions of their plant as their trade grew. But of systematic research into principles they have done very little; and it is probable that the two or three British experts who have seriously gone into the water-gas question already know more about the elements of success, having regard to their own circumstances, than could be told them by men who, as a matter of trade, sell the same class of gas largely.

Mr. Frank Livesey's paper was a stimulating contribution to the literature of gas-works construction, and went to show that the possibilities of improvement in the matter of gasholder design are far from spent. It is a healthy shock to preconceived notions to propound the example of a holder composed of six shallow lifts, and show how a difficulty of guiding which would be of recognized magnitude in a holder of one or two such lifts becomes less rather than greater when these are multiplied. The gas engineering world will await with the liveliest interest an authentic report upon the performance of the remarkable structure described by Mr. Livesey, and seen in a partly completed state by the members of the Institution at East Greenwich. It will be quite in order, therefore, if he arranges to furnish a sequel to his paper for next year's meeting, telling how the holder has fared during the winter. Opinion is agreed upon the point that the *crux* of the system which this holder exemplifies will be the proper working, while rising alone, and the accurate cupping of the top or first lift. To all intents and purposes, this lift will be guided mainly from the base by the arrangement of radial and tangential rollers provided at this part of the structure; and if it acts well—of which there is little reason to doubt, so excellent is the workmanship—its success will be a further vindication of principle.

The Programme for The Gas Institute Meeting.

THE programme for the forthcoming meeting of The Incorporated Gas Institute, which is to commence this day fortnight under the presidency of Mr. W. A. Valon, of Ramsgate and London, and be prolonged for the usual period, has been issued by the Secretary (Mr. W. H. Harvey, B.A.). Both Tuesday and Wednesday will be whole-day meetings. The first item of interest in the proceedings will be the presentation of the Birmingham Medal to Dr. Perkin, F.R.S., the discoverer of the tinctorial quality of coal-tar derivatives, who, it is understood, will endeavour to be present in person to receive and acknowledge the gift. The premiums for last year's papers will also be awarded to Professor Vivian B. Lewes, Mr. A. T. Walmisley, and Mr. T. N. Ritson, in the order named. A special feature of Wednesday's business will be the Murdoch commemorative lecture, to be delivered by Professor Lewes, the subject being "A Century of Work on the Development of Light from Coal Gas." There will be a reception, to be followed by a *conversazione* and dance at the Westminster Town Hall on Wednesday night. An opportunity of inspecting the chief distributing station of The Gaslight and Coke Company in Goswell Road will be provided on Thursday evening, through the kindness of Mr. George F. L. Foulger. The Friday's excursion will be an up-river trip to Windsor. The customary tale of papers and communications to be submitted to the meeting has been made up as follows: Mr. W. R. Chester, of Nottingham, will treat of the "Structural Capacity and Cost of Gas-Works." Mr. F. G. Dexter, of Winchester, promises a paper on the "Application of Steam as an Aid to the Revivification of Oxide of Iron *in situ*." Mr. Thos. Newbigging will read a second paper on "Difficulties in Tank Construction." In addition to these members' contributions, Professor Lewes will give some "Notes on the Carburetting of Gases;" Professor W. Foster will recount some "Analyses and Lighting Values of English Coal Gas made during the Year 1891;" Dr. L. T. Thorne will discourse on the "Influence of Combustible Diluents on Illuminating Gases;" Mr. A. T. Walmisley will give a paper on "Vertical Standards for Gasholder Framing;" and Mr. W. Gadd another on "Cantilevers and Cantilever Gasholders." It is particularly desired that there should be a good attendance at the meeting of donors and subscribers to the Benevolent Fund, which will be held at five o'clock on Tuesday.

Three Excursion Meetings.

THREE District Associations of Gas Managers held meetings last week—the Southern and the Midland on Thursday, and the Manchester on Saturday; and in all the element of pleasure, of the solace of congenial companionship in the open air, outweighed the formal, or the technical and business, element. The Southern organization visited the President, Mr. Andrew Dougall, at Tunbridge Wells. The Midland Association went to Rugby, where the members were received by their popular Treasurer, Mr. Peter Simpson—soon, we are sorry to learn, to transfer himself from the "active" to the "retired" list of members of the gas industry—and after listening to the deferred Inaugural Address of the President (Mr. W. Littlewood, of West Bromwich), and discussing a paper on the Monier system of construction in cement, spent the rest of the day in visiting places of interest in the neighbourhood. The Manchester Institution devoted the day to an excursion to Skipton and Bolton Woods—a notable locality for all Englishmen by whom the rich history of their country is recognized as a precious heritage. By these well-organized trips in the early summer-time, when, if the weather is only propitious, it is a satisfying pleasure merely to exist in the fresh air, and to feel oneself in accord with the ever-renewing energy of Nature, our technical societies undoubtedly fulfil a highly important function of their being. The members evidently think so; for the "out-meetings" are not the least well attended of all the gatherings which break the monotony of the gas manager's year. And even if the benefit derived from mutual association at regularly recurring periods were to be computed upon rigidly technical data, it would probably be found that notes can be compared and experiences exchanged to just as good purpose while driving through a pleasant country, or strolling over an old-world domain, as in a more severely business meeting. It is unnecessary,

however, to excuse, upon the score of mere utility, these little excursions, enjoyed for themselves and as opportunities of congenial converse between men who have so much in common in their work and their business cares, that it is easy for them to participate in the pleasant whiling of a few summer hours once a year. It is a poor heart that never rejoices. The gas manager's life is not all made up of difficulties with pipes and machinery and stokers. He has hours when the mention of the gas examiner stirs not his spleen, and when his pet aversion in the town council is powerless to annoy. Such are the hours which, with good health and fine weather to keep him cheerful, he spends with his fellows in reviving memories of the gallant Sidneys, in appreciating the influence of the great Master of Rugby, or in conjuring up visions of "Bolton Abbey in the Olden Time." Let us sincerely hope that the era may be very far distant when the associated gas managers of Great Britain will be too heavily burdened with the anxieties of money-making for other people, to spare the time for such outings as those to which so many of them, as by common consent, appropriated some of the most shining hours of a week phenomenal in English meteorological records.

Mr. A. P. Trotter's Illumination Photometer.—We are asked by Messrs. Alexander Wright and Co. to mention that the manufacture of the above-named instrument, to which reference was made in the JOURNAL last week, has been entrusted to them; and that they will be pleased to reply to any inquiries respecting it from those who are interested in its use.

The Gas Industry at the Labour Commission.—At the meeting of Section C of the Labour Commission yesterday, the following witnesses were examined in connection with the gas industry: Mr. C. Wheeler, representing Beckton coal porters; Mr. W. A. Valon, President of the Incorporated Gas Institute, who laid before the Commission a mass of statistical information which he had been able to collect from gas undertakings in Great Britain, Ireland, and the Channel Islands; Mr. T. Duxbury, Manager of the Darwen Corporation Gas-Works; and Mr. H. E. Jones, Engineer of the Commercial Gas Company. A report of their evidence will be given next week.

The Albert Medal of the Society of Arts for the present year has been awarded to Mr. Thomas Alva Edison, in consideration of the important services rendered by him to the progress of electric lighting, telegraphy, and the telephone. It may be remembered that this medal was instituted in 1862 as a memorial of the Prince Consort, for 18 years the President of the Society, and is bestowed annually for distinguished merit in promoting arts, manufactures, or commerce. It was first awarded in the year 1864 to Sir Rowland Hill; and among the men of science who have since received it have been Faraday, Whitworth, Liebig, Bessemer, Siemens, Armstrong, Thompson, Joule, Hofmann, and Helmholtz.

A Murdoch Centenary Cot in the Children's Hospital, Leicester.—In conjunction with a movement set on foot by the Mayor of Leicester (Mr. T. Wright) for the support of cots in the Children's Hospital in that town, the employees in the Corporation Gas Department have decided to maintain one. In a communication addressed by the Engineer and Manager (Mr. A. Colson M.Inst.C.E.) to his Worship announcing this determination, he said he should like, the present being the centenary of the discovery and introduction of gas lighting, the cot to be designated the "Murdoch Centenary Cot." This suggestion has been acquiesced in. The cot will cost about £25 per annum, which will be covered by a subscription of about a penny a month from each employee; and the idea was taken up most enthusiastically by the entire staff of the Gas Department.

Iron and Steel Institute.—The annual meeting of this Institute was held on Thursday and Friday last week, at the Institution of Civil Engineers, under the presidency of Sir F. Abel, F.R.S. In the course of his address, the President alluded to the loss the Institute had lately sustained in the death of the Duke of Devonshire, whose Inaugural Address delivered in 1869 he took as the text of his own. He proceeded to indicate the rapid advances which have been made in the knowledge at the disposal of iron and steel makers; pointing out, in particular, the great service afforded to metallurgy by the investigations pursued by Sir Lowthian Bell in various directions. In conclusion, he showed how strikingly the late Duke's address illustrated the progress which has been made in the expansion of the steel industry since its delivery. The examples of the marvellous development in the applications of iron to which the Duke referred, constituted in the present day the directions in which the steel manufacturer had accomplished his most prominent achievements, and in which the use of iron was becoming a memory of the past. Several papers were presented; one on "Platinum Pyrometers," by Mr. H. L. Callendar, M.A., and another by Mr. B. H. Thwaite, of Liverpool, on "Fuel and its Efficiency in Metallurgic Operations."

WATER AND SANITARY AFFAIRS.

OUR suggestion of last week, that the most proper amendment for the London Water Bill would be the extinction of all the clauses, was nearly receiving a practical fulfilment on the day when our remarks appeared. The Select Committee on the Bill held their second sitting on that day, and having received further evidence from the promoters, proceeded at once to declare, through their Chairman (Sir Joseph Pease), that they could not at the present time sanction a new Water Authority for London, such as was involved in the constitution of the proposed Joint Committee of the County Council and the Corporation. Of course, the effect of this decision was to shut the Corporation entirely out of the Bill; and, as joint promoters with the County Council, it became necessary for the two authorities to confer as to the course they should adopt. The Corporation had clearly nothing to gain by going on with the Bill; but the County Council had something left—the Committee being of opinion that it might be desirable to give the Council, apart from any other body, the powers asked for to carry on negotiations with the Water Companies and to promote Bills in Parliament. The County Council and the Corporation having taken the decision of the Select Committee into consideration, it was resolved to go on with the Bill, or so much of it as remained. The Committee then proceeded to adopt amendments, enabling the Council to expend £10,000 on inquiries into the water supply, and in the conduct of negotiations with the Water Companies. Power was also given to promote Bills in Parliament. In this form the Committee passed the Bill; and the County Council profess to be hugely pleased with the result, while expressing their condolence with the Corporation at the entire exclusion of that body from any voice or representation in the matter. Should the Bill by any chance fail to get through Parliament, the Corporation will at least have the satisfaction of paying for the cost of its promotion. As the case stands, the County Council have failed in their grand endeavour to become practically a Water Authority under cover of the proposed Statutory Committee. Very much has either been left out of the Bill or struck out of it; and although power to promote Bills dealing with the water supply opens up a prospect for the Council, the actual result will be regulated by circumstances not yet developed. A singular step was taken by the Select Committee, in giving the County Council power to expend £10,000 in inquiries and negotiations, whereas the Council only asked for £5000. This is so much of the ratepayers' money to be expended in fighting the Water Companies; the plea urged by the Council when asking for the £5000 being that the money was wanted in order to put their case properly before the Royal Commissioners, and also to ascertain the legal power and position of the Water Companies. The sinews of war are thus to be provided; and the County Council will not fail to spend up to the maximum. The aspect of the Bill as it affects the Corporation is one which can hardly be acceptable to that body. In future, the County Council will have no need to seek the aid of the Corporation in going before Parliament on the water question; the younger body having abundant resources of its own. The scheme of a Joint Committee is not likely to be revived; and yet we do not know that the Corporation need regret the privation. The semblance of power without the reality is little else than a snare; and this would have been the fate of the Corporation with a representation of one-eighth on a Water Committee owing no allegiance but to the County Council.

The Gas-Testing Arrangements in the City of London.—At the meeting of the Court of Common Council of the City of London last Thursday, it was decided, on the recommendation of the County Purposes Committee, that apparatus to the amount of £300 should be purchased for the gas-testing stations in the City, over which Professor Vivian B. Lewes, F.I.C., F.C.S., as the Corporation Gas Examiner, has sole supervision.

Return of Mr. W. Carr to England.—We learn that Mr. William Carr, who has been for some time in Johannesburg superintending the erection of the works (designed by Mr. T. Newbigging) for the supply of gas there, left the Cape on the 18th inst. on his way to England. He will therefore probably arrive in time to exchange greetings with his numerous friends on the occasion of the forthcoming meeting of The Gas Institute.

THE INCORPORATED INSTITUTION OF GAS ENGINEERS.

PROCEEDINGS AT THE GENERAL MEETING,

HELD AT THE

INSTITUTION OF CIVIL ENGINEERS, MAY 11 & 12, 1892.

Mr. CHARLES HUNT, M.Inst.C.E., President.

DISCUSSIONS ON THE PAPERS.

We complete to-day the report (commenced last week) of the discussions on the papers read at the meeting.

MESSRS. PADDON AND GOULDEN'S PAPER ON THE TECHNOLOGY OF WATER GAS.

The PRESIDENT said the paper they had heard was a most interesting and complete one on the technology of water gas. No doubt Mr. Goulden would be glad to answer any inquiries or give any further information in his power. He (the President) would like to ask him if he could say what was the cost of producing water gas.

Mr. W. FOULIS (Glasgow) said according to the paper it required from 60 to 80 gallons of water per 1000 cubic feet of gas made for spraying and cooling the hydraulic main. This seemed to him to be a very large quantity.

Mr. GOULDEN said they were now making 26-candle gas at Beckton, and the cost of manufacturing it—viz., materials and labour—was about 1s. 10½d. No capital or administrative charges were included; but this cost would be reduced shortly, and might be taken as a maximum. In reply to a question by Mr. Denny Lane, he added that different classes of oil were used.

Mr. A. G. GLASGOW said he hardly felt that he had anything to add to the paper, to which he had listened with very great pleasure; but there was one point whereon he might make a few remarks—viz., that with reference to which Mr. A. C. Humphreys was quoted, and as to which he could speak authoritatively. He was speaking to Mr. Humphreys less than a fortnight previously; and he might say that, while he was quoted correctly, the paper referred to was written three years ago, and in the last eighteen months there had been a very great advance in the efficiency of water-gas manufacture in America. If Mr. Humphreys were making the statement now, instead of giving 5 gallons of Lima crude oil per 1000 cubic feet, he would probably feel safer in putting it at 4½ gallons. Then it must be remembered that these were American gallons, which when reduced to English would come out to about 3¾ gallons per 1000 cubic feet, for making 26-candle gas. The paragraph in which it was stated that the object in blowing up was to raise all three vessels to the desired temperature simultaneously, and in the shortest possible time, was of the utmost importance. If this paragraph had not contained the last sentence, it would have omitted one of the chief points in the process. It was not so necessary to raise the energy of the generator fuel to its maximum in a short time, as it was to get a certain degree of richness of generator gas, all the energy due to burning which in the carburetter and superheater with no access of air (thus being burned under most efficient conditions) would raise the three vessels to the proper degree of temperature simultaneously. This was the important feature. When it was blown up as quickly as possible, one was apt to get the most economical conditions—viz., that there should be no carbonic oxide escaping from the superheater, and no access of air, but that all the lost energy of the blast should be simply the sensible heat of the final products of combustion, nitrogen and carbonic acid. Mr. Goulden pictured renewing the chequer work every six months. He (Mr. Glasgow) did not find it necessary to actually renew the brickwork; they simply removed it, brushed off the accumulated ash which made it inefficient as a storer of the secondary heat of combustion, and put the bricks back again. As a rule, unless the oil were introduced very carefully—viz., in the form of vapour—during the pre-heating of the small amount of liquid oil that was being sprayed in, the bricks in the top of the carburetter would be disintegrated at the end of six months, and probably one-fourth of them would have to be renewed. He found that, by replacing them by bricks which had been during six months used in

the superheater, they would last very much longer; new bricks being put into the superheaters, where they seemed carbonated to a certain extent, so as to resist the disintegrating action better than new bricks would. He had listened with much interest to the description of the difficulties of utilizing the tar. They had had a great deal of trouble with this in America, although they did not find anything like so high a percentage of water as was mentioned. There was a large quantity—sometimes 40 per cent.; and existing as it did as an emulsion, made it difficult to distil. A great many managers of gas-works did not trouble about that, on account of the high demand there had been for tar, due to the extensive introduction of water gas; so that the tar distillers were glad to get hold of the tar, and did not scrutinize it very much. They sold the tar, and whatever else was in it, and made the best of it. In fact, he had been astonished at the price some of them obtained for this tar, with its 40 per cent. of water. Where the tar was treated locally in the gas-works, it had been found advantageous, instead of introducing water into the hydraulic main and scrubber, to make the seal entirely with tar. In this way, they kept the water out of contact with the gas until all the tar had been deposited; in fact, it was not brought into contact with water at all. There being no ammonia, it was not necessary. The tar was kept circulating—entering at the top of the scrubber, passing through the seal, and out again into a sufficiently large tank to enable it to cool before it came back again. The next question was to what extent the contact of the gas with the tar would reduce its illuminating power; but the best information yet obtained led to the belief that it was not so injurious to the gas as scrubbing it with water. Probably something depended upon the temperature of the tar. Considering a water-gas apparatus as a heat-engine, and looking at the oil handled as so much iron turned on a lathe, the whole energy required for the production of gas was furnished by the generator fuel. Now the energy of the fuel was distributed and applied entirely by the energy of the blast; so that of all the problems that entered into the manufacture of water gas from that point of view, regarded as a heat-engine burning so much coal, it was of the highest importance to get the apparatus in the first place designed so that it would permit of blast conditions most economical to the manufacture of gas. Having had this done, it was equally important that those conditions should be maintained in practice. Roughly speaking, it depended to a great extent on the relative size of the carburetter and superheater; because in them was stored up the heat applied to the oil. The other question of importance was the proportion between the diameter and the height of the fuel-bed in the generator, which varied very materially with the fuel used and the pressure of the blast in the generator; this difference being the difference in pressure on the top of the fuel-bed and below it. It might be interesting to know that, of all the gas made in the United States and Canada during the past year, upwards of 60 per cent. was carburetted water gas, including not only the independent water-gas plants where it was made exclusively, but also plants auxiliary to ordinary gas-works. On taking a recent trip to the Pacific Coast, he found that the water gas made in San Francisco was produced exclusively from oil, at 3½d. per gallon, and from Welsh anthracite coal. The Pacific Coast being so remote from their own anthracite regions, it made it economical to procure from Wales coal costing \$9, or 36s. per ton. The reason water gas was adopted in a place like that was because coal gas could not compete with electric lighting, which was there making a tremendous advance.

Mr. C. E. BOTLEY (Hastings) said that Mr. Goulden had given the cost at 1s. 10½d.; while in the abstract he gave the number of gallons of oil used as nearly 5½. He should like to know the price of the oil, because it seemed to him to leave a very small margin for labour and fuel. In the experimental tests, he presumed that the oils were cracked up in water-gas plant.

Mr. F. LIVESEY said he had hoped Mr. Springer, who had been putting up an apparatus at the South Metropolitan Gas-Works, would have been present, as he would have been able to discuss the paper much better than he (Mr. Livesey) could. With reference to the labour required, it was no doubt exceedingly small. The principal item was the oil. He should like to ask Mr. Goulden if he had tried crude oil, because every halfpenny a gallon reduction

in the price of the oil would make a considerable difference in the cost of the gas. He should also like to know if it was necessary to use such a large quantity of water in the hydraulic seal and scrubber. It seemed to be the best way in which to mix up as much water as possible with the tar; in fact, the tar was nearly all water. Mr. Glasgow had referred to working without any water; and he should be glad to know if this could be done. The water was used principally for cooling; so that, if a proper condenser were used, this large quantity of water would not be required. There was nothing but a carbonaceous smell in it; and it was of no value. The gas as it was now being made left the scrubber at a temperature of 150° Fahr.; and there being no condenser beyond the scrubber, it went into the equalizing gasholder at 140° Fahr. It was then pumped out and forced through the purifier into the working gasholders.

Mr. FOULIS asked if it was measured at that temperature.

Mr. LIVESEY said it was not. The quantity was calculated at 60° Fahr. Mr. Springer at first had some doubts about using ordinary gas coke; but he had not found any difficulty there, and was as satisfied with it as with anthracite coal. He also had a plan which he had published for alternating the steam blast; sending it upwards through the fuel for two or three blasts, and then inverting it, and blowing downwards—thus preventing the accumulation of clinker.

Mr. LACEY (Pimlico) said he noticed in the paper that the quantity of steam admitted must be most carefully adjusted; an insufficiency limiting the volume of gas made, and an excess causing the production of a large percentage of carbonic acid. No doubt this was a very important point. He should like to know if the quantity of water vapour in the gas from the producer had been estimated, because it was quite possible there might be an excess of steam under the most favourable conditions; and it was very desirable to know whether or not there was any excess, and what it was. It was evident that it was of the first importance that the producer should be so worked as to give a small amount of carbonic acid in the gas. That being so, unless the quantity of oil were adjusted to suit the heat given off when blowing up for the production of the water gas, how would it be possible to economically use the whole of the heat up to the point where it was coming from the superheater? Of course, he was taking into consideration the temperature at which it must be maintained. Loss did not necessarily follow, though carbonic oxide was going out of the superheater; and if one had heat enough to do the work, he could not do more.

Mr. PADDON (Beckton) said there was very little left for him to say, especially as Mr. Glasgow had satisfied him on so many points on which he had been in a condition of doubt. He did not think any subject of leading importance had been left untouched in the discussion; but he could not quite follow Mr. Lacey's remarks. He seemed to anticipate the presence of aqueous vapour in the finished gas.

Mr. LACEY: No; in the water gas. There might be an excess of steam under all conditions.

Mr. PADDON said the only deleterious effect of an excess of steam, if the fire were in anything like a state of efficiency, would be the proportional presence of carbonic acid; and of course, this was always objectionable. If the paper emphasized the importance of keeping this at the lowest possible figure, which could only be done by close attention to the condition of the fire, it would serve a most useful purpose. A remark had been made that gas coke was as good as anthracite coal. He had had no experience of working the latter; but, from the very high percentage of carbon it contained, he could not imagine gas coke, under any circumstances, being so favourable for the purpose of water-gas manufacture, because coke was always varying. The percentage of ash varied; and this was a most important matter. Then there were other constituents. There was always a certain amount of slate; and if the energy of the fire was impaired, as it must be by the presence of any such inert constituents, great difficulty would necessarily be experienced in working without allowing the carbon dioxide to rise to an undesirable percentage. Where anthracite could be obtained, he thought anyone with a long experience of water gas would avail himself of it. They had to put up with gas coke, because they had no other; it was a matter of convenience. But if they could get a better form of carbon as easily and cheaply, they should use it at once. He imagined that the carbon from retorts would

afford perhaps almost the ideal fuel for this purpose. Anyhow, the carbon efficiency of any fuel constituted its greatest claim to consideration.

Mr. DENNY LANE asked if Mr. Goulden had formed any estimate of the price at which non-carburetted water gas could be produced.

Mr. J. METHVEN (Beckton) said the paper was probably written some time ago, at a time when they were at the height of their trouble with the water in the tar. He was happy now to be able to correct this. The tar had accumulated to a large extent on the works; and the mere fact of standing for some time in a large tank had caused a considerable quantity of the water to separate—so much so, that the last lot sent to the tar-works for distillation was considered perfectly satisfactory.

Mr. PADDON said Mr. Glasgow had suggested the circulation of a certain amount of tar or tarry water through the seal. This had been carried into effect at Beckton; and the clean water supply had been almost completely withdrawn from the scrubber and from the seal, and a fixed quantity of soiled water was circulated round and round—thus obviating the use of the very large amount of water which was previously employed. He did not think Mr. Springer could claim priority for his method of alternating the steam and air blast from the top to the bottom of the generator, as he imagined Mr. Humphreys had made that a feature of one of his forms of apparatus.

Mr. GOULDEN said that he had already replied to the question as to the cost. As to the large amount of water mentioned in the paper, as Mr. Methven had stated, it was correct at the time the paper was written. This, however, was some time back; and by the use of the circulating arrangement Mr. Glasgow had suggested, they were able to bring the water figure down to 4 gallons per 1000 cubic feet, and possibly another 2 gallons for additions to the scrubber, which would make a total of about 6 gallons per 1000 cubic feet. The reason they wasted a little producer gas by blowing away from the stack-valve was probably because they were using coke instead of anthracite. They had to blow more air through the coke to get it to the proper state of incandescence for decomposing the steam. It was, perhaps, hardly correct to speak of renewing the bricks in the superheater and carburetter. They renewed some portion of them; but the rest were simply treated as Mr. Glasgow had himself suggested, by brushing off the ash. With regard to the price of the oil, they were paying from 2½d. to 3½d. per gallon, and were now using about 5¼ gallons per 1000 cubic feet. All the oils used had been tested, to find out their maximum value, in a special apparatus, not in the water-gas apparatus at all. They had taken every means to satisfy themselves of the real maximum value of the various oils. They had used crude Russian oil, and were in consequence kept in a constant state of misery for about six months. They had hardly put it in the plant before they found the whole of the brickwork blocked up; and they had to be continually burning and blowing out the apparatus. It was quite impossible to use crude oil—at any rate, if it contained such a percentage of pitch as that they had tried. The difficulty with the water was disposed of by circulation, which would be applicable to the Springer apparatus just the same as to the Lowe. In fact, the Springer was simply a Lowe apparatus; the only difference being that the superheater and carburetter were put on the top of the cupola. Mr. Lacey had made a remark about steam going forward towards the end of the run. There certainly was a little, but only a small percentage, which was hardly material. If the fuel-bed were kept at a proper state of efficiency, and the steam cut off at the point where the fire began to lose its proper degree of heat in the generator, very little steam would go forward. As to the cost of water gas alone, he should think, roughly speaking, it might be reckoned as 5d. to 6d. per 1000 cubic feet.

The PRESIDENT, in closing the discussion, expressed regret that time had not permitted of a longer debate on the very interesting paper before them, for which he would move a cordial vote of thanks to the authors.

This was carried by acclamation.

MR. FRANK LIVESSEY'S PAPER ON THE SIX-LIFT GASHOLDER AND TANK AT EAST GREENWICH.

The PRESIDENT said they had kept till the last a paper which, judged by the standard of the originality of the

work it described, and probably also by the magnitude of interest it would evoke, was the most important one on the list. It was not necessary to enter very fully into a discussion of it then, as the members would have an opportunity of inspecting the work that afternoon; but if anyone wished to ask any questions on the particulars involved, he was sure Mr. Livesey would be most pleased to answer them.

Mr. TREWBY asked if Mr. Livesey could tell them what saving was effected by carrying the two lifts above the standards. No doubt, in designing the holder, this must have entered into his calculation. Of course, there would be a saving in the cost of the standards for the two lifts; but against this must be put the additional strengthening of those lifts.

Mr. DENNY LANE inquired if the figures given included the cost of the tank.

Mr. LIVESSEY replied in the affirmative.

Mr. S. GLOVER (St. Helens) asked if the roof was untrussed; and, if so, how it was intended to support it.

Mr. C. GANDON (Sydenham) said he had always admired the combined system of radial and tangential rollers, which he thought was right, especially for large gasholders; but he did not know how it might work when they were alternated, as he understood was being done with the holder in question—the lifts having alternately radial and tangential rollers. All would watch with great interest the result of the two top lifts rising without any framework. There were instances of holders erected without any guide-framing at all; but they were only small ones. This would be the most interesting instance, on account of its being the largest holder yet built. As to whether the plan would work as satisfactorily as it had done with smaller holders, he would not like to express an opinion; but it seemed to him that greater strength must be needed, not only in the bottom curb, but also in the plating of the holder, to enable it to resist the strains that would occur on the sides.

Mr. FOULIS asked whether the guides were opened out at the top, so as to enable the pulleys to enter freely. It struck him that if the rollers had any chance of missing the guides, the consequences would be very serious.

Mr. LIVESSEY replied that they were tapered off to a certain extent to receive them. There was about 6 inches play to allow the rollers to come into their places.

Mr. GANDON said he understood there was some special arrangement made to prevent any danger from tilting on account of the shallow lifts.

Mr. T. MAY (Richmond) said they were much indebted to Mr. Livesey for the description he had given them; but they would be able to criticize it better after seeing the holder. As Mr. Gandon had remarked, having so large a holder as the one in question with two lifts to go out, was quite a new departure. The only thing which struck him as being open to criticism was the width of the top girder, which was only 22 inches; and as the usual Paddon ties were dispensed with, it seemed to him that it was not sufficient to keep the framing steady. With the holder in the Old Kent Road, before the Paddon ties were put on, the framing used to sway about in the winter; and it seemed to him that this top girder, instead of being only 22 inches, ought to be several feet wide.

Mr. R. MORTON said he was very much interested in the holder, and some of the difficulties mentioned, and the questions asked, had occurred to him. But it went without saying that all these things had been very fully considered, or the holder would not have been in course of erection. Mr. Foulis was a little mistaken in asking if the guides were opened out at the top. He would see that they required rather to be tapered off, because the wheels did not come in between them, but outside. With regard to the guiding of the inner lift, which was the *crux* of the whole question, it was very clearly shown on the drawings before them. He thought the top carriage ought also to have a radial roller, as the main strain would come at that point. They were working, as it were, on two inclined planes on a wedge; and a very great strain would come there, which would be obviated by putting in an additional radial roller. Without that, with the two angular rollers at the top and three at the bottom, he did not see how the holder could possibly rise otherwise than level. This being so, when once it was cupped they had the 62 feet, which would ensure the rest of the holder going perfectly level.

Mr. FOULIS said it had sometimes occurred to him that, in a large structure of this kind, the difference in the

diameter of the holder in winter and summer would be considerable—probably as much as $\frac{3}{4}$ inch. The effect of this would be to alter the guiding of the holder, especially when there were a great number of wheels, as in the present case. He should like to know whether this point had been considered.

Mr. BOTLEY asked if the space behind where the rollers worked in the guide-path was filled up at all; and, if so, how it was reached in order to preserve it.

Mr. W. W. WOODWARD (Bromley) congratulated Mr. Livesey on the ingenuity of his arrangement. He said it seemed to him that the difficulty would have been obviated if he had adopted the Gadd and Mason system on the two lifts; and it would have materially improved the appearance of the holder, by doing away with the two long horns standing out, which he was sure, if they had it in a district like Bromley, would be the subject of a great amount of criticism.

Mr. LIVESEY, in replying upon the discussion, said, in answer to Mr. Trewby, that he could not at the moment give the figures he asked for; but he would add them to the paper for the Transactions. The only difference was that, by allowing the two lifts to go out of the framing, additional stiffeners were required in the inner and second lifts; and the saving would be the top lengths of framing dispensed with, and also the erection, which was a considerable part of the cost. The holder was not trussed; in fact, it would be a difficult matter to truss a holder of this kind. It was a defect in the paper that no description had been given of the internal framing; but it could be seen, and any omission could be supplied by inspection that afternoon. With reference to tilting, a scheme had been thought out; but nothing had been done, as it was believed that the present arrangement of rollers would be sufficient. In reply to Mr. May, he might say the top girder was a very strong member of the structure. The large angle gusset-piece connecting the two girders from one side to the other of the standard, really made it exceptionally stiff. As to the difference in winter and summer, if the holder decreased in diameter in winter, the framing would do the same. It was a fact that, in the first holder put up with flat diagonal bars, if they were riveted up at six o'clock on a spring morning, when the temperature might be 35° Fahr., at midday, with the temperature at perhaps 70° , they were certainly rather slack. If the frame expanded, the standards must tilt over a little. The difficulty was, however, more imaginary than real. With reference to the Gadd and Mason principle, it might answer very well if the holder did not rise far above the houses; but those who had been on the top of a holder when there was only a light wind blowing below, and found it was almost a gale above, would agree with him that, if they were to allow the whole of this part of the holder to go up without framing, the bottom lift would have to be made so excessively strong that as much would be lost by this as would be gained by doing away with the framing. In reply to Mr. Botley's question, the back of the roller path was filled up with concrete. He could only say, in conclusion, that, on seeing the holder, the members would be able to form better opinions of its merits than they could by a description of it.

The PRESIDENT said they would be able to resume the discussion in the afternoon; and therefore all he could now do was to propose a vote of thanks to Mr. Livesey for his description of the holder. As Mr. Morton had remarked, the *crux* of the whole thing was in the guiding of the inner lift; and they would all watch with intense interest the results of this most important experiment. If it proved as successful as he had little doubt it would do, there was scarcely a limit to the extent to which one might go in the capacity of gasholders. If six shallow lifts answered, six deep lifts ought to be made to do the same; and there would be no reason why the next gasholder should not be double the capacity of the one they would shortly inspect at East Greenwich.

The remaining business at the meeting has been already reported (*ante*, p. 896).

Queen's Birthday Honours.—Among the honours conferred by Her Majesty on the anniversary of her birthday, we notice that Lord Balfour of Burleigh (Chairman of the Metropolitan Water Commission) is to be a member of the Privy Council; and that Mr. Courtenay Boyle, Assistant-Secretary to the Board of Trade, who was associated with his Lordship in the important inquiry on railway rates, is to be a K.C.B.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1028.)

TAKING everything into consideration, the markets have made very fair progress during the past week. Speculative business continues rather shy; but purchases for investment are still largely in order. As a result, prices of pretty well everything worth buying, have risen to a moderate extent. A slight check was experienced when it was found that the settlement would involve one or two operators in difficulties; but the influence hardly extended outside the special market affected. The Money Market continues in the same overloaded condition; there being scarcely any employment for the superabundance. The Gas Market has shown only moderate activity; and movements are somewhat irregular. The chief feature is the continued improvement in the value of high-class secured issues for investment purposes; while the ordinary stocks, on the other hand, are decidedly easier. In Gaslights, the "A" has receded three points; transactions falling gradually away from 212 on Monday to 207½ on Saturday. The debenture, preference, and limited issues were brisk and in good demand at improving prices; the "C," "D," and "E" advancing 1; the "H," 1½; and the 4 per cent. debenture and "B," ½ each. South Metropolitan were weaker; but business was limited. The "A" receded 5; and the "B," 2. Small business was done in Commercial at rather better than average figures. Among the Suburban and Provincial undertakings, hardly anything was dealt in except Brentford, the old shares of which have risen 2 more. Bromley also improved ½. The Continental companies remained quiet; and the tendency is still towards easier prices. The only fall marked was a loss of 2 in Imperial Continental. The rest exhibit little change. Buenos Ayres regained the ½ it lost the week before; and Chicago first mortgage bonds improved 2. In the Water undertakings, a few transactions were marked daily; but, on the whole, they were quiet. Changes are few and slight; but all are in the upward direction, except West Middlesex. Grand Junction are going to pay a dividend of 8½ per cent. Twelve months ago they dropped from 9 to 8 per cent.; so they now recover half the lost ground.

The daily operations were: The market was rather quiet on Monday; and the tendency was somewhat downward. Imperial Continental and South Metropolitan "A" and "B" receded 1 each; but Gaslight "B" rose ½. Southwark Water rose 1. On Tuesday, the principal issues were still flat; Gaslight "A" and Imperial Continental losing 1 each. Chicago First Bonds rose 2; and Buenos Ayres, ½. Gas was extremely quiet on Wednesday. Movements were irregular. Gaslight "A" fell 2; but ditto "C," "D," and "E" rose 1; ditto "H," 1½; and Brentford old, 2. West Middlesex Water fell 1. Thursday was more active, and changes were few. South Metropolitan "B" fell 1; but Gaslight 4 per cent. debentures rose ½. In Water, Kent rose 2½; Southwark, 2; and East London, 1. On Friday, the only feature was a fall of 2 in South Metropolitan "A." Saturday was as quiet as usual, and changes were few; the only moves being an advance of ½ in Bromley, and a fall of 2 in South Metropolitan "A."

ELECTRIC LIGHTING MEMORANDA.

Another Metropolitan Electric Lighting Company—The Disadvantages of Ship Electric Lighting—The Difficulties of Electrical Traction—Electric Lighting and the Fire at "Scott's."

ANOTHER Metropolitan electric lighting venture was put upon the market last week; the name being "The Electricity Supply Corporation, Limited," which is about as indeterminate a title as could well have been selected. There really ought to be some rule in this matter of the nomenclature of electric lighting speculations, unless confusion is to reign in the technical and financial worlds respecting the question of identity. After a while there will be sore grief over the difficulty of distinguishing by their names between companies solvent and the opposite, and between concerns fresh from the promoters' hands and others safe in the hands of the Receiver. Now this name of the Electricity Supply Corporation has a familiar sound; it also shows a lordly scorn of local restriction. Yet the venture is a fresh one, and its sponsors have no wider horizon than the boundaries of the parish of St. Martin-in-the-Fields. Nay, it is as yet far from occupying all this area, being merely an amplification of an installation originally put down for their own purposes by Messrs. A. and S. Gatti, the well-known *restaurateurs* of the Adelphi. The district may be a good one for the extension of the electric light; and the Company may do as well as others of the same order (which is not saying very much); but £170,000 in shares and debentures is a good deal for Messrs. Gatti's little enterprise, even with its new and comprehensive name.

The extended use of electric lighting on board ship is one of the most certain gains of this system of lighting. One has grown quite accustomed to say, as though the matter were beyond argument, that the electric light is a conspicuous success for passenger and war steamers. But from some of the remarks of Lieut. F. T. Hamilton, R.N., in the course of a

lecture recently delivered by this officer at the Royal United Service Institution, upon the present condition of electricity in the navy, it appears that the very free employment of electric light on board Her Majesty's ships is not unattended with some drawbacks. It must be admitted that electric lighting is very popular on board ship, as it may well be when its only rival is the dingy and smelly oil-lamp; but the officers whose duty it is to watch over the development of ships as a whole are becoming uneasy with regard to the great quantity of machinery required for so much electric lighting as is now deemed almost indispensable for modern craft. It has already come to this, that a vessel of the *Latona* class requires about 5 tons of coal per week to keep her electric lamps going. This not only costs a great deal of money, especially when the ship is on a foreign station, where coal is dear, but there are other considerations upon the same head; one of them being the striking fact that the space occupied by a week's coal supply for the electric lighting would hold candles enough to last the ship for six months. Again, while the incandescent lamps are very nice in the ship, it is by no means agreed by all naval authorities that the showy "search-lights" are likely to be of much real use in war time. On the whole, therefore, it must be admitted that electric lighting is not an unmixed good, even in the place which it seems to suit best.

There appears to be little present prospect of the electrical engineers entering upon that wide inheritance of railway and tramway traction which they confess would pay them so much better than anything they can hope to do by lighting. They talk about electrical traction and the transmission of power by electricity as among the certainties of the future. But it is always "the future;" and the promised triumph continually keeps moving a little farther off, like the foot of a rainbow as we approach its apparent resting-place. The fact that electrical tramways do run in the United States, and in a few localities in this country, does not appear to advance the general solution of the problem. Our English cases of electric traction are essentially sporadic, and nobody seems to think of it when new lines of tramway are being laid down under ordinary conditions, where electricity would have to take its chance among other equally available systems of car propulsion. One of the main difficulties, besides the initial one of a suitable disposition for the current conductor, is the enormous disproportion between the effective power (say) of horses, and of the electrical mechanism necessary to do the same work. Our contemporary the *Electrician* puts the question thus: "Why do you want two 15-horse power motors to do the work of two horses?" but without eliciting a satisfactory reply. The incomprehensible genius of Electricity must be feminine; for to all such inquiries she only answers, "Because you do!" which is conclusive, but not convincing. It is a fact that, in order to start a tramcar, which a couple of horses can do with a little effort, 20 or 30 electrical horse power must be available. And when the same proportion is maintained in the case of a train of railway carriages, it is easy to see why electrical traction fails to take the place of the steam locomotive.

There was a fatal fire the other day at a well-known supper-house in the Bohemian quarter of London; and in the course of the inquest it was suggested that an investigation of the electric lighting arrangements of the premises might explain the mystery of the origin of a fire which was otherwise unaccountable. Accordingly, the inquiry was adjourned for this purpose. But when the expert appointed to the task came to present his report, it transpired that there was not sufficient evidence for the conclusion that the electric light wiring caused the outbreak. It is not wonderful that the ruins of a house which has been gutted with fire should fail to furnish evidence of the existence at some anterior period of a "short circuit;" for fire has a way of wiping out all but its own record, and escaping electricity, unlike petroleum, leaves no odour behind. The Middlesex Coroner, however, was not at all satisfied with regard to the innocence of the electric lighting arrangements in this particular house; and he dropped expressions on the subject serious enough to engage the attention of householders and insurance offices. We are not going to strain the evidence further than the Coroner and his jury felt themselves in duty bound to act upon it; but the incident is deserving of notice as one more example of the groundlessness of the claims occasionally put forward by electricians for the perfect harmlessness of their system of lighting.

The Russian Petroleum Wells.—The total amount of crude petroleum oil obtained at Baku during the past year was 4,670,000 tons, of which 4,086,000 tons were piped to the refineries. The quantity of refined oil produced was 1,176,000 tons; and the proportion of this amount exported from Russia was 607,000 tons. At the end of 1891 the number of producing wells was 315; being an increase of 77 on the number at the end of 1890. The increase in the production of the crude oil was about 20,000 barrels per diem. During 1890, prices rose as high as 2s. per barrel; and the average for the year was about 1s. 3d. Last year the highest price was about 1s., and the lowest 2½d., which was much under cost. The producers did not, therefore, benefit by the increased output; and a few small failures were the result. The shipments so far this year give promise of a further increase in export.

PHOTOMETRIE A LA FRANCAISE.

At this time, when so much is being said and done about photometry, it is particularly desirable that those who are interested in the subject should keep abreast of the contemporary developments of the science and practice of light measurement; and for this reason we have to draw our readers' attention to the publication of Dr. Palaz's work,* which is practically a collection of the author's articles that have appeared since 1887 in *La Lumière Electrique*. Thus, while it must be borne in mind that the motive of these writings was the need felt by French electricians for instruction in a branch of applied optical science, with which they had no concern before they began to undertake practical lighting, the matter which Dr. Palaz has brought together, may perhaps be profitably studied by a wider circle. We therefore propose to give a general description of this work, of which our electrical contemporaries have spoken favourably, in order that our gas engineering readers may form their own opinions respecting the extent to which the Lausanne Professor has added to the general stock of information relating to the measurement of lights and lighting.

The book begins with the inevitable theoretical chapter, which is neither better nor worse than others in earlier text-books. We notice that the author ascribes the derivation of the "law of the cosinus" to Lambert, in 1760. For the rest, this chapter, although comprehensive, is anything but easy reading. Dr. Palaz remarks, after Masson, that "the eye is incapable of appreciating more closely than 0.01 the equality of lighting upon two contiguous surfaces, even when the tint of the two lights is the same." This is the limitation of the exactitude of photometric measurements. The author repeats many interesting spectroscopic observations upon the effects of different lights. The second chapter deals with photometers, which are divided into four classes, according to the principle governing their design. Dr. Palaz ascribes the common Rumford photometer to Lambert; as he does what is more generally recognized as the Keplerian law already mentioned. He states that it is not a very exact apparatus; but for rapid determinations of illuminating power to within 10 or 15 per cent., the shadow photometer may be regarded as "very precious," on account of its extreme simplicity. Bouguer's photometer is described as the oldest. The modern Foucault instrument is only a simple modification of it. These photometers are made by the Continental Meter Company, of Paris. They have the inconvenience of requiring the two lights to be on the same side of the screen; but by the use of mirrors, Ritchie has altered this. It was with a modified Foucault photometer that M. Violle carried out his experiments to discover the absolute standard unit of light, which was so enthusiastically adopted, and so unanimously neglected. Dr. Palaz next describes what he calls "relief" photometers; and he then deals with the Bunsen form of the apparatus, which he admits to be the most generally used in industrial testing—especially, he says, in Germany. Of the fact that there are probably ten photometers upon the Bunsen, or grease-spot principle in use in the United Kingdom to one in Germany, Dr. Palaz is apparently profoundly ignorant. He probably does not read English technical publications to any extent, or we should have seen some recognition of the supreme design and workmanship of English photometer manufacturers, which is recognized all the world over—excepting, apparently, in Lausanne. He knows something of what pure experimenters like Sabine, or Ayrton and Perry, have suggested; but if asked how and by what means photometrical work is really done in the United Kingdom and the Colonies, or even the United States, our author would be found wanting. At the same time, he is a mine of information respecting out-of-the-way photometrical notions; and he can tell us all we want to know, and more, about Weber, and Töepling, and Arnoux, and half a hundred more of the same brand. He describes and illustrates several remarkable instruments, designed for photometers, which we confess to never having heard of—such as the Lion photometric balance, the registering photometer of Dessendier, and so forth. These, of course, are mere curiosities; and in noting their existence, Dr. Palaz is careful to point out the theoretical character of most of them. We know of no such book for curious lore of this kind.

It is a striking illustration of the author's want of grasp of the practical side of his subject, that, in introducing his chapter upon photometrical standards, he merely says that Bouguer used the candle as a standard; and he immediately passes on to mention other standards without saying anything about the extent to which the candle is actually employed for this purpose. Like that of so many French *savants*, the knowledge of Dr. Palaz, though profound, is restricted in range. He seems to know what he does know so thoroughly, that one regrets he does not know more. Yet with all his limitations, this author has much that is instructive to say about candles and lamps, and he draws the sweeping conclusion that "there is not in general, for any combustible whatever, a definite relation between the material burnt and the light produced." For his information respecting candles, Dr. Palaz relies principally upon Herr Kruss.

* "Traité de Photométrie Industrielle," par A. Palaz, Docteur-ès-Sciences. Paris: G. Carré, 58, Rue Saint André des Arts; 1892.

He also mentions Heisch and Hartley, Dibdin and Williamson; but he is not very familiar with the work of the English photometrists. We do not complain of this; for we should not recommend anyone to go to a French author for instruction concerning the doings of M. "Methwen," as Dr. Palaz calls the well-known gas engineer and photometrist. What we should look to a foreign writer for is information respecting foreign work; and this our author supplies in abundance. Among other things, he describes in great detail, and essays to defend, the Violle unit; but he does not say he has ever used it.

Altogether, the book of Dr. Palaz should certainly be found in the library of every British photometrist who aims at a general knowledge of his art, and does not restrict his studies to the "Instructions" of the Metropolitan Gas Referees. It would not have hurt Dr. Palaz, by the way, if he had known something about these intensely practical and matter-of-fact directions to photometrists. The book concludes with a scholarly chapter upon "Lighting."

NOTES.

The Calorimetry of Fuel Gas.

Dr. E. G. Love has contributed to the *School of Mines Quarterly* (of America) an article upon the valuation of fuel gas, in the course of which he states the case for and against the separate distribution of non-luminous combustible gas intended solely for fuel purposes. He admits that the results of the efforts that have been made in this direction up to the present time are not encouraging. The gas has generally been odourless; and although sold at a low price, its calorific value has been low in comparison with that of illuminating gas. Dr. Love remarks that its cost is the only drawback to the use of illuminating gas for fuel. Tests made with the carburetted water gas supplied by the Consolidated Gas Company of New York, have demonstrated that this product possesses an average calorific power of 721 heat units per cubic foot. Similar tests of mixtures of coal and water gas made by other branches of the same Company, give an average value of 694.7 heat units per cubic foot. Dr. Love takes the calorific power of the common coal gas of London at 668 units per cubic foot; and states the price at about one-half that of gas in New York. A large number of fuel gases tested by Dr. Love gave a calorific power of from 184 to 470 units per cubic foot, or an average of 309 units. All Dr. Love's calorimetric experiments are made with Hartley's apparatus—of which he speaks very highly, as a simple, convenient, and sufficiently accurate appliance for the purpose. He explains the apparatus and describes its use, giving as an example a specimen test of the gas supplied by the Municipal Branch of the Consolidated Gas Company, which is shown to possess a calorific value of 725 heat units at 60° Fahr. and 30 in. barometrical pressure.

The Silent Combination of Oxygen and Hydrogen.

Some interesting experiments with regard to the silent combination of oxygen and hydrogen have been conducted by Prof. Victor Mayer and Herr Askenasy, who have published their results in *Liebig's Annalen*. The object of the experiments was to ascertain whether there is any connection between the time element in this phenomenon and the quantity of water produced; and the main result of the tests has been to answer the question in the negative. Some important observations were, however, made during the course of these experiments. It was found that, when a quantity of the pure dry mixture of two volumes of hydrogen and one volume of oxygen was sealed up in a glass bulb and heated in a bath of the vapour of phosphorus pentasulphide, the temperature of which (518°) is such as to render the bulb slightly luminous, no explosion occurred, but a small proportion of the gases silently combined, with production of water. Upon immersing the bulb in a bath of boiling stannous chloride, which has a temperature of 606°, explosive combination instantly occurred. It was surmised therefore that the temperature at which the explosion takes place lies somewhere between 518° and 606°. But upon modifying the experiment in such a manner as to allow a slow stream of the gaseous mixture to pass continuously through the open bulb, it was found that no explosion ensued under these conditions at the temperature of boiling stannous chloride; although at this temperature the bulb glows with a cherry-red heat and the glass is quite soft. It is thought therefore that the extra pressure of the gases in the closed vessel determines the explosion. The irregularity of the rate at which the silent combination proceeds would appear to be due to differences of the condition of the inner surfaces of the vessels containing the gaseous mixture. When the bulbs are silvered inside, the silent formation of water occurs at temperatures several hundred degrees lower than in unsilvered glass bulbs. Finally, it was found that bright July sunshine is incapable of inducing the combination of hydrogen and oxygen, even when it is concentrated upon a bulb traversed by the gaseous mixture and heated to 606° in a bath of boiling stannous chloride.

Certain Peculiarities of the Electric Arc.

Some instructive observations upon the light of the electric arc were made by Mr. A. P. Trotter, before the recent meeting of the Institution of Electrical Engineers. It was stated,

among other things, that, assuming the light to be due to the luminous crater formed in the carbon, the brilliancy of this is as much as 75,000 candles per square inch. The light developed at the St. Catherine's Point lighthouse has been called 6,000,000 or 7,000,000 candles; but to give this, would require an area of luminous crater of about 1 square foot, whereas in point of fact the mean area of the crater is 0.2087 square inch, as determined by Mr. Trotter in a series of twelve projections taken at half-minute intervals. He takes the candle power at about 16,000. The difficulty is in getting the light out of the carbon arc; for unless the points of the carbons are close together the arc is very irregular, and yet this close approximation shuts up a great deal of the light actually produced. If the lower carbon could be dispensed with, and its shadow thereby eliminated, "there would be an overpowering illumination, which would make street lighting much more irregular than at present, unless very high posts were used." Mr. Trotter says that "the nominal 2000-candle power, which 10 ampere arc lamps are sometimes supposed to give, is a perfectly unjustifiable convention; and has been very properly characterized as a 'fine old crusted lie.'" He remarks that, since the ordinary opal globe surrounding an arc lamp does not appear to differ greatly from a uniformly luminous sphere, the candle power at different angles should be very much more uniform than it is with the naked arc; but this is not the case. Mr. Trotter mentions with approval the suggestion of M. Crova, that the portion of the spectrum lying near line 582 gives a true measure of the total candle power; since for a considerable range of temperature, the ratio between the different intensities of this part of the spectrum is practically identical with the ratio of the candle power of two lights.

Grand Junction Water Company.—Subject to audit, the Directors of this Company have decided to recommend a dividend at the rate of 8½ per cent. per annum on the ordinary share capital.

Silver Plating for Gas-Fittings.—The great drawback to the silver plating of goods to be exposed to an atmosphere containing even a slight trace of sulphur is the difficulty of keeping them bright. The sulphur combines with the silver, and forms a sulphide of silver, which has to be removed by means of polishing powder before the silver is restored to its natural brightness; and this cleaning causes the rapid wearing away of the silver plate. The London Metallurgical Company, Limited, of 80 and 81, Turnbull Street, E.C., have introduced a new system which they call "Arcas" silver plating. "Arcas," we learn, is silver alloyed so as to harden it; and this prevents it tarnishing so severely. It is claimed for it that it has every appearance of silver, is cheaper, and no powder is required to clean it; it is capable of being deposited to any required thickness in an adhesive form, and is impervious to moisture; it is far more elastic than nickel, and 25 per cent. harder than silver; and it is suitable for iron, steel, German silver, brass, and Britannia metal. Specimens which we have seen of work done by the process certainly look very beautiful, and appear to be durable; so there should be a good field for it in the coating of such articles as gas-brackets, chandeliers, lamps and reflectors, water and electrical fittings, and the metallic parts of meters.

Making Water-Tight Work Below Water-Level.—A correspondent of the *Engineering Record* dealt with the above subject in a recent communication; the work in question being the construction of some brick reservoirs. The ground was sandy, and the flow of water was very strong; causing much trouble in making the work water-tight. The bottom of one reservoir consisted of an inverted arch built on concrete, and the water forced its way through the concrete before it could be set. On laying the courses of bricks, there was the same trouble; the water breaking through the joints before the cement mortar could set. To overcome this, a thin layer of mortar was spread over the concrete, on which a layer of tarred roofing paper was placed. The first layer of bricks of the inverted arch was laid on this paper; beginning in the centre, and working both ways. When the sides of the reservoir were reached, the tarred paper was turned up, and afterwards built into the wall, until it was carried above the water-line. The bottom was not fully water-tight after the first course had been put in, although the flow of water was very nearly stopped. The process was therefore repeated between the layer just put down and the one following; perfect tightness being thus secured. In another small reservoir, the bottom consisted of concrete, which, when laid, was made tight, except at one place. After the concrete had been put in, the reservoir walls were built; the water which came in through the opening in the bottom being constantly pumped out. When the walls were finished, the whole was left undisturbed for some time, with the water standing in the reservoir, in order to give the concrete a chance to harden thoroughly. The reservoir was then pumped out; and it was attempted to stop the leak in the bottom—first with strong mortar, then with pure cement, and then with plaster of Paris. Finally, a mixture of oakum and cement was tried; but it proved equally inefficient. At last a suggestion was made to drive a tube in the opening, just deep enough to catch the water coming in. This was done, and a common suction-pump was hitched on. The scheme of thus keeping the water from rising proved entirely successful.

TECHNICAL RECORD.

MIDLAND ASSOCIATION OF GAS MANAGERS.

Meeting at Rugby.

More than the usual amount of business was transacted at the "out" meeting of the members of the Midland Association of Gas Managers, which was held at Rugby on Thursday last, under the presidency of Mr. W. Littlewood, of West Bromwich. In compliment to the respected Treasurer of the Association (Mr. Peter Simpson), there was a large gathering of members at the town with which he has been connected—not in gas matters alone—for the past 38 years, and which connection, it was a grief to all attending the meeting to learn, is now so soon to be severed.

On assembling in the Board-room of the Gas Company an hour before noon, light refreshments were served before business commenced. On taking the chair, Mr. Littlewood called upon the Honorary Secretary (Mr. C. Meiklejohn, of Oldbury) to read the minutes of the last meeting, which, it may be remembered, the President was prevented by indisposition from attending, and so his Inaugural Address had to be deferred, and was the next item on the *agenda* for the present meeting. Mr. Littlewood's address (as given below) was well received, and was followed by a paper by Mr. P. Hutchings, on "The Monier System of Construction, and its Adaptability to Gas Engineering Work." The paper, with a report of the discussion to which it gave rise, will appear in due course. Meanwhile, it may again be mentioned that this Monier system was pretty exhaustively dealt with in the JOURNAL for Dec. 8 last year (p. 1035).

At the close of the meeting, a short visit was paid to the far-famed Rugby Schools, and the many historical spots in and about the buildings and grounds were inspected with very keen interest. In conveyances kindly provided by Mr. Simpson, the party then enjoyed a lengthened drive through some of the beautiful lanes surrounding the town—finishing up by a visit of inspection to the works of the Newbold Cement Company and the Rugby Cement Company. For the convenience of the management of these two establishments, half of the members visited each place. The preparation of the cement, and the various methods adopted in testing its strength, occupied a considerable time; but this was certainly not the least interesting part of the day's proceedings. The courtesy of the proprietors in permitting the inspection, having been duly acknowledged in each case, the parties returned to the Gas Offices to dine there on the invitation of Mr. Simpson. As host, Mr. Simpson was in the chair, supported by the Secretary and one of the Directors of the Company; Mr. Littlewood occupying the vice-chair. After dinner, a short toast-list was gone through—the principal item being the "Health of Mr. Simpson," proposed by his old friend Mr. W. North, of Stourbridge, who feelingly alluded to the approaching retirement of Mr. Simpson from active participation in the management of a gas undertaking, and assured him that he would have, in his retirement, the pleasing reflection that he had always been regarded with the utmost esteem and respect, not only by the members of the Midland Association, but also by the gas engineering profession at large.

MR. LITTLEWOOD'S ADDRESS.

Gentlemen,—Permit me to thank you for the unexpected honour you conferred upon me when you elected me to the position of President of your Association. I can assure you of my high appreciation of your kindness; and I am not unmindful of the responsibilities and onerous duties of the office. At the same time, I could have wished that the honour had been conferred upon some one better qualified to fulfil those duties. However, having accepted the office, it shall be my endeavour to carry out those duties to the best of my ability, and with credit to the Association. All I ask from you is that you will lend me your valuable aid in making the year of my presidency as instructive and interesting as those in the past have been, by submitting papers upon various subjects of interest to all.

I have no doubt the past year has proved a very trying and anxious one to most of you; for what with the maintained high price of coal, the higher rate of labour in the retort-house, and the reduced value of residuals, happy is the manager who has been able, in the face of all these, to show a profit on the year's trading without having to advance the price of gas. The coal market at the present time is in a very unsatisfactory state; and the maintained high price is, I am afraid, mainly due to the present unsettled condition of the labour market, which is being kept in a state of agitation arising from such an "unhealthy" cause as will ultimately rebound to the discomfiture of those responsible for it.

Then, again, there are the concessions made to the men employed in the retort-house, which I would not mind so much if they would take interest in their work, which I fear is not done in many instances, since the eight-hour system was introduced—at least, I have noticed this in my own works, and I have been told by my brother managers that they have experienced the same thing. This state of things ought not to be, if the men would but remember what it has cost the share-

holders or ratepayers, as the case may be, to make these concessions. Indeed, there is no class of labour that has had such advantages given them, which in many cases have so increased the cost of producing gas as to have made all the difference between profit and loss on the year's trading; and in many cases where the price of gas has not been advanced or maintained at a high price, it has necessitated a draw upon the reserve fund to enable them to meet their obligations.

It must be admitted that, under the old system of drawing and charging, and sometimes in retort-houses where the walls were so close to the mouthpieces that there was hardly room for the man to get his rake in the retorts, the work of a stoker was no light one, and must have been very unhealthy and trying to the most robust constitution. This being the case, it becomes our duty to make the work as light as possible. In many works this has been met by the introduction of inclined retorts, mechanical stoking-machines and manual stoking-machines, by the aid of which considerable saving of labour is effected, with greater ease to the men and considerable advantage to the employer.

This question of labour has become a very serious one, not only to ourselves but to all the other branches of trade. Why there should be this embittered antagonism between (let us say) capital and labour, when each depends so much upon the other, I am at a loss to say definitely. What I should like to see is a closer and more friendly relationship between the two, which if happily effected, when petty disputes arise they would be settled in a more friendly manner than at present, with an absence of that bitterness which is now displayed.

I trust that the Labour Commission will see their way to formulate a plan upon which all disputes affecting the large classes of labour may be submitted to a kind of Board of Arbitration, thereby preventing these ill-advised strikes and lock-outs, which unfortunately lead to so much personal suffering and life-long struggles with poverty and distress, but seldom to a satisfactory settlement of the question in dispute.

There is one solution to this question, which to my mind is the best so far. I refer to the mutual benefit or profit-sharing system as adopted at the South Metropolitan Gas-Works, and which so far has given every satisfaction to all parties. I do not know whether this plan has ever been tried by any of our municipal authorities; but, of course, special powers would have to be obtained before it could. These, however, might easily be obtained; and afterwards it would only be a question of finance. At present I am not prepared to say how such a scheme could be got to work in works belonging to our local authorities; but I do think that the consideration of such a subject, as applied in gas-works belonging to a town, might with advantage be made the subject of a very interesting paper for discussion at a future meeting. I throw out the suggestion with a hope that some member will give the matter his serious consideration with that view.

With reference to the present standards of light, as generally adopted throughout the country, I see that, so far as London is concerned, there is a prospect of there being an alteration in the immediate future, which, if carried out, will no doubt affect us sooner or later; and whatever becomes the standard for London will be the same for the provinces. However that may be, I wish the Committee appointed by the Board of Trade every and speedy success in arriving at a standard which shall be satisfactory both to the manufacturer and the consumer; for the present one is by no means all that could be wished.

Where the illuminating power of the gas is (say) from 16 to 17 candles, it is difficult to maintain an absolutely uniform quality without the judicious admixture of an enricher—cannel being the material most generally in use for the purpose, though I see that some engineers have been using oil for this purpose, with, I am informed, varying results. From experiments made by myself in the use of oil as an enricher, I have come to the conclusion that it is very difficult in ordinary working to maintain the uniform temperature necessary to give satisfactory results; for either the retort is too hot and the oil is converted into solid carbon, or if not hot enough it is not converted into a permanent gas. As a consequence, it would be condensing in the mains, and the mixture would be very irregular in quality. I once had an amusing confirmation of this. I had sent up to London for repairs, &c., one of our jet photometers; and the firm were so long in returning it, that I wrote them a rather sharp letter. Upon this I received an explanation to the effect that there had been some delay in the setting and adjustment of the scale, owing to the gas supplied to the factory being very irregular in quality, due to the gas company in question using oil for enriching.

In conclusion, gentlemen, there are many subjects which I might have taken up your time by remarking upon; but all of them have been so often referred to that I have found some difficulty in avoiding what might be considered but repetition. I trust we shall have no lack of papers which may lead to interesting discussions, and a mutual interchange of experience.

The Proposed New Electrical Term.—It appears that the word "kelvin" will not be introduced into the Electric Lighting Provisional Orders of the present session, to represent the Board of Trade unit, as was recently stated; Lord Kelvin having given the Board certain reasons against its use. He says that, in scientific statements, the words "supply unit" will perfectly distinguish from all others the particular unit intended.

SOUTHERN DISTRICT ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

The members of the above Association held their annual excursion meeting at Tunbridge Wells on Thursday last, under the presidency of Mr. Andrew Dougall, Engineer and Manager of the Tunbridge Wells Gas Company. The bulk of the party assembled at the Charing Cross Terminus of the South-Eastern Railway. The Honorary Secretary of the Association (Mr. J. W. Helps, of Croydon) had made special arrangements for the trip; and they were successfully and punctually adhered to throughout the day. On arriving at Tunbridge Wells, the members and their friends found breaks in readiness to convey them to the gas-works, which were inspected under the guidance of the President, and of several of the Directors of the Tunbridge Wells Gas Company, who, together with the Secretary (Mr. John Read), made the visitors heartily welcome to their handsome establishment. The works, as is generally known, were for many years under the control of the late Mr. R. P. Spice, as Consulting Engineer, who has left in the various buildings some enduring monuments of his broad policy and constructive skill. The consumption of gas is rapidly increasing in the district, and the liberal provision for expansion allowed by Mr. Spice is already taken up. Enough was seen at the works to show that, in the President of the Association, the Directors of the Company have an Engineer who is bent upon making the very best use of the opportunities for improvement which a growing business offers to a progressive Manager.

After the gas-works had been thoroughly inspected, luncheon was served in a marquee on the grounds attached to Mr. Dougall's residence; the hospitality of the Directors of the Company being duly recognized, in the name of the Association, by Mr. W. A. Valon, President of the Incorporated Gas Institute, who, with admirable brevity and directness, proposed a vote of thanks to them, which was acknowledged by the Chairman, Mr. W. H. Delves. The kindness of Mr. John Read, who had taken upon himself much of the responsibility of arranging the programme of the day, was also acknowledged.

Leaving the gas-works, the party had an enjoyable drive to Penshurst Place, the historic home of the Sidneys; and having, by the kind permission of Lord de l'Isle, inspected the interior of this most interesting house, whose very walls are eloquent with English history, they partook of high tea together at the Leicester Arms Hotel, in the village, preparatory to the return drive to the town.

The weather was all that could be desired; and the day proved to be one of the most enjoyable in the annals of the Association. Great credit for the unequivocal success of all their arrangements must be given to the President and the Honorary Secretary, who certainly deserve the best thanks of their colleagues for the treat they provided on this occasion.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

On Saturday last the members of this Institution held their annual holiday meeting. This year Bolton Abbey, near Skipton, was the rendezvous; and some sixty members and friends availed themselves of the opportunity of visiting or re-visiting the lovely scenery of Wharfedale. There was a large muster at Victoria Station, Manchester, where two saloon carriages were attached to the 9.25 a.m. train for Skipton. Considerable additions were made to the party *en route*; and others, including the President (Mr. Charles Armitage, of Lancaster), joined it at Skipton. Lunch was served at the Devonshire Hotel. This over, there was a very brief business meeting. First the minutes of the last meeting, held at Manchester in February, were read and confirmed. Then a new member—Mr. Geo. R. Pickering, of Cheadle, Staffs.—was elected, on the proposition of Mr. S. S. Mellor, of Northwich, seconded by Mr. T. Duxbury, of Darwen. This was all the business; and the party immediately made their way to the waggonettes which were awaiting them, and proceeded to Bolton Abbey. The weather proved fine, the drive was delightful, and the scenery in the vicinity of the Abbey most lovely. The journey was so arranged as to take in the most notable features of the district; and in a walk of about a mile from the Strid to the Abbey, the members passed through a scene of sylvan beauty which could scarcely be surpassed. The drive back to Skipton was made under pleasant conditions; and after partaking of tea at the Devonshire Hotel, it was time to think of the train home. Altogether, it was a most enjoyable day. The arrangements for the comfort and convenience of the party were perfect; and for this, credit is due to the Secretary (Mr. Mellor), the President, and one or two other gentlemen.

The Public Health Act and London Fog and Smoke.—We have received a copy of a pamphlet (published by Messrs. Crosby Lockwood and Son) dealing with the above subjects, by Mr. H. G. Assiter. It consists of an amplification of the paper read by him before the Balloon Society on New Year's Day, and briefly noticed in the JOURNAL at the time. An appendix has been added, with a few remarks on the smoke question; and suggestions are offered for carrying out some of the provisions of the Public Health Act which came into operation at the commencement of the year.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

"Decremental Rate of Increase."

SIR,—As your editorial explanation in regard to the above phrase is essentially a repetition of statements which were traversed by my letter to you of the 20th inst. (*ante*, p. 968), I hope you will allow me to place upon record this further protest against them. I cannot have been "wrong in ascribing the formula to Mr. G. Livesey," for the simple reason that I did not so ascribe it, in the sense you suggest. Nor is it true that I placed my own interpretation upon it, as you state. The fact remains that Mr. Livesey did, in 1887, advocate a voluntary reduction, in certain cases, of the standard scale of dividend, which he called, in all seriousness, and, so far as I can see, with perfect propriety, a "decremental rate of increase." I simply recalled this fact, and suggested a revival of the idea, if only for the purpose indicated in the course of my remarks. Why an attempt should now be made to discredit it, I am at a loss to understand.

Your assumption that I attempted to trace, by recollection, the origin of the phrase, is quite a mistaken one. Mr. Livesey's speech was before me when I wrote; and it would have been easy for me to have pointed out whence he derived the expression. But it certainly never occurred to me that anybody could care a straw as to who, of all the sons of Adam, first used it, or whose forensic eloquence happens to have been employed against it. Nor, with all deference to you, can I yet bring myself to believe that these are matters of absorbing interest. The phrase itself lives, and will continue to live, because, as Mr. Livesey says, it is "a proper expression." My sole object was to reproduce, with sufficient exactness, Mr. Livesey's idea and words. In this, I claim to have succeeded; but, if otherwise, it is for Mr. Livesey to put me right.

Birmingham, May 26, 1892.

CHAS. HUNT.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress was made with Bills last week:—

Bills read the first time: Gas Provisional Orders Bill; Middlesbrough Corporation Bill.

Bills read a second time and committed: Bournemouth Improvement Bill; Gas and Water Orders Confirmation Bills.

Bills reported: Blackburn Corporation Bill; Brynmawr and Aber-tillery Gas and Water Bill; East Grinstead Gas and Water Bill; Electric Lighting Provisional Orders Bills (Nos. 1, 2, and 3); Rhyl District Water Bill; Rhyl Improvement Bill; Water Companies (Regulation of Powers) Bill.

Bills read the third time and passed: Electric Lighting Provisional Orders Bills (Nos. 1, 2, and 3); Mold Water Bill; Newport Corporation Bill; Southend Gas Bill.

Petition presented against the Water Orders Confirmation Bill [Sevenoaks Water Order], from the Sevenoaks Rural Sanitary Authority and the Sevenoaks Local Board.

HOUSE OF COMMONS.

The following progress was made with Bills last week:—

Bill read the first time: Newport Corporation Bill.

Bills read a second time and committed: Ipswich Corporation Bill; Pontypridd Water Bill; Rhymney Valley Gas and Water Bill.

Bills reported: Birmingham Corporation Water Bill; Ipswich Corporation Bill; London Water (No. 1) Bill.

Bills read the third time and passed: Gas Provisional Orders Bill; Middlesbrough Corporation Bill; Tredegar Local Board Water Bill.

Petition presented against alterations in the Pontypridd Water Bill, from the Pontypridd Local Board.

Petitions withdrawn: Guardians of Saddleworth and the West Riding County Council, against the Ashton-under-Lyne, Staly-bridge, and Dukinfield District Water Bill; Magistrates and Police Commissioners of Partick, against the Glasgow Corporation Water Bill; Monmouth County Council, against the Swansea Corporation Water Bill.

HOUSE OF COMMONS COMMITTEES.

Monday, May 23.

(Before Sir J. PEASE, Chairman; Lord F. HERVEY, Mr. M'ARTHUR, and Mr. V. CAVENDISH.)

LONDON WATER (No 1) BILL.

This Bill—which is promoted jointly by the London County Council and the Corporation, to provide for the appointment of a Committee with power to inquire into the existing supply of water in the Metropolitan area, and to enter into negotiations for the acquisition or lease of water undertakings, and to supply water from any works acquired, leased, or constructed, and also to empower the Council to promote Bills in Parliament in relation to water supply—came before the above-named Select Committee to-day.

Mr. LITTLER, Q.C., Mr. MOULTON, Q.C., Mr. RUSSELL GRIFFITHS, and Mr. FREEMAN appeared for the promoters. The petitioners against the Bill were: The New River and other London Water Companies, for whom Mr. POPE, Q.C., Mr. BIDDER, Q.C., Mr. PEMBER, Q.C., and Mr. CLAUD BAGGALLAY appeared; the County Council of Middlesex and the Conservators of the River Thames (Counsel reserved) the Kent Water Company, for whom Mr. LEWIS COWARD

appeared; the Southwark and Vauxhall, East London, and Grand Junction Water Companies (Counsel reserved); the West Kent Main Sewerage Board (no appearance); the Corporation of West Ham, for whom Mr. CLIFFORD appeared; the Provincial Water Companies' Association (no appearance); the Proprietors of the Lambeth Water-Works (Counsel reserved); the Corporation of Croydon (Counsel reserved); the Hertfordshire County Council, for whom Lord R. CECIL appeared; and the East Ham Local Board (Counsel reserved).

Mr. LITTLER, in opening the case for the promoters, referred to the Bill which last session came before the Select Committee presided over by Sir Matthew White Ridley, and stated that the present was an entirely different measure. It did not affect the interests of the outside district; being limited to the area of supply of the eight London Water Companies. The result, it would be remembered, of the deliberations of the Committee of last year was embodied in a report which stated that the Committee had proceeded on the assumption that, in the opinion of Parliament, it was desirable to establish a single public representative Water Authority for the Metropolis. They considered it to be most desirable that the problem of the water supply of London should be carefully and deliberately examined by the County Council. After the publication of this report, a great deal of discussion and negotiation took place on the subject, which eventually resulted in the appointment of the Royal Commission now sitting. The Corporation of London and the County Council then deliberated together, and came to the conclusion that at the same time that they were pressing on the Government the appointment of a Royal Commission for the purpose of inquiring into the quantity and quality of the existing water supply, they should promote the present Bill, which had for its chief object the nomination of a Joint Water Committee. The duties of the Committee would be to make inquiries as to the existing supply of water within the Metropolitan water area, and the charges made for it, and to enter into negotiations with any public authority or water company for the purchase or lease of any of their undertakings, and to enforce regulations from time to time for prescribing the strength, character, weight, and materials of fittings and appliances to be used for preventing waste. It was proposed that the Committee should consist of 48 members, one-eighth of whom should be appointed by the Corporation, and the remainder by the County Council. The Bill now differed considerably from what it was originally. They had the authority of Mr. Ritchie for saying that it had taken its present shape very largely at the suggestion, and certainly with the approval, of the Local Government Board. Clause 3 of the Bill, which defined the objects for which the County Council should have power to promote Bills in Parliament, had been very much criticized, and was opposed by a large number of people on different grounds. Corporations, local authorities, and water companies had all professed themselves dissatisfied with it; and, as a result, the clause was now struck out and a new one inserted. The new clause was to the effect that the London County Council should have power from time to time to pay the costs and expenses of promoting Bills in Parliament relating to the supply of water in the Administrative County of London and the neighbouring counties, or to any company having powers as to such supply, or to any undertakings of any such company. At present, there was an immense difficulty in entering into negotiation or bargain with water companies with regard to their undertakings; and it could only be removed by the appointment of some responsible body whose negotiations would have weight. One of the recommendations of the Committee of last year was that there should be careful consideration as to how the rights and powers of inhabitants beyond the Metropolitan area should be protected; and some arrangement might possibly be made in future for selling water in bulk to the outside authorities.

Lord HERVEY: Do you consider that the new clause which you have inserted omits any of the provisions which were specifically contained in the old one?

Mr. POPE: On the contrary, it rather extends them, as general powers frequently do.

Mr. LITTLER: It does not prevent powers being applied for, by a Bill in Parliament, to acquire water-works, or to take them on lease. There is not the slightest doubt that the meaning of the new clause is to leave it entirely open.

Lord HERVEY: In fact, it is quite as extensive as your old clause.

Mr. LITTLER said he thought it was; and what the promoters desired was that they should have the power of promoting such Bills as might be necessary. As to the petition of the New River and other Water Companies against the Bill, as a matter of fact the Companies would be the gainers if the proposal were carried out to establish a single representative Board for the Metropolis; and either the Corporation or the County Council must be this authority. Their expenditure under the present Bill was limited to £5000, to be used for inquiries, and so forth; they had expressly given to them the power to spend money on future Bills. He urged that this measure was absolutely necessary in order to enable them, when the report of the Royal Commission was issued, to act upon it.

Mr. POPE: On behalf of the associated Water Companies, I would desire the Committee to give us some considered intimation of the course this investigation ought to take. I do not approve of raising preliminary objections to an inquiry of this kind; but the Bill is put before the Committee as an attempt to realize by legislation the decision of the Committee of last year. I can only say, for the associated Water Companies, that, unless we receive some intimation from the Committee as to the course the inquiry should take, I cannot see any alternative to its being as long and as tedious as last year.

The CHAIRMAN: I think we had better allow the promoters to proceed with their case in the usual way.

Mr. J. Hutton, Vice-Chairman of the London County Council and Chairman of the Water Committee of the Council, was then called, and, in answer to Mr. MOULTON, said he had read the Bill before the Committee, and considered that the powers by it were, in effect, the same as those already possessed by other corporate bodies. It was desirable that London should have the same power of expressing its wishes with regard to its water supply as other municipal bodies had, subject, of course, to the Borough Funds Act, as the Bill did not attempt to settle the proposed form of legislation with regard to the

actual transfer of any of the water supply to the Council. In his opinion, the Bill carried out the recommendation of the Select Committee of last year. With regard to the money question, it did not in any way touch anything but the power of using the money for making inquiries promoting Bills.

Mr. BIDDER: Of what nature are the further inquiries to be on which you want to spend this £5000?

Witness: They will cover a very wide field. To put it shortly, the question is the quality and quantity of the water, and its capability of supplying London (say) 50 years hence.

Am I rightly informed that you have received the reports of engineers on these questions, which are thoroughly exhaustive and satisfactory?—Satisfactory, but not exhaustive.

What else have you spent money upon besides engineers' reports?—On the necessary analyses of the water.

Mr. COWARD: Have you any special knowledge of water questions?

Witness: None, except what I know through my connection with the Water Committee of the Council.

I should like to ask you why you have brought the Kent Water Company here?—I do not see why you should be here.

Mr. MOULTON: Are there any special references to the Kent Water Company's works in the Bill?

Witness: None whatever.

The CHAIRMAN: Your fourth clause says the Water Committee are to have power to make inquiries as to the "existing supply of water within the Metropolitan water area, and the charges made for the same, and as to the possible sources of supply." Is not the main part of that now delegated to the Royal Commission?

Witness: Yes, no doubt; as far as regards quality and quantity, that would be so.

You have full power over the Metropolitan streets at present, have you not—such as the power to open the streets to lay pipes?—No; that is in the hands of the local authorities—the Vestries.

Have you made up your minds as to whether you will constitute yourselves the Water Authority?—It is rather difficult to answer that question. No doubt the action of the Council would be largely governed by the result of the inquiry before the Royal Commission. If the Bill were passed, the procedure would be, after friendly negotiations had been entered into with any one of these Water Companies, that a recommendation on the subject would be made to the County Council. If the Council adopted it, a Bill would be prepared for the following session; and if both parties agreed, the Committee would approve the terms of purchase.

Do you agree with the recommendation of Sir Matthew White Ridley's Committee, that, if you were constituted the Water Authority, you should be required to purchase the undertakings of the eight Companies by arbitration, failing agreement?—We say it would eventually come to that. We submit that an arbitrator would be guided very largely by the Stock Exchange quotation of the stocks of a water company. An arbitrator might not take such considerations into account as the sufficiency of the service within a given area for the future supply of London; and, consequently, if expensive works had been undertaken by a company, and they had been paying large dividends, it might happen that, although their stock had a high quotation, they might really be on the verge of bankruptcy.

In fact, you have no confidence in any arbitration but your own?—I should be sorry to say that, exactly; but we think an outside arbitrator could not always be trusted.

Mr. H. L. Cripps, Parliamentary Agent to the promoters, was then called. In answer to Mr. MOULTON, he said that London could not at present use public funds to promote any Bills in Parliament relating to the supply of water. The previous Bill was one which represented not only London but the whole area around. The general object of the present Bill was to give the County Council a municipal authority in regard to water. There was a peculiarity in the position of London, by reason of the concurrent jurisdiction of the Corporation and the County Council; and it was desired to put London as nearly as possible in the same position as every other municipal county.

Tuesday, May 24.

On the resumption of the proceedings this morning,

Mr. Cripps was cross-examined by Mr. BIDDER on behalf of the Water Companies. He said that the power to spend £5000 on inquiries had been withdrawn from the General Powers Bill of the Council, and inserted in the present Bill in accordance with the views of Mr. Ritchie and Sir John Lubbock.

Mr. BIDDER: Taking the range of the whole general subject of the water question, on what matter can the London County Council possibly want to spend money in inquiries which are not covered by the Royal Commission?

Witness: One very important matter, for instance, is the legal power and position of the various Companies. That is a very doubtful thing, which must, of necessity, be very carefully investigated before the County Council can come to any satisfactory conclusion.

The CHAIRMAN: As I read the clause, the money is not asked for the purpose of inquiry into title; but three things are named—viz., the existing supply of water, the charges, and the possible sources of supply.

Witness: The reference to the Royal Commission does not deal with the question of what possible sources of supply there may be outside the watersheds of the Thames and Lea Valleys. It is only a question as between the watersheds of the Thames Valley and the Lea Valley and the rights of those populations on the one hand and the demands of London on the other. The Royal Commission might possibly report that more water was necessary, and that it could not be obtained in those areas; but there was nothing which would enable them to deal with any question of other sources of supply.

The CHAIRMAN pointed out that the clause in the Bill did not go outside the question of the Metropolitan water area.

In re-examination by Mr. MOULTON, witness said that the money was also wanted for carrying on the proceedings before the Royal Commission, and properly placing the case of the County Council before that body.

Mr. G. Rose-Innes, Chairman of the County Purposes Committee of the Corporation, and ex-Chairman of the Commissioners of Sewers, examined by Mr. RUSSELL GRIFFITHS, said the Corporation had from time to time taken great interest in the legislation affecting the gas and water supply of the Metropolis, and had spent on the matter large sums of money, by which they had greatly benefited the consumers of both commodities.

Mr. RUSSELL GRIFFITHS: I will take you shortly to the gas first.

The CHAIRMAN: Do we need to go into the question of gas?

Mr. RUSSELL GRIFFITHS: Only so far as it is analagous. The petition of the Water Companies objects to the Statutory Committee; and I am going to show that there is a precedent for it in the joint action of the Metropolitan Board of Works and the City before the County Council came into existence.

The CHAIRMAN: It seems an obviously good arrangement that it should be so.

Witness: In 1868, when the Chartered Gas Company proposed to amalgamate with certain other Gas Companies, the Corporation introduced a competing Bill, and the end of it was that in 1875, instead of purchase, regulation was substituted, with the consent of Parliament and of all parties. In November, 1875, the Board of Trade submitted the scheme of the Chartered Company to the Corporation and the Metropolitan Board of Works, as representing the gas consumers of the Metropolis; and from that time the legislation of the Gas Companies was conducted in accordance with the joint views of the Metropolitan Board and of the Corporation, with very small differences in detail from time to time. In the matter of water supply, in 1886, when the East London, the Lambeth, and the Southwark and Vauxhall Water Companies introduced Bills, the City of London succeeded in having a provision inserted in those Bills for a sinking fund by which the Chamberlain of the City was made Treasurer of the fund; and Parliament agreed to it. That fund was also allowed in 1888 in the Kent Water Company's Bill; and again last year, in the Southwark and Vauxhall Company's subsequent Bill. I was Chairman of the Committee of the Corporation which investigated the water question in 1890 and 1891; and the decision of that body was that it was most necessary that legislation should take place upon the subject before the next quinquennial assessment.

Mr. W. H. Dickinson, Deputy-Chairman of the London County Council, gave evidence as to the arrangements come to between the Corporation and the Council as to the promotion of the Joint Bill.

This closed the promoters' case.

The CHAIRMAN said that, before Mr. Pope began his address on behalf of the Water Companies, the Committee desired to intimate that they were of opinion that, in any event, those portions of the Bill which constituted a new Water Authority, with powers of inquiry and negotiation, should not be proceeded with. They understood from Mr. Bidder that there was no objection to those parts of the Bill which allowed applications to be made to Parliament, and gave the cost of such applications, by the London County Council, and which authorized them to spend money on inquiries. If there was to be further opposition to the Bill after this intimation, the opposition must address itself to those points only. If, after this intimation of the view of the Committee, the promoters desired to go on with the Bill (a measure of a more limited character), of course the Committee would give them every attention; but if they considered their Bill to be too limited, and thought they could get powers in other shapes and ways, of course they would act accordingly.

Mr. MOULTON said he felt fully the importance of this announcement; and before proceeding further, he would like to consult with his clients.

The CHAIRMAN said that at present the Committee did not see any objection to an inquiry, and would be prepared to give the Council ample powers and funds for the purpose; but they were not prepared to constitute a new Water Authority, with power of investigation of any kind.

Mr. POPE, on the part of the associated Water Companies, said he should not appear in opposition to the Bill if it were confined to clause 3, and to the paragraph at the close of clause 4 which gave the London County Council the sum of £5000.

Mr. RUSSELL GRIFFITHS, on behalf of the Corporation, asked if it was the Committee's wish to exclude the City from being put into any part of the Bill.

The CHAIRMAN: We do not see any motive for putting in the Corporation. They have always acted with great ability and foresight on this question; and they have plenty of funds with which to do it. They do not ask for powers to apply to Parliament, and they do not ask for money.

Mr. RUSSELL GRIFFITHS: But we do want to be included in a Statutory Committee.

The CHAIRMAN: We do not want a Statutory Committee. I do not like to do drafting for those who ought to do it for me, but the idea that my colleagues and myself have is that the Bill should be confined practically to clause 3 in the first place. "The London County Council shall have power from time to time to pay the costs and expenses of promoting Bills in Parliament relating to the supply of water in the Administrative County of London, and within the limits of supply of the Metropolitan Water Companies." Then you go on to the first part of clause 4; and instead of saying, "the Water Committee," you put in: "The London County Council shall have power to make inquiries as to the existing supply of water within the Metropolitan water area, and the charges made for the same, and as to the possible sources of supply." You would end there; and then you would go on: "The Council may from time to time pay the costs and expenses of such inquiries"—I think it ought to be "by Royal Commission or otherwise," because you rather laid emphasis on what you are going to do before the Royal Commission—"to an extent not exceeding £5000." If you like to add to that amount, we think that £5000 is rather a short sum for any such inquiry as the London County Council wish to undertake. Then I think we should be also inclined to pass a clause such as clause 11, giving you power to charge the costs of this Bill.

Mr. RUSSELL GRIFFITHS joined with Mr. Moulton in asking that the proceedings should be adjourned, to give time for consideration.

The Committee then adjourned till the next day.

Wednesday, May 25.

At the opening of the proceedings this morning.

Mr. LITTLER, on behalf of the County Council, stated that they had very carefully considered the Committee's decision of the previous day, and were prepared to proceed with the Bill.

The CHAIRMAN: Mr. Bidder opposes clause 3, does he not?

Mr. LITTLER: We accept the proposal of the Committee as regards the position of other people.

Mr. BIDDER: Are you going to alter the clauses at all?

Mr. LITTLER: They shall be exactly in uniformity with the decision of the Committee.

Mr. BIDDER said the London County Council had asked that they should have power to promote Bills in Parliament, seeing that they were under a disadvantage in not being able to do so in the same way as municipal authorities in the provinces, under the Borough Funds Act. He ventured to point out that it did not seem to cause them very much difficulty, as they were promoting the present Bill. He thought that any legislation on the subject should follow the Borough Funds Act—that there should be a general clause authorizing them to promote Bills under proper conditions; and to such a clause the Water Companies would offer no opposition. He objected to clause 3 in its present form.

The CHAIRMAN: I think there is a little irregularity. Mr. Bidder must make up his mind whether he opposes further on the preamble before going into clauses. It is open to him, if he thinks it worth while, to go on with his opposition to the preamble.

Mr. BIDDER said the Companies thought that, if the County Council made up their minds to become the responsible Water Authority, there would be no difficulty about the Bills. It was not the power of promoting Bills in Parliament, which anyone could do, that the Council sought, but the power of charging on the rates the cost of those Bills. They were, he thought, trying to get some kind of left-handed recognition from Parliament that they had to deal with the water question before they had made up their minds to become the Water Authority.

Mr. LEWIS COWARD, on behalf of the Kent Water Company, concurred in what Mr. Bidder had said.

The Committee then passed the preamble, and entered upon the consideration of the clauses of the Bill.

It was finally settled that clause 3 should read thus: "The London County Council shall have the power from time to time to pay the costs and expenses of promoting Bills in Parliament relating to the supply of water in the Administrative County of London, and within the limits of supply of the Metropolitan Water Companies; the Metropolitan Water Companies being and including the several Companies mentioned in the schedule of this Act." This restored the schedule which had been struck out. The Committee decided that £10,000 instead of £5000 should be granted to the County Council by the Bill for the cost and expenses of inquiries made by the Council as to the existing supply of water within the Metropolitan area. A definition of this area was added to clause 4, to the effect that it should mean the whole of the area within which any of the Metropolitan Water Companies defined in the Bill had powers to supply.

The Bill was then ordered to be reported to the House.

Monday, May 2.

(Before Mr. CAMPBELL-BANNERMAN, Chairman; Sir W. HOULDSWORTH, Sir H. STAFFORD NORTHCOTE, Mr. R. K. CAUSTON, Mr. S. GEDGE, Mr. P. STANHOPE, Mr. POWELL WILLIAMS, Mr. W. JAMES, and Mr. E. H. LLEWELLYN.)

BIRMINGHAM CORPORATION WATER BILL.

To-day the proceedings on this Bill were resumed; the opposition from Hereford being the principal matter dealt with.

Mr. J. W. Grover, examined by Mr. LAWRENCE, said the present water supply of Hereford was entirely dependent on the River Wye, of which river the promoters proposed to take two tributaries. In fact, they desired to appropriate between one-sixth and one-seventh of the watershed serving the city, and from which the purest water was obtained. The taking away of this water would most certainly have a very deleterious effect upon that water which constituted the supply of the city of Hereford. It would have the effect of reducing the standard of purity in the river. The remaining water left to be dealt with by the subsidence-tanks and filtering-beds would be less pure than it was now. The compensation water which the promoters proposed to give afforded adequate redress to Hereford for the damage imposed upon it by taking this water away so far as quantity was concerned; but not as to quality. The 27 million gallons would do little good in purifying the water at Hereford during an appreciable part of the year. The only time in which he could fairly say the compensation water would have been beneficial was in 1887. In that year the rainfall was 44.16 inches against 69.5 inches last year; but that was only for a short time. He had taken 21 years, and had found that it would only have been beneficial in the one he had named.

Mr. LAWRENCE: Is it your suggestion that Hereford should be empowered to lay a main to that of the promoters at Ludlow for the purpose of tapping it, and that the city should be entitled to take a million gallons of water per day free of charge?

Witness: As compensation, yes. That proposal contemplates the whole of the works necessary to tap their main being provided at the expense of the city. I ask virtually for running powers through their pipes for a million gallons a day. The estimated cost of making the necessary works is £30,000. But then there would be the sinking fund and some extra expenses besides, so that the total would be a good deal more than £30,000. The promoters asked us to pay something for the water, and we absolutely declined.

In cross-examination by Mr. BALFOUR BROWNE, witness said the Hereford water could not be made sufficient in quantity and quality for the supply of the city without going to very serious expense, as in neither storage nor filtration were the works sufficient. If £20,000 or £30,000 were spent, they would be much improved.

Mr. J. Parker, examined by Mr. LAWRENCE, said he had been Water Engineer at Hereford for ten years. He had frequently visited the

district proposed to be acquired by the promoters; and he was convinced that an injury would be done to the city unless there was ample compensation. He considered that taking away one-sixth of the pure water would have an injurious result, as it would have exactly the same effect as polluting the river *pro tanto*. If they were left alone, there would be an ample supply of pure water at Hereford for many years.

In cross-examination by Mr. FITZGERALD, witness said the abstraction of the water proposed to be appropriated would have a serious effect on that remaining, because the cleanest would be taken and the dirtiest left. The impurity of the water left would certainly be appreciable. The cost of the Hereford filtration system was about £150 a year.

In answer to the CHAIRMAN, witness said that with care they could go on for another ten years without further expenditure, and then the increase in the population and the necessity for new machinery would entail fresh expenditure.

This concluded the evidence for Hereford.

Mr. FREEMAN then addressed the Committee on behalf of the owners of fisheries and properties on the River Wye, and called witnesses in support of his case.

Tuesday, May 3.

On the re-assembling of the Committee this morning,

Mr. PEMBER said he had to trouble the Committee with the case of the Builth Lead Mining Company, Limited, who complained that both their surface and water rights would be greatly limited, and their operations seriously fettered, if the Bill passed. It was not supposed for one moment that the opposition of the Company would be likely to stop the Committee from saying the preamble of the Bill had been proved, and therefore he said nothing on the general merits of the scheme; but he did ask the Committee to see that the property of the Company he represented was adequately protected. They desired to have a proper purchase clause, which should come into effect within a reasonable time—say, twelve months or so—and that the arbitrator, in assessing the compensation, should consider the worth of the property with regard to both its present and its prospective value.

Mr. CRIPPS said his clients considered the owners of the mine were amply protected. It was only, he thought, a question of a clause; and if his learned friend had brought up one, they would have considered it. This, however, could be done now; and the issue might then be narrowed.

The rest of the day was mainly occupied in considering the cases of certain Welsh opponents, who disapproved of the Bill on the ground that it would materially interfere with their existing rights.

Wednesday, May 4.

To-day the proceedings of the Committee were confined to hearing the case of the opponents of the Bill resident in Birmingham.

Mr. GOUGH said he represented 383 property owners in Birmingham, 53 of whom owned 3285 houses of the estimated value of £291,518. His opposition differed entirely from that of any of the other opponents, because their interests were only, for the most part, such as could be compensated either in water or in money; but his objections struck at the very root, principle, and necessity for the Bill. Having epitomized the provisions of the measure, he proceeded to question the necessity for the proposed works. He said he intended to call evidence to prove that the local water-sources of supply were ample, and that the objections to the quality of the water could easily be remedied. He should show that the hardness of the well water, in so far as it required to be corrected, could be softened at a very trifling cost, and that the objection to the spring water was merely a question of additional filtration.

Mr. POWELL WILLIAMS: Shall you suggest any alternative in the shape of a double supply, or anything of that kind?

Mr. GOUGH said he only suggested an alternative in the shape of a double supply when their requirements necessitated it. He had no intention of suggesting a double service immediately; but he should submit that their local supplies, if properly developed, would be ample for at least 50 years to come, without even the dual supply, and that, by adopting the course his clients suggested, the quality of the water would be very greatly improved, as there would be a considerable increase of water from the wells. He denied that there was any urgency for the Bill, and said that, on the top of all the sources of supply which they could develop, they could, by merely utilizing the waters of the Tame for the sanitary purposes for which they were available, increase their supply to 91 million gallons a day; whereas Mr. Mansergh expected to get from the Welsh rivers, after allowing 27 million gallons compensation, only 71 million gallons a day for the supply of Birmingham and all the other places within the 15 miles limit. The cost of Mr. Mansergh's scheme would be practically ten times as great as that of developing their own resources. He should call evidence to show that it was unnecessary to resort to the waters of the Tame, and that for a very long period to come, they had, within a distance of 20 miles of Birmingham, a large area of sandstone rocks, which would yield about 30 million gallons a day. He should be in a position to prove that to bring the Welsh waters to Birmingham would be like carrying coals to Newcastle; for they had in Birmingham what was, at any rate for them, an unlimited supply of water. He objected to the celerity with which the Council voted the scheme, involving an expenditure of nearly £7,000,000 sterling; and he complained that it was never adequately debated. The town's meeting, too, could not be said to represent the feeling of the town. There was no adequate discussion of the scheme; and altogether the meeting was irregular.

The CHAIRMAN said the Committee were satisfied that everything was regularly done; and if there was any irregularity, it was not a matter for the Committee. The opponents of the Bill could have gone elsewhere to quash the proceedings.

The TOWN CLERK said that every formality was complied with.

Mr. GOUGH (continuing his argument) said there was no evidence to show that the Welsh water had ever been tested for lead, copper, zinc, arsenic, or peat; and he would call witnesses to prove that there were all those objectionable characteristics in the water, and that the water would have to be "doctored" before it was free from those objectionable features. The double-service system had been received with a good deal of contempt; but it had long ago been introduced into several

towns of importance, such as Southampton, Hartlepool, Newcastle-on-Tyne, Shrewsbury, Stockton-on-Tees, and Middlesbrough. Besides these places, it had existed in Paris for 40 years. *Primâ facie*, it seemed rather a sin and a shame to use potable water for sanitary purposes, especially when, according to the promoters, the supply was running short; and if they adopted the secondary system he suggested, they would save the enormous expense of the scheme before the Committee. In conclusion, he said that a great change had come over public opinion in Birmingham on the subject of the Bill. It was perfectly true that, at the time the town's meeting was held, a great amount of apathy existed; but since the application to Parliament had been made, there had been a change. The petitioners against the Bill altogether numbered 10,000 or 15,000. Taking all the facts into consideration, therefore, he asked the Committee to say that the claim for urgency had not been proved.

Thursday, May 5.

At the commencement of the proceedings to-day,

Mr. WOOD announced that the Corporation had arranged terms with the tenants and occupiers of the watershed. They had agreed not to disturb them, and had promised to grant them leases for 21 years at the same rent and on the same conditions as they had hitherto enjoyed. The tenants, too, would be allowed to remain in occupation of the land not actually required for reservoir purposes.

Mr. CRIPPS, on behalf of the promoters, said there would be a clause in the leases that nothing should be done to affect the purity of the water.

The CHAIRMAN remarked that it was very satisfactory that the matter had been settled on such amicable terms. It was only what he expected from the way in which the Corporation had negotiated other things in which local interests were concerned.

Witnesses from Wales were then called by the Committee to give evidence with respect to the rights of the people in the neighbourhood of the watershed which might be affected by the Bill. It was found, however, that their objections could mostly be met by clauses.

The evidence of the Birmingham dissentients was next commenced; but we give only that of the more important witnesses.

Professor E. Hull said that for many years he had made the question of underground water a special study, and had had considerable professional experience in advising public bodies as regarded this source of supply. He had an intimate acquaintance with the geological structure of the district around Birmingham, having been engaged for several years, while on the Government geological survey of Great Britain, in surveying the districts adjoining the coal-fields of South Staffordshire, consisting of the new red sandstone and permian formations, which were the greatest water-bearing strata of the central and northern counties of England; and, from his knowledge of their extent and water-bearing capabilities, he was prepared to maintain that, within a few miles of Birmingham, there were abundant supplies of excellent underground water which could be utilized, and were capable of being made use of, in addition to those already in existence. Witness proceeded to describe the district north of Birmingham; saying that the tract between Sutton Coldfield and the boundary of the South Staffordshire coal-field on the west, and ranging northwards for several miles, would give an area of 20 to 25 square miles of new red sandstone. The southern limit of the tract would extend to within about a mile of the King's Vale pumping-station. The quantity of water from this area might be taken at from 5 to 6 million gallons per day. The district of Cannock Chase between Cannock and Stafford was formed of new red conglomerate, and was capable of giving large supplies of excellent water. The area was about 35 square miles; and there ought to be a supply of from 10 to 12 million gallons of water available. East of Birmingham, the Over Whitacre district had an area of about 30 square miles; and the tract was formed of permian marls, sandstone, and conglomerates, which were to a large extent water-bearing, and supplied the towns of Coventry and Tamworth with water. At least two pumping-stations, each capable of supplying from 2 to 3 million gallons of water per day, might be established in carefully-selected sites. South and west of Birmingham was a large tract lying between the valley of the Severn and the western and southern border of the coal-field, which consisted of red sandstone and permian strata, and might be regarded as one of the most important water-bearing districts of central England. The area he estimated at above 100 square miles. The strata were of great thickness, highly absorbent, and generally freely exposed to the rainfall, which might be taken at from 28 to 30 inches per annum. Wolverhampton and Stourbridge drew their supplies from this area; but, making large allowances for their present and future requirements, there was a very great margin, which might be made available for Birmingham. Taking the absorption at one-third of the rainfall, or 10 inches per annum, this gave 400,000 gallons of underground water per square mile per day. So that, with an area of 100 square miles, the total quantity of underground water in the area referred to would amount to 40 million gallons daily, of which Wolverhampton, Stourbridge, and other towns might take in the distant future one-half; leaving 20 million gallons available. From all these districts they might, therefore, consider there was still an available supply of 39 to 44 millions. He agreed with Professor Lapworth that Birmingham was admirably suited as regarded its water supply; but he disagreed with him that the city was coming to the end of its resources. It was a remarkable fact that the pure water from the mountainous districts acted very detrimentally on the lead pipes. The water from new red sandstone did not corrode the lead pipes so much. Birmingham was one of the few towns which were exempt from the visitation of cholera when it raged in the country about 50 years ago.

The Committee adjourned until the following day.

Elland-cum-Greetland Gas Company.—This Company are offering for sale by tender 500 new preference shares of £10 each, bearing 4½ per cent. interest per annum. The maximum dividends have been paid on the ordinary shares, now amounting to 12 per cent.; and with gas at its present price, the Company are authorized to pay 14 per cent. The new capital is required to extend the works.

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Saturday, May 21.

(Before the MASTER OF THE ROLLS and Lords Justices FRY and LOPES.)
The London County Council, Appellants; The Churchwardens and Overseers of West Ham and the Assessment Committee of the West Ham Union, Respondents.

This case raised the question as to the rateability of the Abbey Mills pumping-station, and the land, premises, house, lodge, and cottages, connected therewith, and also the outfall mains of the sewers in West Ham parish. The pumping-station, land, and premises are assessed at £6227 gross and £4982 net rateable value, and the outfall drains of the sewers at £13,781 gross and £11,026 net; and the poor-rate, the subject of the appeal, was made on May 1, 1891. The pumping-station had for many years been rated at £1875 gross and £1500 net; and in the case of the *Metropolitan Board of Works v. West Ham Parish*, it was stated that the question was what a tenant would give for the station if it was not used for the main drainage, but disconnected from it, and applied to any useful purposes for which it might be made available. It was understood that the assessment had been raised in consequence of the decision of the Court of Appeal in the case of *The Mayor and Corporation of Burton-on-Trent v. the Assessment Committee of Burton-on-Trent* (the Burton Sewage Farm case); and the result of this decision had been not merely the raising the assessment of the station and works at West Ham and the assessment of outfall sewers in several parishes, but also of the assessment of every other place where the Council have works above ground in connection with their main drainage system. The matter came before the Essex Quarter Sessions in July last, and was shortly noticed in the JOURNAL at the time. (See Vol. LVIII., p. 36.) It was then stated that very important points of law relating to the rating of sewers were involved, which would lead to an appeal to a higher tribunal. The case was taken to a Divisional Court, where the assessment was upheld. From this decision, the County Council appealed.

Mr. HORACE AVORY appeared on behalf of the appellants; Mr. REID, Q.C., and Mr. MONTEFIORE, for the Overseers. Mr. GWYN JAMES represented the Assessment Committee; but he intimated that he did not intend to further argue the case.

The MASTER of the ROLLS, in giving judgment, said the only question on which the Court were called upon to give an opinion was as to whether the sewers were rateable. The rest of the works were given up; and as to these they said nothing. With regard to the sewers, they were vested in the County Council—the creation of an Act of Parliament, and having only statutory authority. The Council had the power to make sewers, and they had a duty to maintain them, and to make rates for their maintenance. But their powers were limited; and they could only make rates to enable them to do their duty and no more. Had they the power to be tenants of sewers? This depended upon the Act of Parliament. They had no authority to take sewers on lease, and pay a rent for them. No such power was given expressly, nor did it arise by implication. It was clear, therefore, that they had no right to take sewers on lease. It was said the case was governed by the Burton case. And it would be so if the Council could be such a tenant of the sewers as the Assessment Act contemplated. But they could not be so; and no persons other than the Council could possibly take the sewers as tenants. The Council could not possibly be taken as the "hypothetical tenant" referred to in the Act, for they could not be tenants of the sewers at all; and, even if they could be so, they would be so subject to restrictions that they could not make anything of them, and would not be the sort of tenant intended in the Act. The appeal, therefore, must be allowed as to the sewers, but not as to the rest of the subjects of assessment.

The LORDS JUSTICES concurred.

The appeal was allowed accordingly.

Wednesday, May 25.

In view of the decision of the Court recorded above, the appellants to-day applied for their costs.

Mr. REID resisted the application, on the ground that the Court had no jurisdiction to allow costs except by statute; and no statute gave jurisdiction in such cases. Therefore, on motions for *certiorari*, there were recognizances to pay costs.

The MASTER of the ROLLS asked, if the Court had no jurisdiction to allow costs, how they could require recognizances.

Mr. REID said it was conferred by statute. The learned Counsel cited precedents in support of his contention.

Mr. AVORY maintained that the Court had power, under the Judicature Act, to grant the costs of the appeal. He cited a case in which, he said, this had been held; and under Order LXV. there was power to give costs in all proceedings in the High Court.

The MASTER of the ROLLS said the order mentioned gave no such power except in cases where it was exercised before the Judicature Act.

Their LORDSHIPS came to the conclusion that they had no power to give the costs of the appeal.

The MASTER of the ROLLS, in giving judgment, said that at common law the Courts had no power to allow costs except by statute; and there was no such statutory power in cases on the Crown side in the Queen's Bench Division. Then, under the Judicature Act, Order LXV. was held to give no such power where the Court had not had jurisdiction before. Doubts on the question had arisen, which were settled by 53 & 54 Vict., cap. 44, and section 4 had the effect of restricting the power to cases in which it was exercised before the Act. Nothing was to alter the practice on the Crown side in the Queen's Bench Division; and so it remained in this respect as before. There was no power, therefore, to give costs in such a case as this.

The LORDS JUSTICES concurred.

The appellants' costs were therefore disallowed.

Barnstable Water Company v. Tucker.

This case, which, as reported in the JOURNAL last week (p. 981), was recently decided by Justices Day and Charles in the Queen's Bench Division, on an *ex parte* argument, came before their Lordships on appeal. The question arose on the construction of the following clause in the plaintiffs' Act: "In all cases in which the Company shall supply water at a pressure above or greater than that afforded by gravitation, either from the now existing reservoir or from any other reservoir supplied otherwise than by pumping from a reservoir or pumping-station on a lower level, the Company may demand and take in respect of such supply, an additional rate not exceeding one-fifth part of the rate authorized by the Act." Defendant was summoned before the local Magistrates for not paying his water-rate, estimated at the higher charge under this enactment; and the question was raised as to whether it applied. The old reservoir was at a lower level than his house, and was fed from a natural stream. The water was pumped from the lower to a new and upper-service reservoir; and he obtained his supply from a branch-pipe opening into the pipe between the two reservoirs. The point to be determined was whether or not the Company were entitled to charge him at the higher rate.

Mr. H. F. DICKENS, Q.C., and Mr. ALDERSON FOOTE, appeared for the defendant; Mr. ASQUITH, Q.C., and Mr. THORNE represented the plaintiffs.

At the conclusion of the arguments,

Their LORDSHIPS came to the conclusion that the case came within the enactment, and that the Company were therefore entitled to charge the defendant at the higher rate.

Judgment was therefore in favour of the Company.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Thursday, May 26.

(Before Justice KEKEWICH.)

Gadd v. Mayor, &c., of Manchester—The Gasholder Guiding Patents.

To-day the reserved judgment was delivered in this important case, the proceedings in which were fully reported in the JOURNAL during the hearing (see *ante*, pp. 628, 668, 853).

His LORDSHIP said: As frequently occurs in cases of magnitude and difficulty, and more especially in cases concerned with patent law, there fall for decision several independent issues. Without saying that there are not subordinate questions deserving consideration, I treat three as of prominent importance; and there is no occasion to discuss others, except in connection with one or more of these three. They are: (1) Whether the invention claimed by the plaintiffs was published in this realm by Mr. Terrace prior to the date of their letters patent; (2) whether there is such non-conformity (to use Lord Blackburn's expression in *Bailey v. Robertson*) of the complete specification with the provisional specification as renders the plaintiffs' letters patent invalid; and (3) whether the plaintiffs' invention has been anticipated otherwise than by Mr. Terrace's publication, if publication there were. These are the questions on which the arguments on either side have proceeded. They were not stated by Counsel in precisely the same language, or in the same order; but I shall treat them in the order just mentioned. First, then, as regards the alleged publication by Mr. Terrace. It is admitted on the part of the plaintiffs that there is no substantial difference between the product of their industry and the product of that of Mr. Terrace; and that if there were a publication by Mr. Terrace, it took place before the plaintiffs filed their provisional specification. So that, in that event, nothing remained for the plaintiffs to give to the public—nothing on which letters patent could properly operate. Again, what Mr. Terrace did is beyond dispute; there is no conflict of evidence about it. The facts are contained in a few letters, and in the clear evidence of a few witnesses, the truth of whose testimony is unchallenged. What is the law on the subject? I have been unable to verify the Attorney-General's quotation from Mr. Hindmarch's book; but I accept the proposition advanced on the authority of that book and the decided cases cited in argument, that, in order to establish publication, there must be proved an intention to publish, unless the acts done clearly produced that effect. Intention to publish may, of course, be declared; but where not declared, may nevertheless be concluded, and this even notwithstanding declarations to the contrary from the facts proved—the judge or the jury, as the case may be, being driven to make the reasonable inference from all the circumstances of the case. Intention, apart from the question of publication or non-publication, is necessarily one of fact to be proved and decided like other questions of fact. Overmuch weight must not be given to the number of persons to whom the secret is communicated; but the number of persons is a factor which cannot ever be disregarded, and may, in connection with the other circumstances of the case, be a matter of serious moment. This seems to have been the opinion of Sir George Jessel, expressed in *Plimpton v. Malcolmson* (3 Ch. Div., 531), which is a valuable authority on this and other questions of patent law. He discusses on p. 556 what is sufficient to make an invention part of the common knowledge or of the public stock of information; and he there says: "If a sufficient number know it, or if the communication is such that a sufficient number may be presumed or assumed to know it, that will do." He is not there considering confidential communications; but the statement appears to me to hold good even in such cases. Whatever a man's declared intentions may have been, however credible his statement that he communicated the secret only in confidence, communication of his secret to a large number of persons is inconsistent with secrecy, and must be so treated. This must especially be so if, as regards any one or more of the persons to whom the communication is made, there is no satisfactory reason for it, or the reason is manifestly a desire that the particular person should know what has been, or is proposed to be, done. My own decision in the case of *Blank v. Footman, Pratty, and Co.* (39, Ch. Div., 678), to which I will not further refer, proceeds on this basis. On the other hand, it is clearly laid down in the text-books, and established by a long series of cases, some of which were cited in argument, that

an inventor is entitled to make experiments to test an invention, and for that purpose to employ others—if need be, a large number—to assist in those experiments. Further, he may take others into his confidence, and obtain their advice and opinions respecting the practical or useful character of his invention. It is impossible to fix any number; and, indeed, it is obvious that, in some cases, gross injustice might ensue if communication were not allowed to such a numerous body as would in some other cases be absurdly large. This is well illustrated by the case of the experiments with a machine for paying out cables, cited by the Attorney-General. It must always be a question of fact, to be reasonably considered with reference to all the circumstances, and the reasonable conduct of prudent men. Judged by this standard, Mr. Terrace's acts do not, in my opinion, amount to a publication. That he did not intend publication is not capable of dispute. He conceived himself to have made a discovery which, if really practicable, solved difficulties long present to the minds of those versed in such matters, and in a manner calculated to unite ability and economy in no common measure. The native caution which was attributed to him was undoubtedly increased by reasonable doubt whether this result was in truth achieved; and he wished to submit the merits of his discovery to the advice of some persons competent to express an opinion. He apparently had no definite intention to apply for letters patent; but, on the other hand, I think that his first letter to Mr. Gadd indicates that the possibility of his doing so was present to his mind even before the suggestion came from Mr. Livesey. His anxiety that Messrs. C. and W. Walker should not make his secret known assists this conclusion, with which his communication to those gentlemen is perfectly consistent. His other communications were all of a confidential character, as is particularly seen from his sending with the drawing a copy of Mr. Livesey's letter. He ran some danger of defeating his own intention. No injunctions to secrecy, however honest and however cogent, would have availed him had any of the persons with whom he communicated committed a breach of confidence, and disclosed the secret in such a way as to make the discovery part of the common knowledge; and, in my opinion, if this had in fact been done, it would have been no answer on Mr. Terrace's part to prove that each person to whom the communication was made was, in his turn, pledged to secrecy. There was, however, no such breach of confidence. The drawing was communicated to some persons—namely, Messrs. Duncan and McKechnie—who were unknown to Mr. Terrace, and to whom he never authorized or intended it to be shown. But they were aware of Mr. Terrace's intention to avoid publication, for they saw Mr. Livesey's letter; and they cannot be regarded as of themselves constituting such a section of the public that communication to them was equivalent to publication. It was attempted to bring this case within the principle of *Humpherson v. Syer* (4 Reports, Patent Cases, 407). The contrast pointed out by the Attorney-General between the careless conduct of a man who knows that he has secured protection for his discovery, and the caution of one not yet arrived at this stage, is sound; and the reasonable inference to be drawn from the states of mind depending upon their relative positions sufficiently, in my opinion, turns the edge of that case, and converts it into an authority rather for the plaintiffs than for the defendants. Consistently with this, consistently also with all the other authorities cited, and the principles which they illustrate and on which they are based, I hold that Mr. Terrace's acts were not a publication of his discovery, and therefore do not avail against the plaintiffs' letters patent. The second question—whether there is non-conformity of the complete with the provisional specification—opens considerations of an entirely different character. The general law is clear, and the decision must turn on the instruments, construed with the aid of expert evidence, and by the light of what is proved to have been common knowledge. That the rule touching non-conformity still holds good, notwithstanding recent legislation, is settled by the judgment on appeal in *Nuttall v. Hargreaves* (1892, 1 Ch. Div., 23) for every Court short of the House of Lords; and, having regard to *Vickers v. Siddall* (15 Appeal Cases, 496), may haply not be treated as open there. The rule, and the reason for it, depend on considerations of high practical value which have influenced the arguments and conclusions on which they are supported. The bargain made with the patentee on behalf of the public is that, in return for the protection granted, he shall make full disclosure of his invention, in order that, though not capable of exercise during the period of privilege, it may at once be added to the stock of common knowledge, and that during such period all concerned may be distinctly warned what they may safely do, and beyond what line they will be trespassers. The necessity of this warning is enhanced by the reflection that in all departments of industry there are ever urgent needs known to, and appreciated by, students and workers; and that consequently many hands and minds are often independently engaged in combating some difficult problem, with the result that several contemporaneously approach the same solution, all unconscious that others are as far forward as themselves. For their sake, therefore, it is important that the first announcement of discovery (that made by the provisional specification) should be distinct, and that they should know at once what has been discovered and what not—how far they may usefully labour, and what has now been placed beyond their grasp; or, to borrow an expression from a note quoted during the argument, what is the "area of protection." Against this fair demand for information must be set the reasonable claim of a patentee for time to develop his invention. The last steps in the journey of discovery are often rapid—too rapid for minute observation of details, even though hitherto progress has been tedious; and the goal once in sight, there is a natural anxiety, quickened by competition, to announce the fact forthwith, and secure such advantages as pertain to it, without pause or reflection. The Legislature has recognized the haste of the discoverer as reasonable, and yet has imposed conditions for the benefit of others. He is bound to disclose in his provisional specification the nature of his invention; but he is allowed a sufficiently long time for developing and fully describing it. The liberty thus afforded him has been construed with some latitude; and nowhere is it made more ample than in *Woodward v. Sansum* (4 Patent Cases, 166), where, on page 175, Lord Justice Cotton says: "A patentee, putting in a provisional specification showing the nature of his invention, is not bound to describe the way in which that can be carried into effect and operation; but if

he does not describe a way of doing it, and, before he files his complete specification, he either finds out improvements in that way, or a different way of carrying into effect that which is described as his invention in the provisional specification, he is bound to give the public the benefit of what he has discovered as regards the mode of carrying the invention, the nature of which must be described in the provisional specification, into effect, even although there may be improvement, and even invention, which was not known to him at the time." The language of Lord Justice Lopes, on page 178, is equally large, and not less apposite, because it treats the patentee's position as regarded from his own rather than from the public point of view. Notwithstanding this ample liberty reserved to the patentee, the protection of others has never been disregarded; and in numerous cases the Courts have insisted on the principle that the complete must be conformable with the provisional specification, in the sense that there must not be anything in the more perfect instrument which cannot be found, at least in embryo, in that of less formal character. I have endeavoured to express, in a few words of my own, the substance of many decisions in which this branch of law has been expounded, and which, whatever language is used, must be my guides and controllers in this respect. There is no need for quotations here from any of them; but it may be mentioned that reference is more especially made to *Bailey v. Robertson* (3 Appeal Cases, 1055), *United Telephone Company v. Harrison* (21 Ch. Div., 720), *Vickers v. Siddall*, and *Nuttall v. Hargreaves*. In order to apply these authorities, and the principle under consideration, to the case in hand, it is first necessary to inquire what the plaintiff's [Mr. Gadd's] invention is—that is, what is the character of his discovery, in what field of industry he was labouring, to what mechanical or other difficulty he was devoting his special attention, and what solution of that difficulty he professes to have found and published. The complete specification should furnish answers to these queries; and, with them in hand, it should be easy to ascertain whether the provisional specification sufficiently describes the nature of the invention. On this the question of non-conformity depends. That the inquiry mentioned is a necessary preliminary to these considerations, is supported by a proposition of law for which there is the highest authority. In *Vickers v. Siddall*, Lord Halsbury says: "It is an essential condition of a good patent that the invention described in the provisional should be the same as that in the complete specification;" and in *Nuttall v. Hargreaves*, Lord Justice Lindley, after referring to *Bailey v. Robertson* (where, in truth, the same proposition is stated), says: "If the invention described in the two specifications is not the same, the patent is bad." No doubt the identity required is identity of the substantial invention, and not identity of details or the means of carrying the invention into effect. There is room for invention, even in this latter process; and that is what I conceive to be referred to in the passage above quoted from *Woodward v. Sansum*, which must not, of course, be read in anywise inconsistent with the broader proposition last stated. The question to be answered might with accuracy be formulated in language adopted from *Woodward v. Sansum* thus: "Does the complete specification do more than state a different mode of carrying into effect the invention the nature of which is described in the provisional specification?" And, again, it is seen, as noticed by Lord Justice Lindley in that very case, that the question turns upon what the invention really was. It is stated by the complete specification to consist in connecting, by means of torsional or tensional gearing, a number of points round the bottom curb of a gasholder, in such manner that, when one point thereof tends to rise or fall, the same tendency is transmitted through such gearing round the circle to every other point. This statement expressly mentions a tensional in contrast with a torsional method; and inasmuch as the ultimate question to solve, for which the preliminary inquiry is required, is whether the tensional method is fairly within the provisional specification, such statement is unfortunately of little service, except in showing, what is otherwise clear, that the tensional method is deemed essential by the patentee. Turning to the introductory words of either specification (for, in this respect, the two are identical), one finds that they are concerned with improvements relating to the construction of gasholders, having for their object the supporting of the same, in their working position, in such a manner as to enable the external or upper guide-framing hitherto employed for this purpose to be dispensed with, and yet to give the requisite stability. Improvements, in such a context, must mean certain defined improvements—some, that is, mentioned specifically, and with more or less detail, in the instrument in which the passage occurs. The necessity for this conclusion is strengthened by the reflection that Messrs. Gadd and Mason had already invented, and obtained letters patent for, one improvement designed to effect, and successfully effecting, the object in view, as also by the general principle that an idea is not proper subject-matter of letters patent. It seems, therefore, that Messrs. Gadd and Mason claim to have invented certain definite improvements, having and effecting a certain definite object; and that, when once it has been ascertained what those improvements are, one has an answer to the inquiry, "What is the invention?" It was not suggested in argument that the improvements are not described with sufficient fulness and exactness in the complete specification, and the figures appended thereto, or that a competent workman, having the specification and those figures before him, might not easily construct a gasholder with those improvements in any of the varieties of form thereby disclosed. On the other hand, it was not suggested—at least, I do not understand it to have been—either in argument or in evidence, that any workman, however competent, could, merely on the instruction of the provisional specification, apply the tensional method to a gasholder, or, in other words, construct a gasholder with the improvements delineated in those figures by which the tensional method is illustrated. Let me not be understood as saying that it is the office of the provisional specification to give such instructions. It is not. But if he could not do it without the exercise of the inventive faculty, I venture to think that it must be because the nature of the invention is not sufficiently described, and this notwithstanding the language of Lord Justice Cotton in the passage quoted from *Woodward v. Sansum*; because, having regard to the connection in which that language was used, I consider myself justified in holding that he did not intend to mean that a description requiring further invention to perfect the work would be insufficient

IMPORTANT TO ENGINEERS AND GAS COMPANIES.

A NEW CARBURETTOR FOR ENRICHING GAS IN BULK.

The Carburettors have been doing practical work for the past two years, in many cases doing all the enrichment without the use of Cannel or other rich Coals. The South Metropolitan Gas Company have these Enrichers at all their Stations. The Gaslight and Coke Company have had them in use at some of their principal Works for two years past, and several more are now being fixed at their other Stations. The Carburettors are also in use at several Suburban and Provincial Gas Companies' Works.

Extracts from a paper read by Mr. T. S. LACEY, Pimlico, at the Meeting of the Incorporated Institution of Gas Engineers, held at the Institution of Civil Engineers, May 11 and 12, 1892, and discussion thereon:—

The process of enrichment with the Clark-Maxim carburettor has been largely used both by The Gaslight and Coke Company and the South Metropolitan Company; the former having applied it at Bromley, where it is used on the inlet of the meters, and at the Pimlico cannel station and Horseferry Road gasholder station, both of which are under the charge of the author. In these cases it is fixed at the outlet of gasholders. In these machines, the spirit is evaporated by means of a steam jacket under pressure, which is utilized by a jet to create a current in a bye-pass main, so that a part of the gas is raised to a high illuminating power, then forced into the main stream, and thoroughly mixed with the bulk. The oil is stored in steel tanks, 5 feet diameter, 8 ft. 6 in. deep, containing 1000 gallons, which are completely enveloped in 6 inches of puddle, and sunk in the ground in brick tanks. The filling and suction pipes are carried nearly to the bottom of the tank, which is ventilated by a $\frac{1}{2}$ -inch iron pipe, carried 30 feet up an adjoining gasholder column. Each tank is fitted with a float, guided by rods and carrying a $\frac{3}{8}$ -inch tube, working through a gland in the crown. When not in use for taking the depth of liquid, the float is pushed down to the bottom of the tank, and a plug screwed into the gland; the only opening to the tank then being the outlet of the ventilating-pipe, which is removed from all source of danger from lights. The carburettor is charged by a small steam-pump, which is also used to empty the barrels. The amount of vapour mixed with the gas is governed by a regulating-valve attached to the injector, and can be adjusted to any quantity required.

The rapidity and certainty with which the illuminating power of the gas can be controlled, are very strong recommendations.

The quantity of carburine required to raise gas of about 20-candle power about 3 candles has been tried at various times, the results varying from 1.75 to 2.25 gallons per candle per 10,000 feet of gas enriched. A recent test on 463,000 feet, extending over four hours, took 208 gallons of carburine to enrich gas from 20.38 to 22.96 candles; being equal to an increase of 2.58 candles, and the oil used 1.74 gallons per 10,000 feet of gas raised 1 candle. The gas was tested with the "London" standard cannel burner at 5 feet per hour; five determinations being made of the gas on the inlet and outlet of the carburettor.

From figures kindly supplied by Mr. Wright, of Bromley, it would appear that 8000 feet of $15\frac{1}{2}$ -candle gas can be raised to $16\frac{1}{2}$ candles with 1 gallon of carburine; the gas being tested in each case with the "London" Argand at 5 feet per hour. This gives 1.25 gallons for each candle added to 10,000 feet of gas. If tested with the Argand, burning up to smoking-point in each case, the quantity required for 1 candle would probably be 1.50 gallons.

As the Clark-Maxim process is generally used to make up the deficiency in hydrocarbons in the cold weather,

the illuminants whose places have to be supplied being probably those bodies of high boiling-point, there seems to be no reason why the gas, when moderately carburetted, should not be permanent. The results of the author's experience confirm this conclusion, none of the liquid having ever been found in the mains in his district.

The commercial aspect of the question is necessarily of greater importance than any theoretical speculations. But unfortunately, money values are quite as open to errors as experimental data. The Engineers of The Gaslight and Coke Company take 50 gallons of carburine as being equal to 1 ton of Lesmahagow cannel. This value is adopted provisionally; but it is believed to be fairly accurate. For enriching cannel gas 2 candles, from about 20-candle power, the author takes 1.8 gallons per candle per 10,000 feet as the quantity required. At 9d. per gallon, allowing 1.5d. for the gas produced, 1 candle would cost 1.74d. per 1000 feet. The cost for enriching 16-candle gas (say) 2 candles, would probably not exceed 1.3d. per candle per 1000 feet. The author does not think it necessary to add another estimate of the cost of cannel to the conflicting values already published; but he believes the evidence in favour of carburine is sufficient to justify its use in the manner described.

Mr. Chas. Gandon (Crystal Palace and District Gas Company) said they had also been trying the Clark-Maxim carburettor, of which he could speak highly, as giving satisfactory results. So far as he could get at it, the cost to enrich gas by 1 candle was about $1\frac{1}{4}$ d. per 1000 cubic feet.

Mr. H. Peaty (Burslem) said that he might contribute a few remarks with regard to the carbureting process. In January last he had a Clark-Maxim carbureting plant put up. The cost was a little less than 1d. per candle per 1000 cubic feet. He could not give the amount produced per gallon, as he included it with the make. The fact remained that they were able to produce an extra candle or two whenever necessary, when the cold weather came, and so raise the gas from $15\frac{3}{4}$ to 17 candles. At present, for the last two or three months, the returns furnished by the Gas Examiner were about 17 candles, while the Corporation never pretended to give more than 16 candles before. They used carburine, which cost just under 1s. per gallon delivered. The great advantage was that a manager was able to bring his gas up to exactly the standard required by his committee or the authorities.

Mr. Lacey said the question of cost seemed to be one on which the greatest difference existed. He would point out that he was not responsible for the figures supplied to him by Mr. Wright; but they agreed very fairly with those given by Mr. Gandon, Mr. Peaty, and also by Mr. Frank Livesey. Mr. Wright gave 1.25 gallons for each candle added to 10,000 cubic feet of $15\frac{1}{2}$ -candle gas to bring it up to $16\frac{1}{2}$ candles. He understood it was tested with an Argand burner.

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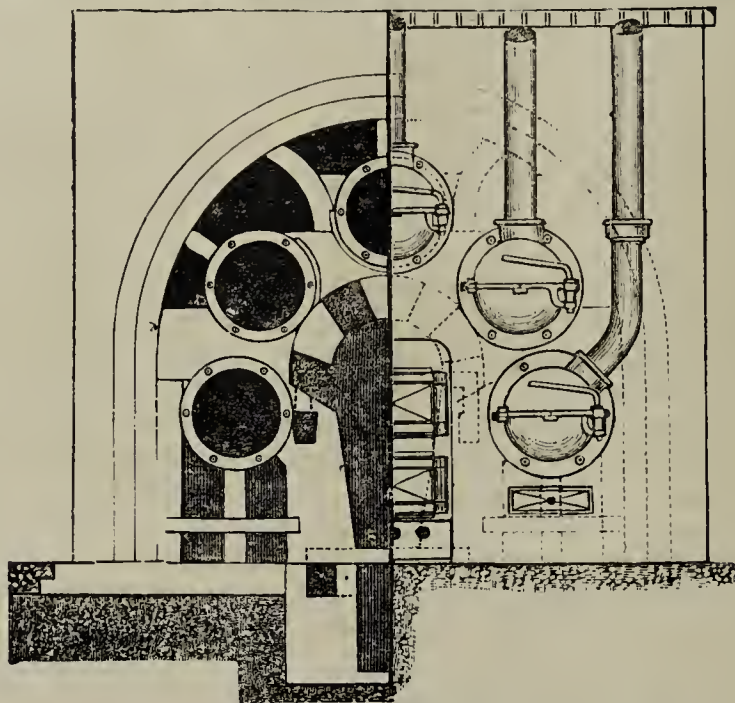
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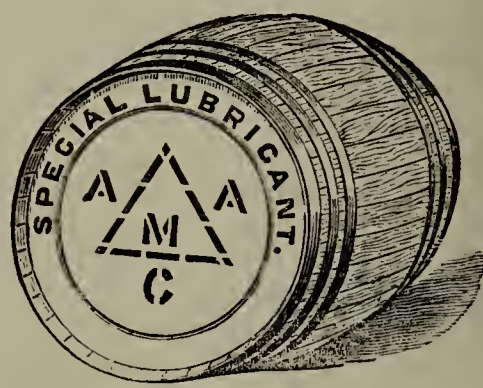
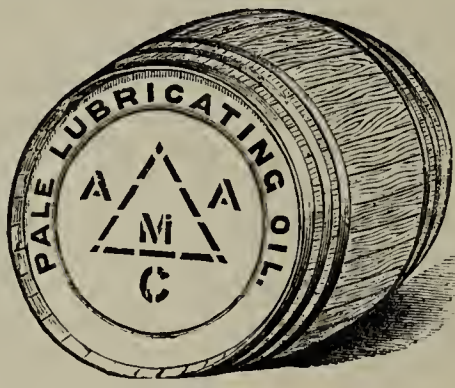
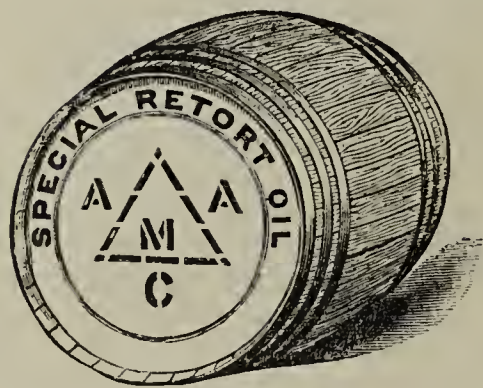
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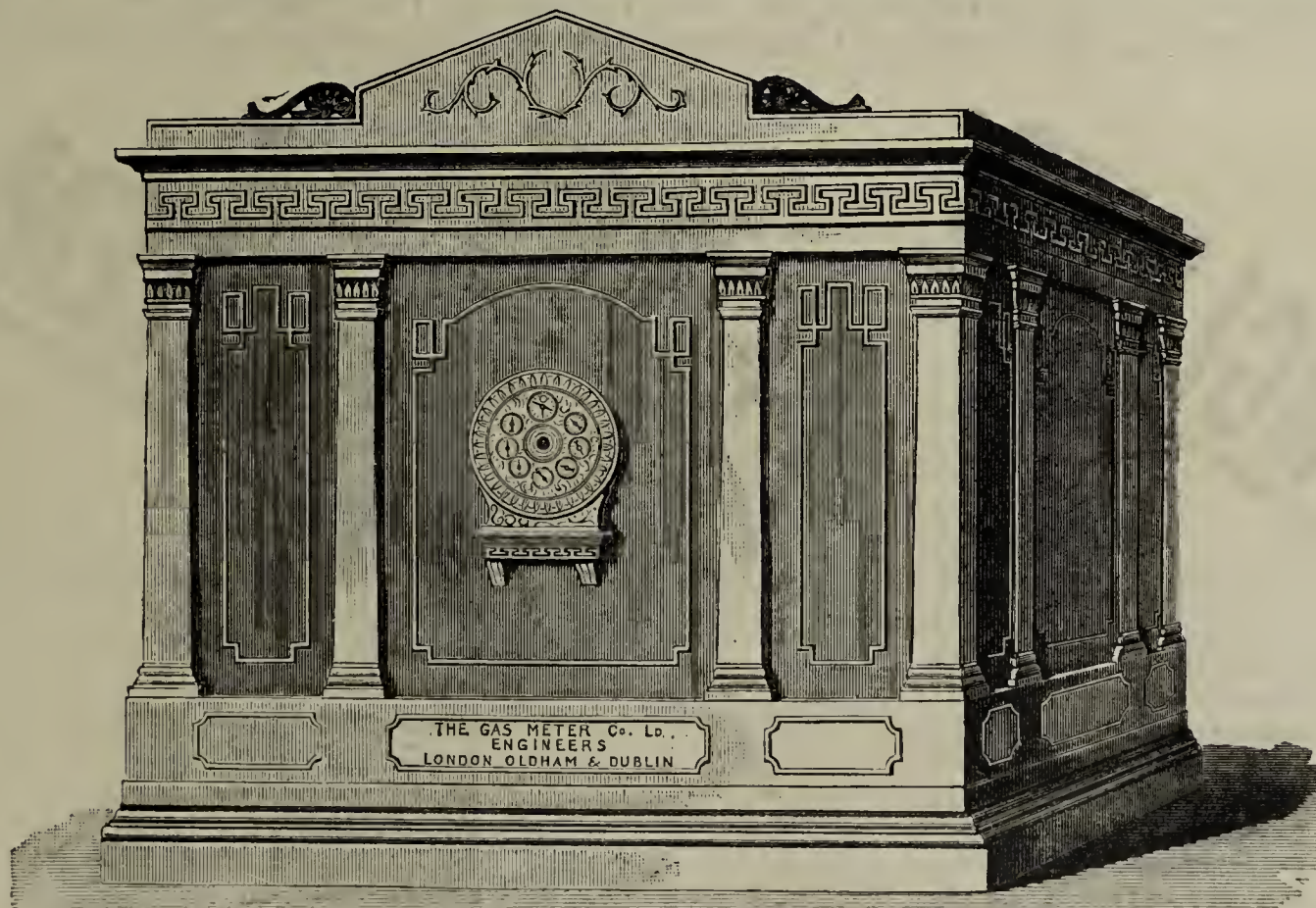
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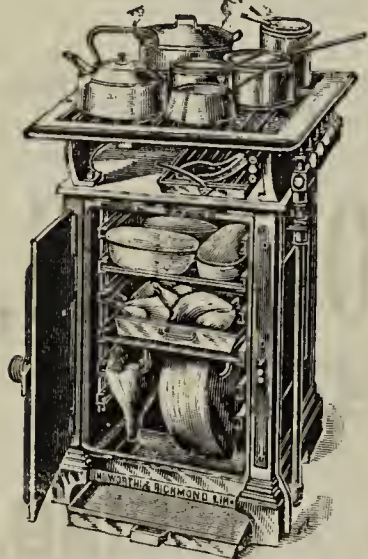


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Even if there is attributed to the term "gearing," to which I must return presently, the full meaning contended for by the plaintiffs, it is admitted, on their behalf, that this tensional method is not directly indicated by the provisional specification; but they argue that it must be treated as included therein by an application of the doctrine of "mechanical equivalents." As against this it was argued, on behalf of the defendants, that the doctrine is inapplicable to a specification claiming definite means for effecting an object; but that in such case the patentee must be restricted to the means selected and stated. There is somewhat of logical inconsistency in a patentee saying that the essence of his invention is in the defined means, but that he claims to bring within it other like means not defined. But I do not construe the plaintiffs' language as laying them open to this charge; and were it otherwise, I should not be prepared to hold that mechanical equivalents would be excluded. The doctrine is well established, and seems to me agreeable to the principles of patent legislation, and the authorities by which that legislation has been construed. To tell a patentee of a defined means of effecting a particular object that he must mention every possible alternative of every mechanical unit employed, or incur the risk of supersession by someone else who has found an alternative to be superior to the original proposition, would be to impose a burden never contemplated by the Legislature, and make the task of filing a provisional specification in such a case well-nigh impossible. This, however, leaves untouched the question whether the doctrine of mechanical equivalents assists the plaintiffs. That necessitates consideration of the term "gearing." It cannot be denied that the plaintiffs seek to attribute to this term a meaning far in excess of its proper one, if the standard of propriety is to be measured by the authority of the dictionaries or treatises, or even by common use. On the other hand, the language of practical science, no less than that of common life, is constantly changing; and words are made from time to time to convey meanings of a secondary and perhaps inaccurate character, which nevertheless are by degrees sufficiently recognized. It would, I think, be treating the plaintiffs too severely to bind them to the strict original meaning of "gear" and "gearing;" and if their patent can be upheld by the extensive and vague use of words, I think it ought to be done. The evidence convinces me that, though their use of the words is questionable, it cannot be said to be wholly unintelligible to those versed in such subjects. But this by no means removes all difficulties from the plaintiffs' way. They have to establish that their tensional method, for which they employ rope gearing, requires merely the substitution of mechanical equivalents for the instrument employed in the torsional method, in order to make the former an adaptation of the latter, or a reproduction thereof in a different form. The arguments and evidence have not convinced me that this is a sound construction of the provisional specification. That the language is difficult of construction is at once seen, if, in place of the words of reference, those referred to are written out at length; and the minute criticism which it received in the course of the arguments exhibited other difficulties not at first sight apparent. However construed, it raises the question whether ropes and friction or anti-friction pulleys (assuming these to be "gearing") are "mechanical equivalents" for toothed wheels. I take Dr. Hopkinson's evidence to decide this question adversely to the plaintiffs. He is not the only expert witness on that side; and the others, including Mr. Gadd himself, deserve, and have received, full attention. But when a gentleman of Dr. Hopkinson's scientific standing and experience in the witness-box is put forward as the prominent supporter of the plaintiffs' case, one must attribute great weight to any admission which he makes; and even if the other witnesses are pressed for, and do not make, like admissions, their testimony cannot be allowed to countervail his. I do not, however, find the other witnesses contradicting Dr. Hopkinson. It may be none of them made such pointed admissions, or saw so much difficulty in treating the complete as a development of the provisional specification. But it must be borne in mind that it was not the duty of the defendants to press, and that they did not press, these other witnesses with the same severity; and that Mr. Gadd's personal interest depreciates his testimony though I am sure he intended to be thoroughly honest. A word, however, about Mr. Davey. He was called after an interval which afforded an opportunity to the plaintiffs of refurbishing the weapons in their armoury, and manufacturing others of some novelty. But he could not cope with the difficulties presented to him; and his answer to a question (No. 2011) confirms Dr. Hopkinson none the less because of its guarded form. There are some other passages which, explaining the witness's views, show what this answer really meant. Coming to this conclusion on the plaintiffs' evidence, there is no occasion for me to criticize that of the defendants. Suffice it to say that Sir Frederick Bramwell was not driven to make an admission capable of contrast with that to which I have referred on this part of the case. The question upon which I have just expressed my opinion is capable of being stated in a somewhat different, and perhaps broader manner. Read the provisional specification, and, having mastered it, consider whether competent skill would discover therein the germ, the outline, the nature of the tensional method described in the complete specification. Or, inversely, read and master the complete specification, and consider whether the tensional method there fully described is indicated in the provisional specification. The latter is, to my mind, the more accurate way of putting the question; but whichever way it may be put, I think the evidence compels a negative answer. Here, again, I conceive Dr. Hopkinson's evidence to be well-nigh conclusive. His expression is that the tensional method is "adumbrated" in the provisional specification. This, so far as I am aware, is the first use of such an expression applied to such a subject. It is capable of several interpretations, some of which would haply be sufficient to save the plaintiffs' patent; but in the mouth of a witness of such learning and skill as Dr. Hopkinson, I construe it to mean that, however broad and deep the shadow may be, there is nothing of substance, and that the shadow did not afford an outline from which the substance could be perfected. In answer to one question, he would say no more than that when a mechanical engineer came to see the arrangement finally indicated, he would see that the words in the provisional specification applied to it; and in answer to another

question, he admitted that no one would have produced from the provisional specification any of the later drawings in the complete specification. I think it unnecessary here to refer to the other evidence, except again to say that Mr. Davey is, after full consideration, in accord; nor need I here repeat my comments on it, which are of the same character as those before made. I have not forgotten Mr. Gadd's original sketch, on which it was said he had made marks indicating that he had then discovered, and intended to include in his provisional specification, the tensional method; or his drawings on newspaper margins. It is quite possible that Mr. Gadd had then made the discovery; and I do not for a moment doubt the honesty of his belief that he had made it, though so large and important an addition to his invention is thus rested on a slender basis. He may have sacrificed accuracy to undue haste; and that undue haste may have been occasioned by Mr. Terrace's communication, and fear that this gentleman might beat him in the race. But I take these inquiries to be of no practical value. If, on the true construction of the two instruments, there is such non-conformity as voids the patent, it is no less fatal because a sufficient description was omitted from the provisional specification by a slip; while, on the other hand, if there be no such non-conformity by it, the patent will stand good, albeit Mr. Gadd did not at once see the whole of his invention, and the fortunate words were inserted without full appreciation of their meaning, or even by accident. The third question is whether the plaintiffs' invention has been anticipated by any of the other patents, or by any of the gasholders mentioned in the particulars of objections. This is a question of considerable detail and difficulty; but I shall dispose of it briefly. Having devoted no little time and thought to it, I desired and intended to express my views for the information of the parties, who might possibly wish to have them, notwithstanding my decision on the second question would make them less useful. But this question has necessarily been considered more or less contemporaneously with the others; and I am not ashamed to confess that, having once arrived at a conclusion on the second question, I have found it practically impossible to treat the third as if a decision thereon were essential to my final judgment in the case. Unless so treated, it could be of little value; and therefore I have been compelled to abandon the task, as I have done. I was much impressed by some of the prior specifications, and especially by those of Wild and Standfield. I cannot help thinking that, if either of these gentlemen had been asked to solve the problem which Mr. Gadd had before him, he would have done it without difficulty by reference to his own discovery as described in his specification; and equally I cannot help thinking that, if Mr. Gadd (whose knowledge outside his own study struck me as strangely narrow, having regard to his attainments, and the work on which he was engaged), had made himself acquainted with those specifications, he would at once have seen that they disclosed what he sought. But this does not make an end to the matter. The discoveries of Wild and Standfield produced results; and, notwithstanding those discoveries, no one had before 1887 seen the way to apply the methods there indicated to gasholders. There is much to be said in favour of the view that the application for the first time to a gasholder of mechanical means before applied on paper only to instruments of so different a character as pontoons and such-like structures, is invention within the meaning of patent law as well as it is in common parlance. That view derived considerable support from some of the cases cited by the Attorney-General—for instance, *Harwood v. The Great Northern Railway Company*, *Otto v. Linford*, and perhaps even still more, *Hill v. Evans*. The passages quoted from Lord Westbury's judgment in the latter case state guiding principles in this direction. I should have hesitated much and long on this point; but, as already mentioned, I have left it undetermined. The short result is that the plaintiffs' case fails. There will be judgment for the defendants, with costs to be taxed on the higher scale.

THAMES POLICE COURT.—Thursday, May 26.

(Before Mr. DICKINSON.)

The Commercial Company Fined for Gas Containing Sulphuretted Hydrogen.

To-day the Commercial Gas Company were summoned, at the instance of the London County Council, for supplying, on three occasions, gas of lower purity than is required by statute.

Mr. C. A. ROBERTS appeared in support of the summonses; Mr. G. H. YOUNG represented the Company.

Mr. ROBERTS opened the case by stating that the summonses were obtained against the Company for sending out gas containing sulphuretted hydrogen, which was specially prohibited by their Act of Parliament.

Mr. YOUNG admitted the liability of the Company to forfeiture; but said the question of the amount was for the Magistrate to decide. He hoped to lay such facts before him that a penalty of a penny would be considered sufficient. The quantity of sulphuretted hydrogen in this case was almost inappreciable; and the Examiner in his report admitted that he only found a "trace present." The Chief Gas Examiner (Dr. A. W. Williamson, F.R.S.) also admitted that the Company had considerable difficulty in discovering the source of the impurity, which was the result of a leakage in a large valve; and he was satisfied that the trace of sulphuretted hydrogen was caused thereby. The leakage occurred through no fault of the Company. He proposed to call the best evidence that could be obtained in England.

Mr. H. E. Jones, M.Inst.C.E., Engineer of the Company, said he could not think of any means by which the accident could have been prevented. The valve in question was the best of its kind, and had been in use for only six years, while a number of others which had been in use for 14 years were found.

Sir Frederick Bramwell, F.R.S., said he had visited the Company's Wapping station, and was acquainted with the mode of purification carried on there. What happened on the occasion in question was that a leakage occurred in the bye-pass valve, through which both pure and impure gas passed. Under ordinary circumstances, the gas was practically pure, and did not affect the quality of the supply. The presence of sulphuretted hydrogen did not arise from any fault on

the part of the Company. They made absolutely pure gas, and then by an accident it became foul.

Mr. DICKINSON said an accident which was extremely difficult to discover had arisen; and he should therefore impose the mitigated penalty of £3 and £1 3s. costs on the first summons, and £1 and 2s. costs on each of the other two summonses.

WEST HAM POLICE COURT.—Wednesday, May 25.

(Before Mr. BAGGALLAY.)

Barford v. The West Ham Gas Company.

To-day the West Ham Gas Company were summoned by Harry Barford, a gas stoker, for £8 1s., being the amount of a month's wages claimed by him in lieu of notice. The matter was taken up by the Gas Workers' Union.

Mr. C. E. JONES appeared in support of the summons; Mr. MORTON represented the Company.

Mr. JONES stated that Barford had been working for the Company for eighteen months; and in April last the Manager introduced some new scoops, which were heavier and longer than those which had been in use before, and therefore he could not lift them. He complained to the officials that he could not work with the new scoops; and their reply was, "If you don't do that, you'll do nothing else here." He therefore went away. One of the men had been injured by a new scoop; and another, who had been with the Company two years, refused to work it on the same grounds.

Mr. W. Thorne, General Secretary of the Union, said he had an interview with the Manager, on the 23rd of April, and they had a general conversation about the men refusing to work. Mr. Thorne admitted to him that the materials in this instance were thicker and heavier than those previously used; adding that it was not his fault, as he had directed the manufacturers to make them as before. Mr. Thorne sent for Mr. Robinson, the head foreman, and they went together down to the blacksmith's shop and examined some of the old scoops. They afterwards went to the retort-house where this scoop was in use, and plaintiff and others complained of it being larger and heavier. He went again on the following Monday to see them; and Mr. Thorne suggested that the scoop should be cut down. Witness visited the works next day; and, as the scoop had not then been cut, Mr. Thorne, in witness's hearing, ordered it to be done.

Mr. E. H. Thorne referred to the discussion between himself and Mr. Thorne, and said the complainant never returned. Had he done so on Monday or Tuesday, he should have set him on. Witness caused much surprise by stating that they would have been compelled to take the man on; but they would have given him a month's notice, as there a scene that it had to be put a stop to.

In cross-examination, witness said he had not heard a word about a man having injured himself by using this scoop. The principal foreman made no complaint to him. He did not cut anything off the shoe end; but off the handle end of the scoop, where there was never any coal. The men, however, said it was difficult to get the handle on again; and he then ordered 3 inches to be cut off the shoe end. He thought the complaint most unreasonable; but he altered the scoop to save any friction with the men. There had been no difference in the length of the scoop for 25 years; but as soon as he found it out he altered it.

His WORSHIP, without any comments, found for the complainant for the amount claimed; but as it transpired that he had been at work five days out of the month, these were deducted, and judgment was given for £6 12s. 3d.

WANDSWORTH POLICE COURT.—Wednesday, May 25.

(Before Mr. DENMAN.)

Charge of Neglecting to Supply Water.

To-day the Southwark and Vauxhall Water Company were summoned by Mr. H. Dumas, an insurance broker and an underwriter at Lloyd's, residing at 7, The Cedars, Clapham Common, for unlawfully neglecting to furnish to his premises a supply of water.

Mr. H. DUMAS, barrister, appeared to support the summons; Mr. W. P. HORTON represented the Company.

Mr. DUMAS, in opening the case, said his client had had cause to complain on more than one occasion about an insufficient supply of water. Remonstrances were of no avail, and on the 8th and 9th of the present month considerable inconvenience was occasioned by an absence of water.

Complainant's cook testified that there was no water in the house on the days in question; and Mr. Dumas stated that he always paid the water-rates promptly. On the 8th inst. a telegram was sent to the Company stating that there was, as usual, no water in the house. Some hours later, the supply was renewed.

Mr. HORTON explained the reason for the non-supply of water on the occasion in question. On the 8th inst., the Company were engaged in laying filter-beds at the central works at Hampton; and it was therefore necessary to divert the main-pipe. The complainant's house was the highest on Clapham Common; and when the water pressure was diminished, Mr. Dumas was deprived of the proper supply. He claimed exemption under section 42 of the Company's Act, which deals with the temporary cessation of water through unavoidable causes or the carrying out of necessary works. His further point was that at the time of the suspension of the supply, the rate had not been paid.

Mr. DENMAN observed that this was a very narrow point for the Company to take up.

Mr. DUMAS said that for 30 years the rate had been paid promptly; and the Company had no right to raise such a question.

Mr. DENMAN said the rate had not been paid, and the complainant must fail in consequence. He dismissed the summons on this ground alone; observing that he had to carry out the Act of Parliament as he found it.

MISCELLANEOUS NEWS.

THE METROPOLITAN WATER SUPPLY COMMISSION.

Tuesday, May 17.

Lord BALFOUR OF BURLEIGH, *Chairman*; Sir G. B. BRUCE, Sir A. GEIKIE, F.R.S., Professor DEWAR, F.R.S., Mr. G. H. HILL, M.Inst.C.E., Mr. J. MANSENGH, M.Inst.C.E., and Dr. W. OGLE, *Commissioners*.)

On the resumption of the proceedings to-day, Mr. Francis was recalled for the purpose of giving some further particulars in regard to the wells.

Mr. MANSENGH remarked that the water from the Chadwell Springs was delivered by gravitation; and he wished the witness to draw a line on the plan through all the wells, giving approximately the normal level of saturation—that was, the level to which the water rose after pumping had been stopped for some time.

Witness said he would furnish the statement.

Evidence was then called on behalf of the East London Company.

Mr. W. B. Bryan, M.Inst.C.E., examined by the CHAIRMAN, said he had been Engineer to the East London Water Company for ten years. They had two intakes—one at Ponder's End, and the other just below the Ordnance Factory at Enfield. At the former, the water left the navigation, and came along the river to Chingford Mill, where the river took the whole stream. The other intake stream went by Sewardstone, and joined first just above Chingford Mill. The water they took finally left the River Lea at Chingford Mill. It did not go back again into the river when it came down these subsidiary streams. They took out of the river, at their upper intake, whatever was flowing down, and passing their works—the whole of it. It amounted, on an average, to from 32,000,000 to 33,000,000 gallons a day, including also what passed out of the river at Ponder's End. The low-level reservoirs were supplied from the tail of the mill. The water from the lower intake went down to the mill-stream, which was cut off absolutely from the Lea. A large quantity of water went into the Lea beyond what was required for the navigation; in fact, the whole of the flow of the river which was not taken into the Company's reservoirs. The bulk varied with the season. In a very droughty season, the quantity which passed down was not very great, though it was never reduced to nothing. Taking one day with another, last year the average was upwards of 35,000,000 gallons; but in 1890 it was more than 37,000,000 gallons. He believed the New River Company might, if they chose, take half of what the East London Company took beyond the 22,500,000 gallons. But there was an arrangement for taking water when it was in flow; and his Company had constructed large reservoirs for the purpose of taking it when the river was high. The distance from the New River Company's intake to the upper intake of the East London Company, measuring along the course of the river, was, roughly speaking, about 22 miles; but measured in a straight line, it was much less than that.

The CHAIRMAN: It has been stated to us that the Lea Conservancy do not wish to have so large a quantity as is allotted to them by the Acts; and reference has been made to the proceedings before the River Lea Committee in 1886 in proof of this statement. Have you any comments to make upon that?

Witness: The only comment I have to make is that the Lea Conservancy take as much as they require for the navigation—that is, they may do it, though I am not prepared to say they do. I can say, however, that my Company have never objected to their taking the full quantity of water; nor have they ever asked the Lea Conservancy not to take it.

Have any other persons made complaints in that respect?—Not that I am aware of, to my Company. There have been letters sent to the newspapers.

You estimate for the future 30,000,000 gallons a day as the amount it will be safe for your Company to take from the Lea, and the full amount you can draw from the Thames. At present, have you ever drawn your full quantity from the Thames?—Yes, as nearly as possible. We get about 9,800,000 gallons. That is as near as we can reckon it. We have drawn that quantity for a fortnight together. We took as much as 9,750,000 gallons a day for about four weeks in 1885; but not so much since that time. The average quantity we draw from the Thames comes out very much lower than that.

Do you think it safe to estimate for the future that you can take 10,000,000 gallons a day?—Certainly. I do not know for the moment, what the population of the Lea Valley above our intake is, though I have gone into the matter.

Do you think the quality of the water at the point where you get it (your raw material), is improving or getting worse?—Improving, distinctly. As regards our Thames works, we do not take in any water there when the river is in flood. We rely upon our storage reservoirs in the Lea Valley. We have a subsiding basin holding 5,000,000 gallons; but it is very small.

Asked if he had any remarks to make with regard to pollution of the Lea from traffic, witness said that whatever pollution there might be was very infinitesimal. The bulk of the traffic along the Lea stopped short below the Company's intake. Some of it went higher, but he could not say how much. The gaugings of the river during the last twelve years, which had been tabulated, had been taken in such a manner as practically to vitiate all the original gaugings, from the fact that mistakes had been made by a new lock-keeper appointed on the death of his predecessor. The gaugings were taken at eight different gates; and the lock-keeper mistook between east and west, and read them in the wrong sequence. This was only discovered at the time of the River Lea Commission, when it became evident that something was wrong because the quantity of water coming into the Company's reservoirs did not agree with that which was stored in times of difficulty. The same thing occurred during the intense frost of December, 1889. According to the gaugings, the amount was 13,000,000 gallons a day; but instead of this, the Company were only drawing 3,000,000 gallons. Fresh gaugings were then taken.

The CHAIRMAN: What we want to know is, what was the minimum quantity of water going over the weir for a certain number of days, or weeks, or months in summer—say, for any particular period in 1887.

Witness: August, 1887, was rather a drouthy month. The flow was pretty equal from the first day to the last. The average amount was 2465 cubic feet per minute.

We cannot take it in that way; we have been dealing with the matter by the numbers of gallons per day.—In October, 1884, it was 30,000,000 gallons a day; for August, 1887, it was about 22,000,000 gallons flowing over Field's Weir. I could not say how much of this would go to the navigation below, because there is a certain quantity taken for this purpose, which would be prevented from passing over the weir.

Have you any other information to give the Commission with regard to the springs or wells from which water is supplied?—We have two wells in process of construction. No account has been taken of the exact quantity of water pumped from the river into the filtering-beds. It would not be very large—not exceeding 2,000,000 gallons a day. I could give exactly how much we distributed from our reservoirs.

What would really be the most adverse set of circumstances which you consider likely to occur in making your estimate of supply?—I think prolonged frost. Suppose the rivers were to be somewhat dry at the end of the year, and we had a very prolonged frost, as we had in the winter of 1889-90, this would be the time when our resources of water would be lowest. We should then have perhaps more water in the wells, but not so much in the river.

Can you give me figures to show for how long you may not get so much water out of the river, and may have to supplement it by the well and storage water?—I think the longest period would be from two to three months that we should have to draw from our storage reservoirs and wells. During that time, I think we could get out of the river from 20,000,000 to 22,000,000 gallons a day; you might put it at 20,000,000 gallons.

Under these circumstances, what amount would be drawn from storage and from the wells?—We should take 20,000,000 gallons from the Lea, 10,000,000 gallons from the Thames, at least 6,000,000 gallons from our existing wells, and the remainder from storage. Our total storage capacity is 910,000,000 gallons. We have more than this, because we have many acres of gravel which are saturated with water; but if you take it at that figure, you will not be far out.

By Mr. MANSERGH: I had no means whatever of stating what quantity we have taken daily from the river. The whole of the water passes through our reservoirs; and we cannot take any direct to our filter-beds without its going through the reservoirs. When the Lea is in flood, we close the intake absolutely for a week together, and sometimes for longer than that. At our Lea Bridge works, we have 25 acres of filter-beds. The maximum area we have out of use at any time for cleaning would be about 3 acres. The length of stroke of the engines varies greatly between night and day. The approximate shortness of stroke would be about 10 per cent. We have a very large amount of reserve power. At the pumping-stations, we have engines capable of pumping the maximum quantity required; and a reserve as well. We have sometimes pumped 55,000,000 gallons; but a great portion of it goes to waste. As regards the future, our increase will all be in the Essex district. The average population per house in the London district is 7·62; in our Essex district, it is only 6·1.

Professor DEWAR: In the statement sent in by the Lea Conservancy, there are named several sewage-treated towns above your intake, in addition to the sewage and cesspool towns. Altogether there are 13 sewage-treated towns above your intake and that of the New River Company. Are you acquainted with any of those towns?

Witness: Only with Hertford and Cheshunt. Cheshunt does not now drain into the river. The East London Water Company constructed a separate drain, about 30 or 40 years ago, extending as far as Ponder's End, and now they treat their sewage themselves. By arrangement with the Company, the effluent is discharged some distance below the intake.

Would it be fair to say that the analysis of the East London water would show an increase of 50 per cent. of organic impurity more than that of the New River Company?—I cannot speak with certainty; but I have no doubt that the amount of organic impurity in the East London water is greater than in that of the New River Company, who have a larger amount of well water. I attribute it also to the better position of their intake; but I do not think there is much contamination in the River Lea between their intake and ours.

You do not attribute this increased amount of organic impurity to the 13 sewage-treated towns between their intake and your own?—No; I attribute it, in a great measure, to the addition of the well water, and not to any large addition of animal or vegetable impurity in this water.

By Mr. HILL: My Company have acquired a very large area—some 90 acres—adjoining their existing reservoirs and higher up the valley, for the purpose of supplementing their storage; and farther up they have excellent sites on which storage reservoirs can be built. At present the Company are in possession of a very large area for storage purposes. We do not take in turbid water; and the figures given are quite irrespective of that. At first the flood water is rather thick; but five or six days afterwards, it is in very good condition. This depends upon the amount of rainfall; and if it is continued, we shut down our intakes and draw from our storage. In no case, in my experience, have we been unable to fill up again with good water two or three days after floods. The levels of the gravel and London clay are very uneven. Some years ago, the Grand Junction Water Company had to go to considerable expense to exclude sewage from the gravel; but this was not a parallel case to that of the East London Company, because a building estate was about to be opened up at that time near the Grand Junction works.

By the CHAIRMAN: A supply of 2,000,000 gallons per day is taken at Hanworth, two miles north of the Thames. This is not included in the 10,000,000 gallons taken from the river. The level of the Hanworth water is 13 feet higher than that of the Thames. When we cease pumping, it is from 4 to 5 feet below the surface of the ground; and when we pump it is 4 or 5 feet more. I do not think there is much danger of pollution from cesspools and from the surrounding population, because we drive tunnels through the London clay, and then take in the water through perforated pipes. These tunnels are 600 or 700 feet from the nearest houses, and are about 40 feet below the surface. They have no reference to the level of the water, and are driven in

the clay as a matter of convenience. Over the clay there is a gravel bed. The supply of 2,000,000 gallons of water a day would depend upon the ground not being opened up for building purposes. The water has been analyzed, and the report was satisfactory.

By Professor DEWAR: The 22,000,000 gallons constitute the entire amount available for any Company; the navigation being provided for, and the New River Company having previously extracted their water. The total flow would be that quantity *plus* what is taken by the New River Company—*i.e.*, 44,000,000 gallons a day. The upper reaches of the Lea are so permeable to percolation that the ordinary gaugings are quite useless. I have not therefore estimated the rainfall, but have taken the measurement of the river itself without giving any fractions for the rainfall. However, percolation results can easily be given.

By Mr. HILL: I think the supply at Hanworth is permanent, because there is a bank of clay which holds up an immense mass of water, and the gravel bed extends 70 or 80 square miles. Ever since we have been pumping—that is three or four years—I have had the depth of water in a bore-hole taken every week; and I find that the supply is permanent. It is water on its way to the Thames, at a much higher level; and our pumping has not been shown to have any effect. The pumping is not absolutely continuous. We are simply taking a small portion of a surplus which is ever flowing towards the river.

By Sir A. GEIKIE: There is a large tract of country to the north of Hanworth which is very permeable; and I think the water comes from there. The ground is not built over; it is a very sparse population indeed.

The CHAIRMAN: Can you furnish us with information as to the wells, their depths, bores, and the amount of water taken from them?

Witness: Our most northerly well is at Waltham Abbey. The cylinders are of cast iron, and are taken into the chalk, so as to exclude any surface water between that and the London clay. That shaft is continued 198 feet from the surface. Galleries have been driven from it, and bore-holes from the bottom of the tunnels. The total yield of that well is slightly over 5,000,000 gallons. At Walthamstow we have a well 15 feet in diameter carried down to the chalk. It is only in process of construction at present. Tunnels are being driven; and we are pumping 2,000,000 gallons a day into the canal.

Your statement is that you take from the wells 3,681,000 gallons, of which 1,500,000 gallons come from the Hanworth Springs; so that you can only have 2,000,000 from the other wells. Yet from this one well at Walthamstow you say you pump 2,000,000 gallons a day into the stream?—But that has not been counted. The water is so chalky while the well is in course of construction, that we pump it to waste to get rid of it. From Waltham Abbey we are pumping at present 800,000 gallons a day direct into the district. Last year the Chingford Well was in operation the whole time, and would average about 500,000 gallons a day. At that time we were also pumping at Walthamstow from an old artesian well sunk in 1867 by Mr. Greaves, the Company's Engineer; and we were pumping from that about 400,000 gallons a day. The remainder of the 3,681,000 gallons was the estimated quantity taken from the gravel springs at Hanworth.

So that last year, exclusive of Hanworth, you had only three wells directly serving your district?—Yes: from the existing wells in the Lea Valley we can get 11,000,000 gallons; that is 9,000,000 gallons more than we are now taking.

You propose to take 20,000,000 gallons a day more than you are taking at present?—Yes; so that between the two Companies we propose to draw something like 44,000,000 gallons more a day from the chalk wells than we are drawing now. With regard to depression, complaint was made that we have reduced the water in Hertfordshire, close to Waltham Cross Station; but last Saturday (May 14) the water-level was about 15 or 16 feet from the surface, and 100 feet above the chalk. This shows at once that the depression cannot go very far. The Tottenham Local Board have a well from which they draw water by suction-pipes. The result is shown that we have not depleted or decreased their water in that well. In all the cases I have investigated, I have found that we have not lowered the water in anything like the manner stated.

Do you think it is a safe estimate that you can take 44,000,000 gallons of water more than you have been in the habit of taking?—Yes; because, in my opinion, there is an immense body of water running to waste, in a south-easterly direction, into the Thames near Purfleet, Grays, and that neighbourhood. I feel confident that there is a huge volume of water passing steadily in that direction into the Thames; and the quantity we pump from it is simply some of the surplus. Our wells fill up again immediately after we cease to pump. The water comes up the shaft at the rate of 40 feet an hour at Waltham. We cannot reduce the level, with our existing pumps, to nearer than 128 feet from the bottom of the wells.

By Sir G. B. BRUCE: We obtained power to sink wells by an Act passed in 1866.

By Mr. HILL: The taking of 44,000,000 gallons of water will not affect the surface of the surrounding country as far as my Company are concerned. The level of the water above the London clay remains exactly the same day by day. I cannot see how any amount of abstraction from the London chalk can affect the surface streams or the springs generally. There is no outcrop of the chalk in the East London Company's district.

The CHAIRMAN: Let us have the calculations upon which you have arrived at the average number of gallons of water per head per day supplied for all purposes in 1871, 1881, and 1891; and you can put into that, if you like, the reasoning by which you think some of the calculations may be made fallacious.

Witness: My calculations have been made fallacious simply by following the returns of the Registrar-General. In 1891 the number of supplies was 172,310; and in making my estimate for the future, I had to take into consideration that in the county of London there has lately been a decrease in the number of houses.

You have divided your district into intra and extra Metropolitan. Where is your line of division?—There are 104,000 supplies within the Metropolis; that is to say, within the county of London. The division is according to the area of the County Council.

What is the reason for taking that rather than dividing the number

of gallons by the supplies?—For the reason that the character of the London area supply is so different.

Will not the districts change in the future as they have changed in the past?—The whole character of the district outside London is such that you cannot take 7·6 as the figure. The houses are very small—four-roomed, in general. The calculation for future supply comes to about 33 gallons per head per day.

You have based upon that assumed figure your calculations as to supplying the gross amount of water you think you may be called upon to send out for the next 40 years?—Yes. I think that is not only a safe, but an excessive amount to estimate for our district, because there is now such a wretched state of things in our supply at the East-end of London. For years the whole county of London has had a constant service; and this increases very much indeed the quantity of water supplied per head per day. In that respect our experience and our population differ very much from those of other companies. There is an utter carelessness among the poorer classes in using water; and the alien immigration has caused an immense amount of waste. Their practice is not to use water with soap in the ordinary way for washing clothes, but to leave the taps running over them for perhaps a couple of days. In some places the consumption runs as high as 70 gallons per head per day. The landlords are willing to help us; but they are quite powerless to deal with the tenants. There is very great waste in the dead of the night. To meet the difficulty of defective fittings, during the last three or four years, my Company, instead of serving notices on the people, have repaired the taps themselves, and put leathers on free of cost. There is a most hopeless condition of things in some parts of the East-end of London. That is the reason I have kept my estimate so high as 33 gallons.

By Dr. OGLE: I do not assume by supplies the same thing as the Registrar-General in returning houses; but it does not affect the results, because I take our total population, and divide by our total number of supplies. In my opinion, I have given much too high a figure for future increase. It is most difficult to estimate the future population of the East-end of London. One or two more Dock strikes would leave very little population in Canning Town and the neighbourhood. That is a decreasing population. It is impossible to tell what the East-end of London will become in a few years. Its prosperity has already been checked. Future increase will probably go farther down the river outside our district. With regard to the 14,000,000 gallons, I am assuming that the increase in future cannot possibly be as rapid as in the past. As to the alleged depletion of the River Lea, it is as full now as it ever has been. Then navigation has always been kept fully supplied. If you dig down a couple of feet anywhere in the valley, you come to water. I do not agree with the complaint made by the Lea Conservancy as to the alleged difficulty in keeping the navigation going at and below Old Ford. The tides come up, and leave a deposit of mud; and they have filled up the compensation reservoir which was constructed by my Company a great number of years ago, so that the mud is no longer flushed out.

Sir F. Bramwell, examined by the CHAIRMAN, said he had directed his attention to the points which the Commission was appointed to consider. He had been consulted by the East London Water Company for some time past, especially with reference to this question; but had no official connection with it. One important question was the growth of the population. The Company's district comprised two divisions—one within, and the other beyond the Metropolis. The former should be taken as practically filled up, and incapable of extension as regards water supply requirements. The extra-Metropolitan area was capable of more extension. With regard to the supplies of the Company, both external and internal, between 1881 and 1882, the percentage of increase was 3·6; in the next year, it was 3·9; and in 1891, it was 1·7. He had not dealt with the rural population of the Lea Valley; but with regard to the urban population north of the New River Company's supply, there had been positive decreases of population in Bishop's Stortford and Hertford between 1881 and 1891. At Luton there had been an increase in the same period from 17,000 to 30,000. He could not imagine that the results of taking water by the East London Company from the Lea Valley could have any prejudicial effect upon those urban populations. Luton was 13 miles away in a direct line. Stevenage was 8 or 9 miles, and Bishop's Stortford was 9 miles from the district of the East London Company. The estimate of 33 gallons per head was largely, he thought, in excess of what it ought to be. He should say that, including the trade supply of 6 or 7 gallons per head, for that class of property it ought to come down to 25 or 27 gallons.

The CHAIRMAN: Is that founded upon your knowledge of East London, or upon what an urban population similar in character ought to consume?

Witness: The fact that they take this quantity of water is obtained from what I am told, and from my knowledge of East London. Other Companies, as you will no doubt hear, are able to do better; and if the East London Company had the fair assistance of the authorities in insisting upon proper fittings and upon the supply not being abused, they would be able to do what I say without stinting anybody.

Mr. MANSEIGH: What is your opinion with regard to the district being on a constant instead of an intermittent supply? Which takes the larger quantity of water?

Witness: I think where the consumers deal honestly and in reasonable fairness with the Company, the constant supply takes the least water.

The CHAIRMAN: As regards the River Lea, do you consider that the pollution which exists above the intakes of the East London Company, and which, to some extent more or less, but still to some extent, arises from sewage being conveyed into the stream from which the intake is derived, has any prejudicial effect upon the quality of the water, or an effect prejudicial for all possible purposes of consumption?

Witness: As regards the form in which the question is put, I should appeal to the facts, and say "No;" as an abstract proposition, "Yes."

Do you think any organic matter which finds its way into the raw material (that is, the water taken from such sources as I have indicated) can be undoubtedly taken out by filtration?—Organic matter I should say "Yes." I do not know that I have sufficient knowledge to say

where organic matter begins or ends. Vegetable matter can be largely taken out; but if you are referring to pollution in the way of sewage, then all I have to say is that I wish that kept out as far as possible. But in so far as it is not kept out, I think one can appeal to the health of the district to show that no harm has arisen from it at present; and I should consider there will be less harm in the future than in the past, because greater and better efforts will be made to keep it out.

Professor *Boyd Dawkins*, examined by the CHAIRMAN as to the areas of chalk and impervious London clay within the Company's district, said the River Lea chalk area was 275 square miles in extent, including outlyers; and the quantity of water falling upon it was very considerable, depending upon the rainfall and the amount of percolation. One inch over this area would give 11,000,000 gallons a day. Looking at all the conditions of the case, there would be not less than 10 inches of rain per annum going into the chalk. The surface of saturation runs to a height of 400 feet in this area. A large quantity of water was derived from the deep wells sunk below the line of saturation. The area of Thanet sand belonged to the same geological system as the chalk; water passing freely from one to the other.

The witness was further examined in detail as to the geological strata of the district.

Mr. *W. Topley*, F.R.S., was examined by the CHAIRMAN as to the surface from which the East London Water Company draw their supply, at the point where the London clay is denuded, and where the gravel and sand overlies the tertiary formation. He said a great part of the water was derived from the tertiary sands. The wells in the Lea Valley might be largely increased.

Mr. *J. H. Barnes*, M.Inst.C.E., examined by the CHAIRMAN, gave evidence as to the flow of the Lea and the gaugings. He handed in a table showing from 1880 to 1891 the average monthly flow of the river at Field's Weir in cubic feet and the number of gallons per day. In September, 1891, the quantity was 21,800,000 gallons daily. He did not know what the navigation required.

Major *Lamorock Flower*, Consulting Engineer to the Lea Conservancy, was called; but his evidence was postponed, so as to be given with that of the other witnesses for that body.

Mr. *W. C. Young*, Consulting Chemist to the Lea Conservancy, said he had made analyses of the water for the East London Water Company, with special reference to this inquiry. There was now a considerable diminution in the organic pollution of the water; the samples taken from the River Lea in 1891 being very much better than those of 1884 and 1886. The remainder of this witness's evidence was postponed, as in the case of the previous witness.

The Commission then adjourned till yesterday, when the evidence on behalf of the Lea Conservancy was taken. It will be followed by that for the Companies drawing their supplies from the Thames, and also for the Kent Water Company.

EXHIBITIONS OF GAS APPLIANCES.

A four days' exhibition of gas ranges, heating-stoves, and other gas appliances, made by Messrs. Fletcher, Russell, and Co., Limited, of Warrington and London, was opened last Tuesday, in the Gladstone Hall, Chatham, under the auspices of the Rochester, Chatham, and Strood Gas Company. The general arrangements were made by the Company's District Superintendent (Mr. Walter Hole), and were highly satisfactory. In connection with the exhibition, Mrs. Charles Marshall delivered a course of cookery lectures which were thoroughly appreciated by crowded audiences; and at the last of the series, Mr. Hole fittingly closed a most successful exhibition by offering, on behalf of the ladies attending the lectures, their hearty thanks to Mrs. Marshall for the kind and sympathetic manner in which she had conducted her lectures, explained difficulties, and answered the frequent questions put to her. Mrs. Marshall briefly thanked the ladies present for the close attention they had paid to the lectures, which had made them so successful. An exhibition of stoves manufactured by Messrs. R. and A. Main, of London and Glasgow, was commenced last Tuesday at Beeston; and during its course Miss Thompson, Principal of the Nottingham and District School of Cookery, delivered practical lectures on high-class cooking. Under the auspices of the Shaftesbury Gas Company, Messrs. Darwin, of London and Glasgow, exhibited last week a collection of their various gas appliances in the Market House, which each evening was brilliantly lighted by Wenham lamps. The exhibition was opened by the Mayor on Tuesday, and was continued on the two following days. Miss Nicholls, of the South Kensington School of Cookery, gave practical lessons in the art of cooking by gas in the afternoon and evening of each day. The whole of the arrangements were efficiently carried out by the Gas Manager (Mr. E. Yates). Last week the Chard Gas Company had a very successful exhibition of gas appliances in the Corn Exchange in that town. The stove exhibits were supplied by Messrs. Richmond and Co., Limited, of Warrington and London, who were represented by Mr. A. Mead; and the general arrangements were carried out by Mr. F. Turner, Manager of the Gas Company. The exhibition was opened by the Mayor (Mr. A. Venables Kyrke), who was thanked by the Chairman of the Company (Mr. Willey) for undertaking the duty. Lectures on cookery were delivered by Mrs. Bennett; and on Friday evening the Mayor and Corporation and the general public partook, in the Town Hall, of a gas-cooked supper, which was a great success.

An Extraordinary Accident to a Gas-Meter.—Early last Wednesday morning, at Messrs. Russell and Sons' Peel Foundry, Derby, the lightning struck a flagpost on one of the out-buildings, and tore away a long strip of wood the whole length of the post. At the same time a loud report was heard in the store-room, where the gas-meter, a very large one, is situated, and a strong smell of gas, which soon made itself apparent, at once showed that something serious had happened. An investigation of the spot revealed that the meter had been displaced, and one side of it had been cut out as though with a knife. It is 3ft. 6in. diameter, and made of cast-iron $\frac{1}{2}$ -inch thick.

THE BIRMINGHAM CORPORATION GAS DEPARTMENT.

The Annual Report.

At the Meeting of the Birmingham City Council last Tuesday—the Mayor (Mr. Lawley Parker) presiding—the annual report of the Gas Committee, the principal portions of which appeared in these columns last week, was submitted.

Alderman POLLACK moved—"That the Gas Committee be authorized to appropriate £22,144 2s. 1d., being the net profit of the Gas Department for the year ended the 31st of March, 1892, to the credit of the improvement rate of 1891." He said that, on the last two occasions on which he had presented reports of the Gas Committee, he had endeavoured to prepare the members to expect unfavourable results from the trading of the last financial year; and this for the obvious reason that, while the cost of coal had slightly increased, the price of coke, which was their chief residual, had to be reduced, and was certain to produce a less revenue than in the preceding financial year. Under these circumstances, it must be an agreeable surprise that the Committee were able to recommend that the sum of £22,144, which was but little short of the usual £25,000, should be appropriated to the improvement rate. It would be seen that, while the gross profits of the preceding financial year were £131,247, those of the year just ended were only £114,170—a decrease of £17,077. In examining as to the cause of this, it would be observed that the revenue from coke and breeze had been £20,423 less than in the preceding year; and this alone would account for even a larger decrease of profits. But there had been other unfavourable causes at work. It was true that, with respect to the sale of gas, they had an exceptionally good year; there having been an increase of £26,138, or a little more than 4 per cent. Under ordinary circumstances, this ought to have yielded them a very large profit; but if they looked at the debtor side of the account, they would see that there had been an additional cost of coal amounting to £20,448, and of wages in the retort-house of £4191. They had also to pay an additional £2859 for purification; and there were other items in which there was an increased expenditure of £586—making a total increased charge in respect of the production of gas of £28,085. He had already said that the extra revenue from the sale of gas was £26,138; and they had to add to this the additional profit on fittings, discount, &c., of £398—making together £26,536. Unfortunately, from this amount they had to deduct £19,417 deficiency of income from residuals, which reduced the surplus on the credit side to £7119. If this sum was deducted from the increased expenditure of £28,085, they found there was a net increase in expenses to produce the quantity of gas they had sold of £20,966. But this was in excess of the £17,077, forming the difference between the trading profit of 1890 and that of 1891; and they would doubtless ask him from what source he derived the difference of £3889. This would be found on the credit side of the revenue account under the head of discounts and adjustments. Last year the amount provided for that item was £19,519; but this year it had been reduced to £15,630. The reason for the reduction was that hitherto they had kept in reserve a sum equivalent to 7½ per cent. of the last quarter of the year's accounts, to provide for discounts and losses from bad debts. They had found, however, during the last few years that their losses from bad debts had been gradually decreasing, and were now very small. The present amount was only £711, as against £803 last year, and £1375 in 1887. Now, if they looked at the profit and loss account, it would be seen that the Committee had omitted to provide for the statutory instalment of the sinking fund, which in the past year amounted to £4217. Twelve months ago they were fortunate enough to be able to recommend, and he had the pleasure of moving, that the sum of £45,256 should be put to the credit of the sinking fund. This was a very large sum; and the Committee thought that, under the circumstances, there was no immediate necessity to increase this account. This omission enabled them to reduce the amounts provided for annuities and interest, and to make up the balance of profit for the year to the sum named in the resolution. Had it not been for this suspension of the statutory instalment of the sinking fund, and the reduction of the amount provided for discounts and adjustments, their profit for the year would have fallen to £14,037. It showed the wisdom of making reserves in the good years, that they might be able to fall back upon them in years of depression. The question was, How long would the depression last? How long would they be able to face it without resorting to an increase in the price of gas? This would entirely depend upon the contracts which they were about to make for coal and tar—contracts which would be completed within a few weeks. Not until then would the Committee be able to make a correct forecast of their income and expenditure, and say whether or not it was necessary to increase the price of gas. The Council knew full well that the Committee were most unwilling to take such a step, and that they would not take it unless they found it absolutely inevitable. In the meantime, he thought the members would give credit to the Committee for having had to face most adverse circumstances. Their coal bill last year was £271,000. Coal had risen greatly since 1888, when the average price was 8s. 8d. per ton, as against 12s. last year. Had they been able to buy coal in the last financial year at the prices of 1888, the difference to them would have been not less than £75,000. The wages for carbonizing, which in 1888 were £35,157, amounted last year to about £57,000. Taking into consideration the additional quantity of coal distilled, the additional wages paid in the retort-house alone, as compared with 1880, were £14,300. Yet, though they had this extra expenditure of nearly £90,000, the price charged for gas was the same as in 1888. There were some hopeful circumstances which they might take into consideration. For instance, there was the increase in the sale of gas, which last year amounted to 235 million cubic feet in excess of the preceding year. This was a larger augmentation than they had had in any year since the acquisition of the undertaking. The cause was, perhaps, a little difficult to explain; but it was no doubt due to a great extent to the large number of gas-engines which were being used, to the stimulus which was being given to the sale of cooking-stoves, and perhaps more than all to the severity of the weather in the quarter from April to Midsummer last year, and also from Christmas to Lady-day last, when they were once more "favoured" by cold and fog. As he had already

said, the revenue from coke was about £20,000 less than that in the previous financial year; but otherwise it had been the largest amount which had been realized for that residual since the transfer to the Corporation. It compared well especially with the years 1886 and 1887, when their revenue from coke was only £35,000, or about half of the year under review. The reduction in revenue from coke was, on the whole much less than had been experienced throughout the country by the large gas companies. A great deal of fault had been found with them in respect of the accumulation of a large stock of coke at the works. This occurred before last winter, and was due to the stagnant condition of the cement industry, which had been one of their best customers. During the winter they had been selling coke as rapidly as they could make it and at the present time every ton of coke in stock on March 31, and all their summer make, was either contracted for or reserved for town sale, and the Committee believed that not more than 1000 tons, if as much, would remain on their hands at Michaelmas. Although the results of the year had not been as favourable as they would have liked, still he thought they could point with some pride to the results achieved by the Gas Department since the transfer of the works. The sale of gas had increased since 1876 from 2386 million cubic feet to 4045 millions, which was nearly 60 per cent.; while their capital expenditure had only risen from £2,084,000 in 1876 to £2,197,000 at the end of March last, or little more than 6 per cent. They had accumulated a sinking and reserve fund of £480,000—a sum by which their indebtedness would be practically reduced, were it not for the increased market value of the unredeemable annuities. The average price of gas, which stood at 2s. 11d. in 1876, had been for some years past 2s. 3d.—a difference which, calculated on last year's sale of gas, would have produced an additional annual revenue of £135,000. The sums that they had contributed to the improvement rate since 1876, including that mentioned in the present resolution, amounted to close upon £425,000, and yet the price which was charged for gas to the consumer was, with very few exceptions in some smaller towns, and no exception in the larger towns, the lowest in the United Kingdom—he might almost say throughout the world. They might, then, congratulate the city upon possessing an industrial undertaking conducted upon sound commercial principles, and with results advantageous alike to the ratepayers and to the gas consumers.

Alderman CLAYTON seconded the resolution, and it was carried.

Alderman POLLACK, in moving that the report be approved, said that the experiment of the Gas Oil Syndicate (referred to in the report) was being carried out at their own cost and risk, and the Committee were considering other processes for enriching coal gas by means of oil carburetters. Since the report was presented, the Committee had agreed to purchase the mains and distributing plant of the Sutton Gas Company, and to supply the parish with gas from Michaelmas next. The present proprietors would retain the site of the works, dismantling them and making use of the land. With reference to the cooking lectures given in Acock's Green, Handsworth, and King's Heath, by Miss Thwaites, of Liverpool, they had been an unqualified success. In each place there had been five afternoon and five evening lectures. The attendance of ladies at Acock's Green had been 1219, at Handsworth 2482, and at King's Heath 2056; and the lectures had resulted already in a large demand for cooking-stoves.

The motion having been seconded,

Mr. PRICE said he thought it a pity to make a ten years' contract for the sale of ammoniacal liquor at present, as the price of ammonia was lower than it had been for years.

Alderman POLLACK explained that the price of ammoniacal liquor under the contract would rise if the price of sulphate of ammonia went up.

The report was approved.

HALIFAX CORPORATION GAS UNDERTAKING.

The Rates and the Gas Profits.

The Halifax County Borough Council held a special meeting last Wednesday week to consider the estimates for rates for the current year, amounting to 5s. 2d. in the pound; and the discussion which took place mainly turned upon a proposal to increase the amount of profits handed over by the Gas Committee in aid of the rates. Alderman Bairstow moved the adoption of the estimates; and in the course of his statement, he told the members that the Gas Committee had decreased their expenditure by £1100, and increased their income by £1400; while the Water Committee had added £825 to their income. He did not anticipate that there would be any reduction in the rates, as, in the near future, they were going to incur a large expenditure on various works—among others, £200,000 on water-works; £100,000 on gas-works; and on electric lighting an "unknown quantity." Mr. Brook interjected a remark to the effect that the outlay on electric lighting would be £40,000. The motion having been seconded, Alderman Booth proposed as an amendment that the price of gas should be increased 1d. per 1000 cubic feet; and the estimates so altered that a rate of 5s. would suffice. He argued that there were some people who thought they ought not to have any profit from the gas-works; but to his mind it was an exceedingly foolish thing to think that they should have so much money invested in the gas-works, and yet it should not be looked upon as a trading concern. A man who did not use gas had just as much right to complain of another who had gas at cost price or less, as to say they had no right to pay rates out of gas profits. What they had expended on the gas-works ought to bear a reasonable return; and theirs was the only town in the West Riding that did not look to the gas-works for some profit. If they did not get profit out of the gas-works, where were they, he inquired, to look for the money with which to carry out improvements? He thought he was fair and moderate when he asked the Council to increase the price of gas by one penny. It was an amount that would not affect anybody—it would hardly be felt; and in fairness and justice to the general ratepayers, he considered the gas consumers ought to pay this increased amount. Alderman Pollard, who seconded the amendment, was of opinion that the time had come when they ought

to take profits from both the gas and water works. The proposal to raise the price of gas might, he said, affect some half-a-dozen firms; but they must occasionally adopt means of this kind in order that the rates should not be so changeable. The Chairman of the Gas Committee (Mr. Brook) followed with a few remarks, from which it appeared that it was only after a good deal of pressure that the Gas Committee had added £1400 as increased income; but where they were going to get it from, was more than he could tell. During the past eight or ten years, a very large sum had been taken from gas profits; the amount in the past year being £4000. In their estimates for next year, they had assumed that coal would cost 3d. or 4d. per ton less; but he could not possibly say whether the Committee would be able to realize that. They were pretty unanimous against an advance in the price of gas, believing that the undertaking was already doing its full share towards the rates. Alderman Midgley said that in 1880 the Council, after full discussion, arrived at the conclusion that the ratepayers should receive 1 per cent. towards the rates from the gas-works. He had gone back every year since to see if that arrangement had been faithfully carried out. One per cent. on the entire capital would be £30,000; but the amount they had received during that time was £60,000, or just about twice the amount agreed upon—being nearly 2 per cent. Including payments to the sinking fund, commissions, &c., he found that altogether, in the past twelve years, 7 per cent. had been taken out of gas profits. It had been asked who was going to pay for the improvements? He held that the ratepayers ought to pay for them; and if they owned the gas-works, as they did—and they ought to have a consideration for their ownership—he thought 2 per cent. was a very reasonable margin. Mr. Clayton remarked that he was utterly opposed to the principle of the Corporation having a cow to be milked, in order to cover the delinquencies and mismanagement of other departments, unless the maintenance of that cow was equally and fairly contributed to by all the ratepayers according to their position and rates. Alderman Booth said that a penny increase in the price of gas would be but a trifling difference to any. To his own firm, who were among the three or four largest gas consumers in the borough, it would represent an addition as nearly as possible of £35 a year, while in contrast to that there were hundreds—probably thousands—who would not be affected to the extent of a penny. This was neither equitable nor right. The amendment was rejected by 25 votes to 5; and the estimates were then approved.

BAHIA GAS COMPANY, LIMITED.

The Half-Yearly General Meeting of this Company was held at the London Offices, 9, Queen Street Place, E.C., last Thursday week—Mr. EDWARD HORNER in the chair.

The SECRETARY (Mr. T. Guyatt) read the notice convening the meeting; and it was agreed to take the report and accounts as read. The former stated that the profit for the six months ending Dec. 31 last was £6845, which, added to the amount brought forward (£3168), made the sum of £10,013, out of which the Directors recommended the usual dividends on the preference shares, and a dividend at the rate of 8 per cent. per annum (free of income-tax) on the ordinary shares, which would absorb £6225. The Directors also mentioned that the period since the last meeting of shareholders had been one of constant anxiety to them and their officers. The Company's tender was sent in to the State Government of Bahia on Nov. 30, but was not opened until Jan. 12 last. It was then referred, with others received, to a Committee of Engineers to examine and report. As far as the Directors were aware, no decision had been arrived at with regard to the acceptance of any one of the tenders. The latest telegraphic advice from Bahia (April 26) was that an agreement had been entered into for the continuance of the supply of gas for three months after the 9th inst., when the Company's present concession would expire.

The CHAIRMAN, in moving that the report and accounts be received and adopted, said that the profit for the six months showed the satisfactory increase of £382, notwithstanding the enormous loss on exchange of £3407, as compared with £1261 for the corresponding six months of 1890. On examining the revenue account, it would be seen that, while there was a decrease in nearly every item of expenditure over which control could be exercised, there was at the same time an increase of receipts of £1376. These were the pleasing points in the accounts—viz., decreased cost and increased receipts. The per contras were the sums due by the State for public lighting and public establishments—together £14,382, as against £9782 in 1890; and the additional loss on exchange already referred to. The Company's Manager had been instructed to make urgent representations to the Governor in regard to the indebtedness of the State to the Company, and to insist upon an early settlement. The unsettled position of political and commercial affairs in Bahia for months past had operated against a settlement. A new Governor having been appointed, it might reasonably be expected that something would soon be done to reduce the excessive arrears. In the matter of the concession, which expired on the 9th inst., he did not propose to enlarge upon it, and it might be considered by the shareholders undesirable to discuss the point at length at that meeting.

Mr. HORATIO BROTHERS seconded the motion.

Mr. BLUNDELL said that, following the hint of the Chairman that probably it would be unwise to discuss at any length the question of the concession, he would not do so; but he thought there ought to be an expression from the shareholders of their deep disappointment at the very great want of courtesy—to say the least of it—which the Company had received from the State Government of Bahia. Unless the Brazilians showed very speedily a change of front with regard to English enterprise, English gold would cease to flow into the Brazils, and they would reap what they had sown—disaster and disgrace.

Mr. GEORGE ANDERSON said he should not have spoken but for the extraordinary circumstances which the Company were in. It appeared to him that the shareholders ought to support the Directors in every way they could, and not yield an inch of that which they were entitled to hold. The State Government were doing a very unjust and very impolitic thing; and the shareholders sympathized—he did most

decidedly—with the difficult position in which the Directors found themselves. The shareholders should arm them with their support; so that they might act in every way to protect their property.

Mr. JONES said he quite agreed with what had been said as to the action of the Provincial Government; but he had the strongest reliance in the good faith of the Imperial Government of Brazil. With regard to the accounts, the Chairman had referred to the large sums due for public lighting and public establishments; but he would ask the shareholders to look at one little cheery aspect in the figures. Their Manager at Bahia had considerably reduced the amount outstanding for private rental. If they looked at the figures twelve months ago (December, 1890), it would be seen that they stood at something like £6720; as against £5390 at December, 1891. There was a reduction in the amount of indebtedness. Now, they ought to be proud of the man who could accomplish this in one year in Bahia. They should strengthen his hands and the hands of the Directors against the encroachments of politicians, and against that terrible tendency of people to run into debt and omit to pay.

The motion was carried unanimously.

The CHAIRMAN moved that a dividend for the half year ended Dec. 31 last, at the rate of 10 per cent. per annum upon the 10 per cent. preference capital, at the rate of 7½ per cent. on the 7½ per cent. preference capital, and at the rate of 8 per cent. per annum (free of income-tax) on the ordinary capital of the Company, be declared.

Mr. HORATIO BROTHERS seconded the motion, which was carried.

Mr. JABEZ CHURCH proposed a vote of thanks to the Chairman and Directors for the way in which they had conducted their business during the past half year. They had heard that they should do all they could to support the Board; and he thought they were very much indebted to them and the gentlemen who had proved themselves so thoroughly able to conduct and carry on their affairs.

Mr. MACHILL seconded the motion, which was cordially agreed to.

The CHAIRMAN assured the shareholders that the Directors greatly appreciated the vote of thanks that had been passed. The matter of the concession had caused them a great deal of labour and anxiety; and they had had many discussions over it. He moved that the thanks of the shareholders be given to the officers in London and Bahia.

Mr. HORATIO BROTHERS seconded the motion.

Mr. GUYATT returned thanks, and the proceedings terminated.

ODESSA WATER-WORKS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Thursday, at the Cannon Street Hotel—Sir PETER SPOKES in the chair.

The ACTING SECRETARY (Mr. E. Allen) read the notice convening the meeting; and the report and accounts for 1891, from which a few particulars were given last week (p. 981), were taken as read.

The CHAIRMAN, in moving the adoption of the report and accounts, referred first to the defalcations of the late Secretary, Mr. W. D. M. Forrest (see *ante*, p. 864). He said he could quite imagine that the shareholders might be disposed to blame the Directors for having reposed so much confidence in one who had proved himself so unworthy of it; yet he ventured to think after all it was not very surprising that one who had been in the Company's service for 20 years, and entered it with credentials of the highest character for integrity and ability, and who had moreover made himself so familiar with the whole of the details of the Company's business from its earliest days, should have been entrusted to an extent that otherwise would not have been the case. The defalcations of the Secretary (for which he was now undergoing a term of six months' imprisonment) had been treated as an asset of the balance-sheet, under the head of suspense account; and he need only further say that the Directors confidently hoped that ultimately the Company would not suffer any loss. Dealing with the report and accounts, he was sure the shareholders must feel it was matter for congratulation that the net revenue for 1891 showed an improvement of more than £4000. If they took the Odessa accounts alone, then the improvement was shown to be nearly £6000—that was to say, the water-rents and miscellaneous receipts amounted to close upon £4000 over 1890, whilst the expenditure exhibited a decrease of about £2000; and during both years the 6-copeck rate had been taken and calculated for the household supply. It would be observed, however, that the rate of exchange during 1891 had not been so favourable as in 1890; and hence their remittances had not produced so much by nearly £2000 as in the previous year. It would have been gathered from the report that the lawsuits in Russia still formed one of the chief obstacles in the way of the shareholders getting something in the shape of dividend. Whoever, he asked, had heard of any country but Russia refusing to pay for the supply of water to the troops—an obligation which, if discharged, would be equal to 2 per cent. upon the "A" shares. Then the Municipality was endeavouring—and had endeavoured for some time past—to blackmail the Company (he used the term without any hesitation) in almost a similar amount, arising out of a claim for the cumulative fines in respect of cloudy water in 1881 (£10,500), which was caused through circumstances over which they had no control. Then there was a third case, which had reference to a reduction in the price of water, and which, if finally given against the Company, was utterly at variance with the language of the concession; and it would be tantamount to depriving the "A" shareholders of another 3 per cent. It might surprise the shareholders to learn that the Mayor had been desirous of re-opening friendly negotiations with the Company; and he had gone so far as to intimate that the concession might be extended for 28 years, although they would not consent to the raising of the price to 8 copecks. He had also hinted that they might be prepared to buy the undertaking, if the Company would accept deferred payments. (Laughter.) The Chairman then proceeded to point out the differences in the principal items in the revenue account in comparison with 1890; among them being a saving of £1400 in the cost of coal, due in some measure to the satisfactory results obtained from the new boilers at the Dniester station. With regard to the balance-sheet, the temporary loans were £2500 less than in 1890, and the balance at the credit of the capital account had quite

disappeared; while the contingency fund had been reduced by the amount affected by the decision of the Senate at St. Petersburg on account of the water supplied to the slaughter-houses, which they had decided should come out of the "gratis" water.

Sir ARTHUR T. F. CLAY seconded the motion.

Mr. WOOD criticized at considerable length the management of the Company. He submitted that the meeting was not a legal one, as, according to the Articles of Association, the ordinary general meeting should be held in April; and he intimated that he should retain his right to question in proper time the legality of the resolutions that might be passed. With regard to the defalcations of the Secretary, he inquired whether it was a fact, as reported, that it was an open cheque which was given to him. He also referred to the great fall in the value of the Company's shares since 1884. In that year Sir Francis Head was the Chairman, and he was blamed for the language he used towards the Russians; but he (Mr. Wood) ventured to say that he never used an expression so strong as that of "blackmailing." In 1884, the value of the shares was £5; but now they were not worth £1 10s.

Alderman Sir J. C. LAWRENCE, referring to the criticisms of Mr. Wood, pointed out that the circumstances of 1884 had since been entirely altered, and that the Directors were now pursuing the policy which was indicated by the Committee who were appointed by the shareholders in October, 1890, to confer with the Directors on the position of the Company. The opinion of the Committee was that the Company had a concern which was gradually increasing in value; and if no untoward circumstance happened, there would be an improvement in their position. His anticipations had been more than realized during the past year. The price of the water was lowered in 1890 to the extent of £2000. But they had recovered all that in one year; and the demand was still increasing.

Mr. CHESTER, Mr. THOMAS, and Mr. BATLEY also addressed the meeting; the last-named gentleman inquiring whether the Directors had a guarantee policy in connection with the officials who had the handling of the Company's money, and, if not, whether they would get guarantees as quickly as possible.

The CHAIRMAN, in reply to a question as to the likelihood of the Municipality purchasing the undertaking, said that in September, 1893, they had the absolute right of pre-emption upon the net revenue on an average of five years. With regard to the inquiry as to guarantees in connection with the Company's officials, they had none at present; but the shareholders might take it that this was a matter which would receive the attention of the Board. The cheque to which reference had been made was an open one.

The motion was then carried.

The retiring Directors (Sir Peter Spokes and Mr. D. H. Goodsall) were re-elected. Mr. G. E. Francis also offered himself for election as a Director; but he received little or no support from the shareholders.

The Auditors (Messrs. W. B. Peat and Co.) were also re-appointed, after a brief discussion, in the course of which it was elicited that the defalcations of the late Secretary up to Dec. 31 last amounted to £1000.

The proceedings then terminated.

METROPOLIS WATER SUPPLY.

The Quality of the Water in April.

The returns furnished to the Registrar-General by the London Water Companies as to the water supply of the Metropolis during the past month, show that the average daily supply was 180,921,835 gallons, as compared with 174,273,526 gallons in the corresponding month of 1891; being at the rate of 29.6 gallons per head of the population. Of the entire bulk of water sent out, 91,255,469 gallons were drawn from the Thames, and 89,666,366 gallons from the Lea and other sources. Reporting upon the quality of the supply, Dr. E. Frankland said: "Taking the average amount of organic impurity contained in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies and by the Tottenham Local Board of Health was: Kent (Orpington Well), 0.4; Kent (Deptford), 0.7; Tottenham and New River, 1.2; Colne Valley, 1.5; East London (deep-well), 2.0; Chelsea, West Middlesex, and Grand Junction, 2.3; Southwark and Lambeth, 2.4; and East London (river supply), 2.6. The water abstracted from the Thames by the Chelsea, West Middlesex, Southwark, Grand Junction, and Lambeth Companies was, for river water, of a high degree of organic purity; the river being fed during the dry season chiefly by springs in the chalk and oolite. It was efficiently filtered before delivery. The water taken chiefly from the Lea by the New River Company ranked with the deep-well waters as regards organic purity; while that supplied from the same source, but lower down the stream, by the East London Company, was slightly inferior to the Thames waters. Both supplies were efficiently filtered. The deep-well waters of the Kent, Colne Valley, and East London Companies, and of the Tottenham Local Board of Health, were of good quality for dietetic use; that of the Kent Company, both at Orpington and Deptford, being especially distinguished for high organic purity. The Colne Valley Company's water, having been softened before delivery, was rendered suitable for washing. All these waters were clear and bright without filtration. Seen through a stratum 2 feet deep, the Kent, Colne Valley, and Tottenham waters were clear and colourless; the New River and East London (deep well), clear and nearly colourless; while the remaining waters were clear and very pale yellow. The bacteriological examination by Dr. Koch's process of gelatine plate culture gave the following results: One cubic centimetre of each water, collected on the same days as the samples for chemical analysis, developed the following numbers of colonies of microbes: Kent, 8; New River, 10; West Middlesex, 12; East London (river supply), 20; Grand Junction, 32; Chelsea, 52; and Southwark, 54."

Messrs. Crookes and Odling, in the course of their report to the Official Water Examiner for the Metropolis (General A. de Courcy Scott) on the quality of the water supplied by the London Water Companies in the past month, as shown by samples taken daily for analysis, say: Of the 168 samples examined, the whole were found to be clear, bright,

and well filtered. The satisfactory condition of the water supply to the Metropolis exhibited throughout the preceding months of the year has been more than maintained during the past month. But, in respect to the results indicative of the nearly always minute proportion of organic matter present in the water, so long as the figures continue low, too much stress must not be laid on their monthly, or even weekly, variations. According to the more or less favourable meteorological conditions affecting the river from time to time, these figures will vary more or less, and have, during the past month, proved to be exceptionally low. Thus, taking the Thames-derived water for comparison—and a similar result is apparent in the case of the New River and East London Companies' supplies—the mean amount of organic carbon present in the April supply was only 0.125 part in 100,000 parts of the water, as against a mean for the January supply of 1.058 parts, and a mean for the first three months of the year of 0.146 part in 100,000 parts of the water. But even as between the January and April supplies, the difference in the mean proportions of organic carbon present, or 0.033 part in 100,000 parts, is quite immaterial; corresponding as it does to about the 1-17th part of a grain of organic matter in a gallon (i.e., 70,000 grains) of the water. A comparison, in the case of the Thames-derived supplies, of the results obtained during the past month, and the mean results afforded by the previous three months, is given below; but the notably low figures furnished by the past month's supply one can scarcely expect to be continuously maintained:—

	Ratio of Brown to Blue Tint. Means.	Oxygen required for Oxidation. Means.	Organic Carbon per 100,000 Parts. Means.	Organic Carbon per 100,000 Parts. Maxima.
First three months	9.8 : 20	0.045	0.146	0.204
April	5.6 : 20	0.045	0.125	0.204

Mexborough and Swinton Gas Company.—In connection with the proposed purchase of this Company's works by the Local Authorities, it is interesting to note that a dividend of 5 per cent. has recently been declared. The sum available for this purpose on the past year's working was £757; and to pay the 5 per cent. necessitated the withdrawal of rather more than £200 from the reserve fund.

The Rhyl Improvement Commissioners and the Gas-Works.—At a recent meeting of the General Purposes Committee of the Rhyl Improvement Commissioners, a communication was read from the Local Government Board with reference to the application of the Commissioners to borrow £35,000 for the purchase and extension of the gas undertaking. It stated that the Board, before giving a final decision, desired the Commissioners to reconsider the matter. Bearing in mind the improvements and repairs necessary, in order to place the plant in an efficient and satisfactory condition, they were inclined to the opinion that the acquisition of the works would not be to the advantage of the town. In any event, they would not be prepared to sanction the loan for more than 25 years. The Commissioners asked that the repayment of the loan should be extended over 50 years; and their calculations were based on the assumption that this length of time would be granted.

Another Water-Meter Case.—Last Thursday week, at the Barnsley County Court, the Deane Valley Water Company sued Mr. A. M. Chambers, the owner of the Hyland Brick-Works to recover the sum of £44 11s. 6d. for water supplied in the last quarter of 1890. It appeared that defendant had been furnished with water by meter since December, 1883; and it was not until January, 1889, that any complaint was made. The state of the meter was taken monthly by one of the Company's inspectors, who in the first place entered the figures into a small book, and then copied them into a large one. The inspector was called; and in cross-examination he admitted that, when he came to make his report at the end of the month, he found the figures faint, and he repencilled them, but did not add to them. On the part of the defendant, evidence was given showing that the meter had been tested; and it was absolutely impossible to use one-tenth of the water charged for. His Honour held that consumers were at the mercy of gas and water companies; and great care ought to be taken that figures were not tampered with by servants in any way. He gave a verdict for the defendant with costs.

Monte Video Gas Company, Limited.—The shareholders of this Company will meet to-day to receive the report of the Directors on the operations of the year ending Dec. 31 last. The net profit, as shown by the revenue account, was £36,478, which sum has been placed to the credit of profit and loss. From this latter account, provision has been made for interest on debentures, for income-tax, and for bad and doubtful debts, and £1632 has been written off capital expenditure for depreciation. The balance then remaining available for dividend is £35,123. Of this the Directors paid on Nov. 23, 1891, an interim dividend of 10s. per share, free of income-tax; and they now recommend the payment of a further amount of 10s. per share, also free of income-tax, making together a dividend of 5 per cent. for the year. This will absorb the sum of £27,096, and leave a balance of £8027 to be carried forward. The year, it appears from the report, was marked by great depression and a complete stagnation of business in Monte Video. Not only was there a stoppage in the erection of new buildings, but many important establishments were compelled to close their doors; and in the autumn of the year, it was reported that at least 1000 houses remained unoccupied. This reaction from the prosperous conditions of 1889-1890 seriously affected the Company's revenue from all sources. As against these adverse circumstances, the long-continued depression in many branches of trade on this side enabled the Directors to make purchases on very favourable terms, and to deliver the coal and other material at exceptionally low rates of freight. A profit also was realized in the exchange on remittances to London of £636. Although the Company's contract with the Municipality for the public lighting of the city remains unrenewed, since the beginning of the current year, at the request of the authorities, they have lit with gas 31 additional lamps. The Directors have the satisfaction of reporting that the current indebtedness of the Authorities is being regularly discharged.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

For my purposes, the times are bad just now. I scarcely remember ever having so much difficulty in procuring material out of which to furnish you with a few "Notes" upon gas matters in Scotland as I have had last week and this. Probably, it is but the lull before the storm. The financial year with most of the gas-supplying bodies has come to an end; and meanwhile office-staffs are busy getting the books of their undertakings balanced. So far as can be seen, there are to be comparatively few good tales to tell when the annual statements are made. The high price of coal laid the foundation for hard times, even at the beginning of the year; and to it has to be added the great fall in the price of residuals which has been experienced. With dear coal, the price of gas was pretty generally raised; and this has told on the consumption. There has accordingly been, not only a lower price for secondary products going, but that smaller price has been realized upon a diminished quantity; and so companies and corporations have been pinned in a double form. While prepared to learn that advances are not the order of the day, in the matter of the amount of business, I do not, however, anticipate that there will be anything serious to record, or indeed anything more than a temporary check upon the general advance that has been experienced during the past few years. That anything more than this is not to be looked for, is shown by the fact that there is scarcely a gas-works of any magnitude in connection with which arrangements have not been made for extensions of some sort or other. Edinburgh is perhaps the most conspicuous exception; for there, though the subject has been discussed, and the need for extension is admitted, it has been resolved not to go on with the work in the meantime—a policy the wisdom of which is open to question. A sudden upward bound in the consumption, which may arise any day, would certainly place the Gas Commissioners in an awkward fix. But in Glasgow, Paisley, Dundee, Aberdeen, and Inverness—all Corporation-owned undertakings—measures for the extension of the works are either in process of being carried out or are under arrangement. There seems to be a disposition to hold over the fixing of coal contracts as long as possible, in the expectation of a further fall in prices—an expectation which there is every likelihood will be realized. The coal owner has had the best of the bargain for the past three years; now the scale seems to be turning against him. I notice this week that the Niddrie and Benhar Coal Company is able to pay a dividend at the rate of 10 per cent., a result which has been attained largely on account of the good prices which have been got for cannel. It is not out of place here to refer to the position of the oil trade in Scotland, seeing that oil is the heaviest competitor with gas. Several oil companies have been holding their annual meetings; and the opinion of the chairman of one of the companies—the Linlithgow—is that their trade is not in a satisfactory position. Competition with petroleum-producing countries is keener than ever; and prices are, on the average, lower than they have been since 1887. A year ago, consumption was ahead of production; but that is not the case now. The best remedy, he considered, was to curtail the output; but unfortunately united action to bring about this result had not been obtained. With the oil trade in that position, there need be no wonder that the gas industry should also be less lively than usual; but the fact that oil stocks are accumulating, shows that that trade is not encroaching upon gas, and that any diminution in the volume of gas consumed is not due, to any large extent, to its place being taken by oil. In the oil trade, the high price of coal and chemicals, and the high rate of wages, are blamed for the bad results. Wages have, however, been recently reduced, from which a considerable measure of relief is anticipated. The question arises whether, if wages in competing trades are being lowered, a corresponding movement may not be necessary in gas-works. So far, I have not seen such a step suggested; but if times continue as they are, it must come up. It would be unfair to go on throwing all the burden on consumers. Very substantial increases were made to the wages of the gas workers within the past ten years, in nearly every instance without dispute; it remains to be seen whether the workers will take as kindly to a reduction as their employers did to the increase.

The Dundee Gas Commissioners have found, on balancing their books, that they are left with a debit balance of £4780. This is the third year in succession that they have been in the position of not being able to make ends meet. Their first debit was £73; last year, it was £2381. Deducting the debit balance of a year ago, the loss on the past year's working was £2399. The result must be rather disappointing, because the estimate was that there would be a balance of £400 of profit. The loss has arisen chiefly on account of the fall in the price of residuals. When the year began, no change was made in the price of gas, which was retained at 3s. 8d. per 1000 cubic feet. Had the Dundee Commissioners followed the course adopted in most places, and raised their price, the balance would have been on the right side. It is now proposed to raise the price by 1d. per 1000 cubic feet; and it is mentioned that no increase in the consumption is expected. The quantity of the output for the past year, as stated in these "Notes" on May 10, was 34½ million cubic feet larger than in the preceding year, which again was 48½ million cubic feet more than in the year preceding that. Last year, too, the gas revenue increased by £4854; so that, apart from the fall in the price of residuals, there were all the elements for a satisfactory termination of the year—no increase in the price of gas, a larger output, and cheaper coal. There is this satisfaction, that the debit does not arise through any failure in the manufacture or the demand, but from a state of matters which affects all gas-works alike, and not gas-works alone but other industries as well. The annual meeting of the Gas Commission will be held about three weeks hence; and then, if not before, a fuller account of the balance-sheet will be obtainable.

At the meeting of the Aberdeen Corporation Gas Committee on Wednesday, tenders for the supply of coal were opened, and handed over to Mr. Alex. Smith, the Manager, to report upon. Several of the members urged that the illuminating power of the gas should be reduced to from 20 to 24 candles, to enable them to buy cheaper coal. Nothing was resolved upon; but the proposal will probably not be lost sight of. The illuminating power now is 23 to 24 candles.

Since I wrote a fortnight ago that Mr. Cuthbert, Gas Manager at Dunbar, was having the best of it in the difference between him and his employers, the Town Council, affairs have taken an unfavourable turn for Mr. Cuthbert. For some reason, which is not explained, he has sent in his resignation; and at a special meeting of the Council on Monday night, it was accepted. It was resolved to ask Mr. Foulis, of Glasgow, to recommend a suitable man for the post. Mr. Cuthbert is an old man; and the Town Council is a young body as Gas Commissioners. They have never yet settled down to work; and whether rightly or wrongly, they seem to throw the blame on Mr. Cuthbert. I fancy the condition of the works has more to do with the discontent of the Commissioners than any defect on Mr. Cuthbert's part. They will, in all probability, find that a new man, if he is not to compromise himself, will insist upon a large outlay before he is satisfied to go on. The post is only worth £70 a year with a free house and the usual allowances.

The Dundee Police Bill has this week passed a Committee of the House of Commons. One of the clauses in the measure upon which evidence was heard was that which gives power to the Police Commissioners to require the owners and occupiers of tenements to light the common-stairs leading to them. The provisions are similar to those in force in Edinburgh, which, by the way, do not give entire satisfaction. A penalty of 40s. for failing to light was proposed; but objection was stated on behalf of the Department of the Secretary for Scotland that the sum was too high, and the Committee reduced it to 20s. Otherwise, the clause as proposed was approved of.

During the past week, a lively discussion has been proceeding in a Glasgow newspaper between Mr. Wm. Key, late Manager of the Tradeston gas-works, and several gentlemen, on the subject of the method of ventilation employed in the Glasgow City Chambers and the Victoria Infirmary. Mr. Key is the inventor of the ventilating system of the Victoria Infirmary; and he complains that the keeper of the City Chambers has adopted his method. He has protected his invention; and he appears to threaten litigation upon the dispute. Mr. Key, it will be remembered, resigned his post at the gas-works in order that he might take up the work of ventilating engineer. His method consists of washing the air by means of screens, and the controversy appears to be over the manner of placing the screens; but, of course, if the matter finds its way into the Law Courts, that may not be the point which will be raised by Counsel.

An augmentation scheme for the water supply of the town of Largs has been completed, at a cost of £4000. The engineer was Mr. W. R. Copland, of Glasgow; and the contractor, Mr. James Miller, of Kirkintilloch. The works consist of a weir on the Noddsdale water, and 1½ miles of iron piping, by which the water is conveyed to the present source of supply at Whittleburn, and thence by a conduit about half a mile long to the reservoir at Middleton. The cost of the original works was £16,000.

A Select Committee of the House of Lords this week had before them a Bill by the Glasgow and South-Western Railway Company for powers to make a line of railway from Dalry to Fairlie, which is intended to shorten their existing line to the Ayrshire coast towns. Opposition was offered to the measure by the Corporation of Irvine as Water Commissioners, on the grounds that the railway, passing through the gathering ground, would be likely to cause a large abstraction of water; and that if town manure were to be conveyed by the railway very serious results might follow, as fever germs might be carried into the Commissioners' reservoir. The opposition, though supported by the evidence of Mr. Reid, Mr. Hawksley, and Dr. Littlejohn, was rather far-fetched; and the Committee passed the Bill.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, May 28.

Sulphate of Ammonia.—The market generally seems steady; and £9 17s. 6d. remains the quotation at country ports. London is reported easier. The shipments from Hull show a little improvement; and those from Liverpool are on a very fair scale. Still an advance in price seems impossible; buyers being apparently determined to combat any such attempt. Viewing the position generally, it may be taken for granted that prices will remain stationary for the present; and it is to be feared that, while speculators anticipate a lower range in the future, and act accordingly, an improvement must not be looked for by manufacturers. Like Pandora's box, the market has had many surprises in store; but a hopeful future need not be given up entirely, as it is clearly to be seen from the present reduction of stocks, that there is no over-production, and thus the greatest danger to the safety of any market is disposed of. The Scotch producers unfortunately, by their committing themselves so far ahead, damage the chances of the market greatly; and if sulphate was sold only as produced, not so much scope would be afforded to speculative operations. Nitrate is quiet, but steady, at 8s. per cwt.

LONDON, May 28.

Tar Products.—The lessened production is now making itself felt in market values. Even with the improvement which is distinctly perceptible in benzols, coal carbonizers will still find business unprofitable. It is expected that the production of benzol by carbonizers will shortly cease, until the price of benzol improves. These remarks, however, do not apply to benzol produced from coke-ovens—the conditions of manufacture there being entirely different. Business is reported in 90's benzol at 1s. 9d.; while 1s. 8d. fails to bring sellers. Stocks are remarkably low; and there is undoubtedly a better future for the article. Pitch is nominally quoted at firmer rates; but buyers expect to purchase their requirements at less money. Meantime very little new business is reported. There is more inquiry for creosote and heavy oils. But there are large stocks of both in existence; and it is not expected that prices will be much increased. Carbolic acid products are more easily saleable at a shade better prices. A steady business is being done in anthracene; but at very low rates. The following business has been done: Tar, 10s. to 12s. 6d. Pitch, 27s. to 29s. Benzols, 90's, 1s. 9d.; 50's, 1s. 4½d. Toluol, 1s. 2½d. Solvent naphtha, 1s. 2d. Crude benzol naphtha, 30 per cent., 8d. Creosote, 1d. Naphthalene

salts, 20s.; pressed, 45s. Carbolic acid, crude, 60's, 1s. 1d.; 70's, 1s. 4d.; crystals, 5d. Cresol, 8d. Anthracene, 30 per cent., "A" quality, 10½d.; "B" quality, 7½d.

Sulphate of Ammonia.—More business is being done; but there seems no hope of any improvement in price this season. Sales are reported as low as £9 15s., less the usual discount; but £9 17s. 6d. is perhaps nearer to-day's value. Gas liquor (10-oz.) is quoted at from 5s. to 6s. 6d.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—A generally slackening demand continues to be reported for all descriptions of round coal throughout this district, with an easier tendency in prices. The best qualities, of course, are necessarily in lessening request for house-fire purposes. Selling prices are rather easier in many cases; and do not average more than 12s. to 12s. 6d. for best Wigan Arley, 10s. to 10s. 6d. for Pemberton four-feet and second qualities of Arley, and 8s. 6d. to 9s. for the common descriptions of round coal suitable for house-fire consumption. The lower qualities of round coal are becoming more difficult to move for iron making, steam, and general manufacturing purposes; whilst requirements for shipment continue very indifferent, and there is a good deal of pressure on the part of buyers to secure concessions in price. This, no doubt, is in a large measure due to the reduction in the contract prices for locomotive fuel, referred to in last week's report, and which it is now evident will regulate the prices at which the Railway Companies will be able to cover the remainder of their requirements in this district. At the pit mouth steam and forge coals for inland requirements may be bought, without difficulty, at 7s. 9d. to 8s. 3d. per ton; whilst for shipment ordinary descriptions of steam coal are offering freely at 9s. 3d. to 9s. 6d. per ton, delivered at the Garston Docks, or the High Level, Liverpool, although for some special qualities collieries are firm in holding to about 10s. to 10s. 3d. per ton. The chief matter of interest just now in the coal trade is, however, the approaching renewal of contracts for gas coal; and tenders for several of the large local contracts have already been sent in. So far as the principal collieries throughout Lancashire are concerned, a strong determination has been expressed to adhere firmly to the basis of the prices obtained last year, which averaged 10s. to 10s. 6d. for best qualities and 9s. to 9s. 3d. for the inferior descriptions of gas coal at the pit mouth; and a resolution to this effect was actually passed at a meeting of the principal colliery owners, held recently, who practically bound themselves not to send in tenders under the current prices obtained in 1891. Of course, this did not bind the whole of the collieries throughout Lancashire; and in some instances there have been slight concessions up to 3d. per ton upon last year's quotations, but as a rule this has so far been only very slight, and for comparatively small quantities. Perhaps the most important contract so far placed is that for Preston, in which I understand supplies were secured at prices slightly under those paid last year; but in this particular instance, the 1891 contracts were placed rather early, and before gas-coal prices actually began to give way, so that the price which has been paid upon the renewal of contracts for the ensuing season is practically on the basis of the current prices which ruled with regard to the bulk of the contracts placed last year. Some sort of joint action is being attempted between the principal colliery owners of Lancashire and Yorkshire, who have held a meeting at Sheffield with a view of coming to some arrangement between the two counties with regard to this year's gas-coal contracts; but how far the policy of holding strictly to last year's prices will be adhered to, remains to be seen. Already, as I have indicated, there is some slight breaking away, which is having a weakening effect by inducing buyers of gas coal to hesitate in closing contracts, and to be more pressing about obtaining concessions before they accept supplies. With regard to engine classes of fuel, the market is fairly steady, owing to the absence of competition from Yorkshire; and although here and there sellers have been willing to take low prices to effect clearances, generally late rates have been held to pretty firmly, and supplies of good qualities are in most cases moving away without difficulty. At the pit mouth, burgy averages 6s. 8d. to 6s. 9d.; the better qualities of slack, 4s. 9d. to 5s. 3d.; and inferior sorts, 3s. 3d. to 3s. 9d. per ton.

Northern Coal Trade.—There has been a fuller supply of coal in the north-east during the last few days; several additional "un-associated" collieries having got fully to work. The Northumbrian collieries are producing very well; and thus the supply of coal has been very considerably increased. Best Northumbrian steam coal is easier, in consequence; the price generally quoted being 11s. 6d. per ton, f.o.b. in the Tyne, whilst for forward delivery a much lower price is taken. Household coal is extremely dull. Durham coal varies very greatly in price for prompt delivery, for the collieries that have been at work during the last few days are turning out comparatively large quantities; and thus the "fancy" prices that were asked are being now no longer paid. Bunker coals are lower—11s. having been accepted for increased Durham qualities, whilst further falls in price are likely to take place. Manufacturing coals are affected in price by the vast supplies of both Scotch and Yorkshire coal brought into the market; and in consequence lower rates prevail. Coke is dear—22s. being still asked for best blast-furnace qualities; but gas coke is fairly abundant. The collapse of the Durham miners' strike is looked upon at the time of writing as inevitable; for the funds of the miners are vanished, and they have no public sympathy. Miners in other districts are making strenuous efforts to induce the Durham men to fight on, for obvious reasons; but whatever the result of the voting in the aggregate, sections of the men will soon be at work.

Scotch Coal Trade.—Business last week may be said to have been of the waiting order. Very little forward demand exists, nearly all the business done being for prompt delivery. The miners have in nearly all cases accepted the reduction of wages. But they are working leisurely; and this, with a continuance of the activity in shipping, prevents stocks accumulating. Most of the shipping trade is foreign; but a good deal has been done with North of England ports.

Traders continue to complain of a scarcity of waggons. The prices quoted are: Main, 7s. 9d.; ell, 8s. 6d.; splint, 8s. 3d.; and steam, 10s. to 10s. 3d. per ton. The shipments for the previous week were again abnormally high—the figures being 186,324 tons; an increase over the preceding six days of 2289 tons, and over the corresponding week of last year of 34,683 tons. For the year to date, the total shipments have been 2,662,151 tons, which is an increase over the same period of last year of 353,775 tons.

Public Lighting of East Ardsley.—It has been decided by a vote of 274 ratepayers against 123 to light the streets of East Ardsley by gas.

Droitwich Corporation Gas Undertaking.—The balance-sheet of the Droitwich Corporation Gas Committee for the past year shows that they received £1648 from the sale of gas; £420 for public lighting; and £268 for coke. The amount of gas sold was 7,609,600 cubic feet; being an increase of about 807,000 feet.

Liversedge and the Bradford Water Bill.—At the meeting of the Liversedge Local Board on Monday of last week, a formal report of the proceedings before the Committee of the House of Commons with reference to the Board's opposition to the Bradford Corporation Water Bill was made by Mr. R. A. Sheard, who also dealt with the effect of clauses added to the Bill on the previous Friday, by which the Corporation have undertaken to purchase the water-works plant of the township, and to distribute the water on the terms in force within the borough. He showed by a comparison of the Bradford charges with those at present in force in the township, that about £560 a year would be saved to the township in respect of 1500 cottages rated at £5 or less, and a further £150 in respect of houses rated at from £5 to £10, and that manufacturers, who have hitherto paid not less than 1s. 3d. per 1000 gallons and up to 1s. 11d., would pay not more than 9d. to Bradford. Occupiers of better-class houses, rated at from £10 to £60, would, on the other hand, pay a little more under the Bradford scale. The Chairman (Mr. Wharton) remarked that the total saving to the township under the Bradford scale was estimated at £1000 a year. Further discussion of the subject was reserved for committee.

Improvements at the Smethwick Gas-Works.—Last Thursday, Mr. T. Codrington, one of the Local Government Board Inspectors, attended at the Public Buildings, Smethwick, for the purpose of holding an inquiry relative to an application made by the Smethwick Local Board for sanction to borrow an additional sum of £9000 to defray the cost of alterations and improvements at the gas-works. The Clerk (Mr. E. Docker) explained that the gas-works were erected in 1882, and since that time the Local Board had not found it necessary to add to their capacity beyond making some slight additions. The population of Smethwick had risen 44 per cent. during the last ten years, and the number of houses in the place was rapidly increasing. The rateable value of the township was £136,241. The manufacture of gas at the works when they were opened was 123,693,000 cubic feet per annum; at the present time it was 154,495,000 cubic feet. In consequence of increase of population, and the resultant extra demand for gas, the works were being taxed to their utmost capacity. It was proposed to apply the £9000 in the following way: The provision of a new retort-house, to be worked on the regenerative system, which would cost about £5300; the other objects of expenditure including a condenser, exhauster and engine, washer, station meter, manager's offices, mess-room for the men, meters, and mains. The Gas Engineer to the Board (Mr. B.W. Smith) stated that the present producing capacity of the works was 154 million cubic feet of gas per annum. They were only intended to turn out 150 millions; but by careful management the yield had been increased 4 millions. The additions and improvements would cover a period of 15 years, or an increased production of 50 per cent. The Secretary (Mr. T. Sturgess) explained that the Board were authorized, under their Provisional Order, to borrow a further sum of £20,000 with the sanction of the Local Government Board. The Inspector visited the gas-works.

Local Opposition to the Birmingham Water Bill.—A meeting of the opponents of the Water Bill of the Corporation was held at Birmingham last Tuesday. The Chairman (Mr. E. Chesshire) contended that the scheme for obtaining water from Wales was a huge mistake as an engineering, a sanitary, and a financial question. Professor Wanklyn stated that Birmingham had in her possession a daily supply of about 10 million gallons of deep-spring water, derivable from springs underneath and adjacent to the city. The water-bearing strata of the locality yielded water which was well known to be excellent from a mineral point of view. Referring to the Bill, he said he had been particularly struck by the extraordinary reticence of the scientific witnesses before the Parliamentary Committee respecting the quality of the water from the Welsh gathering-ground. That the water contained very little mineral matter, and was soft, was almost the sum total of their evidence. Beyond that, though there was a perfect wilderness of figures, there was no information. If it should turn out to be true that the bulk of the Welsh water was peaty, the outlook for Birmingham would be bad; and the cost of the scheme would be greatly increased by the necessity for additional filters. The region of the gathering-ground in Wales was pre-eminently metalliferous; so that Birmingham people would run the risk of being poisoned by lead off the ground, and the further risk of being poisoned by lead dissolved off the pipes. For the first, there was no remedy; for the second, there was a remedy, but it would be costly and require constant vigilance. An analysis of the water showed that it contained half a grain of lead in a gallon; but the gentleman who made the analysis was not called as a witness for the Bill. Professor Hull expressed his belief that Birmingham was standing on the verge of a very serious catastrophe. No one was better convinced of the absolute necessity for an abundant supply of water to such a town than he; but it was also his opinion, founded on an experience of 35 years, that there were in the vicinity of Birmingham sources of supply capable of giving water of the finest quality for the next 100 years. Mr. Samuel Lloyd, Mr. Wilson Lloyd, and other gentlemen also addressed the meeting; and then a resolution was passed condemning the Welsh scheme and expressing the earnest desire of those present that it should not be further proceeded with.

Imperial Continental Gas Association.—The offices of this Association have been removed to No. 21, Austin Friars, E.C.

A New Water Scheme for Penrith.—The Water Committee of the Penrith Local Board has lately had under consideration a report made by Mr. G. F. Deacon, C.E., on the defective water supply of the town. Mr. Deacon points out that the volume of water pumped on the average for the supply is about 450,000 gallons a day, out of which 80,000 gallons are sold for trade purposes, leaving 370,000 gallons for domestic consumption and leakage. On the population of the town, this gives an allowance of more than 42 gallons per head per day. The proposed works, he estimates, will cost £8000.

Extinction of the Lucigen Light Company.—A circular has been sent to the share and debenture holders in the above Company, stating that, in order to protect the interests of the latter, the Directors have been compelled to present a petition for winding up. This step has, it is said, been forced upon them by the action of the Solicitors for the Company from its promotion in 1887 until 1890, who have served a writ on the Manager for about £730 for their bill of costs. As the Company are unable to pay the debt, the only course open for the Directors was to take the steps they have done.

The Sevenoaks Local Board and the Water Company's Works.—The Directors of the Sevenoaks Water Company have informed the Local Board that they decline to name a price for their works, as this cannot be done without the consent of three-fourths of the shareholders present at a general meeting; and that they also decline to enter into any agreement for the sale of the works at a sum to be fixed by arbitration. The Local Board have answered this, to the effect that, as the Company will not go to arbitration, the Board are disposed to make an offer of purchase; and, with a view to so doing, they have asked permission for their Engineers to view the property.

South-West Suburban Water Company.—The report of this Company for the six months ending the 25th of March states that, comparing this half year with the corresponding one of 1891, there has been a decrease in the working expenses of £744, which has been owing to the adoption of the new engine, filter-beds, &c., which have come into full operation, and an increase of revenue of £685. The Directors believe they have now reduced these expenses to a low limit; and that they will only increase in proportion to the rise in the revenue. The works, plant, and machinery of the Company have been fully maintained, and are stated to be in good working order. The water supplied by the Company continues satisfactory. The Directors have used their utmost endeavours to improve the position of the Company, and they continue to ask for the confidence of the shareholders.

Young's Paraffin Light and Mineral Oil Company, Limited, intimate that their books for the financial year ending April 30, 1892, after expending £25,774 for maintenance and repairs of works, pits, and mines—subject to audit—show a profit on the year's operations of £64,734. Adding the balance from last year—viz., £5138—and deducting £1965 for dividend paid, less interest, on £72,987 of debenture stock converted during the year, there is a total of £67,908. From this sum deductions have to be made for interest on mortgage debenture bonds, &c., and on 6 per cent. convertible debenture stock, leaving £43,111, out of which the Directors recommend that a dividend of 5 per cent. be paid to the ordinary shareholders in equal proportions, on June 20 and Dec. 19, less income-tax. These payments will absorb £16,980, and leave a balance of £26,131. From this balance it is recommended that the sum of £23,364 be written off in extinction of the "Pentland retorts account," which will leave the sum of £2767 to be carried forward.

Sales of Stock and Shares.—Last Wednesday, at Bristol, Messrs. Nichols, Smith, and Alder offered for sale by public auction, £20,000 of new debenture stock in the *Bristol Gas Company* created under their Act of 1891. The stock, which was put up in lots of £100, bears interest at the rate of 4 per cent. per annum. The result of the sale was as follows: 14 lots were sold at £104 5s.; 7 lots, at £104 2s. 6d.; 22 lots, at £104; 5 lots, at £103 17s. 6d.; 74 lots, at £103 15s.; and 78 lots, at £103 10s. The total sum realized was £20,746 5s.—On the previous day, £50,000 of stock in the *Newcastle and Gateshead Water Company* was sold at prices ranging from £146 to £150. At a sale by auction at Eckington last Wednesday, a number of original shares of £1 each in the *Eckington and Mosbro' Gas Company* realized from £1 14s. to £1 15s. apiece; and 10 additional £5 shares produced £7 6s. each.—Last Wednesday, Mr. Hodgkinson sold in the town a number of shares in the *Matlock Water Company* and the *Matlock Gas Company*. Thirty-seven £10 fully paid-up shares in the former realized from £13 2s. 6d. to £13 10s.; and 65 fully paid-up £5 shares sold from £5 12s. 6d. to £5 17s. each. Fourteen £10 paid-up shares in the Gas Company produced £19 and £19 10s.

The London County Council (Subways) Bill.—The Select Committee of the House of Lords engaged in considering the provisions of the London County Council (Subways) Bill last Wednesday had before them clause 11, which deals with the regulation of water, gas, and electric wire mains carried through the subway. The six Electric Lighting Companies petitioned against the Bill; objecting to have their wires subject to the control of the County Council instead of the Board of Trade, and claiming to remain, as hitherto, under the general order of 1889. The Earl of Crawford was examined in support of the petitioners' case. He stated that the objection to having the mains for electric lighting and gas and water in one chamber was the danger of flooding and of explosion from fire when the pipes were under repair. It would, in his opinion, be desirable that the Board of Trade should have control of the mains in the subways, and not the County Council. The expense of insulating conductors required for carrying the wires through subways would be very great, and the inconvenience in breaking up streets to make lateral connections would be another objection. Sir F. Bramwell also gave evidence in support of the objections raised. The Committee decided that the petitioners had proved their case, and that they should be exempted from the provisions of the Bill, with the exception that if clause 11 were so altered that the Board of Trade should be the controlling authority, the Companies should not be exempt.

Burgess Hill Water Company.—From an available balance of £813, the shareholders of this Company, at their recent half-yearly meeting, declared a dividend at the rate of 3½ per cent., free of income-tax.

Gas Explosion at Wigan.—Yesterday week a serious gas explosion took place in an empty house at Wigan. The landlord (Mr. W. Ormston), with his wife and daughter, entered for some purpose or other; and on stepping into one of the front rooms with a lighted candle, a loud explosion occurred. They were badly burnt about the head and face, whilst the house was also considerably damaged. Mr. and Mrs. Ormston's injuries were of such a nature that they had to be medically attended. On an examination of the premises being made, it was found that a gas-burner in the room where the accident happened had been left turned on.

The Finances of the Stoke-upon-Trent Gas Department.—At the monthly meeting of the Stoke Town Council last Thursday week, Mr. Sant moved, in accordance with notice, "That the report given to the Gas Committee and the Town Council by Messrs. A. Lass, Wood, and Co., in respect to the gas-works accounts is incorrect—(1) As to the sinking fund; (2) as to the cost price of production of gas at the works; (3) as to the formation of a reserve fund." He said the Council knew perfectly well that the figures given in the report were not in accordance with the facts. He did not say that Mr. Lass had made a mistake in his calculations, but simply that he was not furnished with the full materials. For instance, Mr. Lass was not informed of a sum of £1600, which was repaid into the sinking fund, and which, instead of being short by £1000, was overpaid by £200. Mr. Sandland seconded the motion, for the purpose of discussion. Mr. Bennett moved, and Alderman Leason seconded, as an amendment, that the Council accept the report in its entirety. The amendment was carried by a large majority. Mr. Geen moved, as a further amendment, that the report was incorrect, because it omitted mention of the £1600, that it was inaccurate in dealing with the cost of gas; and that the question of the reserve fund should be referred to the Local Government Board. Mr. Marks seconded the amendment, which the Mayor ruled out of order, as in his opinion it was a direct negative, and could not therefore be put.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

For Stock Market Intelligence, see ante, p. 1009.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.					£ s. d.
GAS COMPANIES.								
590,000	10	13 Apr.	10½	Alliance & Dublin 10 p. c.	10	16½-17½	..	6 0 0
100,000	10	"	7½	Do. 7 p. c.	10	11-12	..	6 5 0
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105-107	..	4 13 5
100,000	20	27 May	8	Bahia, Limited	20	10-12*	..	13 6 8
200,000	5	12 May	7½	Bombay, Limited	5	6½-6¾	..	5 11 1
40,000	5	"	7½	Do. New	4	4½-5	..	6 0 0
380,000	Stock.	26 Feb.	12½	Brentford Consolidated . . .	100	212-217	+2	5 12 11
150,000	"	"	9½	Do. New	100	162-167	..	5 10 9
220,000	20	11 Mar.	11½	Brighton & Hove Original . .	20	40-42	..	5 9 6
888,500	Stock.	11 Mar.	5	Bristol	100	95-100	..	5 0 0
320,000	20	13 Apr.	11½	British	20	42-44	..	5 2 3
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	10	19-20	..	5 15 0
51,510	10	"	8½	Do. 7 p. c.	10	15-16	+½	5 6 3
328,750	10	"	—	Buenos Ayres (New) Limited	10	7-8	+½	—
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	94-97	..	6 3 9
150,000	20	26 Feb.	8	Cagliari, Limited	20	25-27	..	5 18 6
550,000	Stock.	13 Apr.	13	Commercial, Old Stock . . .	100	229-234	..	5 11 1
165,000	"	"	10	Do. New do.	100	180-190	..	5 5 3
130,000	"	30 Dec.	4½	Do. 4½ p. c. Deb. do.	100	118-123	..	3 13 2
800,000	Stock.	30 Dec.	13	Continental Union, Limited .	100	220-225	..	5 15 6
200,000	"	"	10	Do. 7 p. c. Pref.	100	190-195	..	5 2 7
75,000	Stock.	30 Mar.	10	Crystal Palace District . . .	100	185-195	..	5 2 7
486,090	10	29 Jan.	10	European, Limited	10	19-20	..	5 0 0
354,060	10	"	10	Do. Partly paid	7½	13½-14½	..	5 3 11
5,470,820	Stock.	12 Feb.	12	Gaslight & Coke, A, Ordinary	100	207-211	-3	5 13 9
100,000	"	"	4	Do. B, 4 p. c. max.	100	94-98	-½	4 1 7
665,000	"	"	10	Do. C, D, & E, 10 p. c. Pf.	100	248-253	+1	3 19 1
30,000	"	"	5	Do. F, 5 p. c. Prf.	100	116-121	..	4 2 9
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	169-174	..	4 6 2
1,300,000	"	"	7	Do. H, 7 p. c. max.	100	154-158	+1½	4 8 7
463,000	"	"	10	Do. J, 10 p. c. Prf.	100	245-250	..	4 0 0
476,000	"	"	—	Do. K, 6 p. c. Prf.	100	146-150	..	4 0 0
1,061,150	"	11 Dec.	4	Do. 4 p. c. Deb. Stk.	100	114-117	+½	3 8 5
294,850	"	"	4½	Do. 4½ p. c. do.	100	118-123	..	3 13 2
908,000	"	"	6	Do. 6 p. c. do.	100	165-169	..	3 11 0
3,800,000	Stock.	12 May	12	Imperial Continental	100	215-219	-2	5 9 7
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4-4½	..	6 13 4
560,000	100	1 Apr.	5	Met. of Melbourne, 5 p. c. Deb.	100	108-110	..	4 10 11
541,920	20	27 Nov.	6½	Monte Video, Limited	20	14½-15½	..	8 7 8
150,000	5	27 May	10	Oriental, Limited	5	7½-8½	..	6 1 2
60,000	5	30 Mar.	7	Ottoman, Limited	5	4-5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited	10	2-3	..	—
People's Gas of Chicago—								
420,000	100	3 May	6	1st Mtg. Bds.	100	104-107	+2	5 12 1
500,000	100	1 Dec.	6	2nd Do.	100	103-106	..	5 13 2
150,000	10	15 Oct.	10	San Paulo, Limited	10	8-9	..	—
500,000	Stock.	26 Feb.	15½	South Metropolitan, A Stock	100	270-275	-5	5 12 9
1,350,000	"	"	12	Do. B do.	100	218-222	-2	5 8 1
200,000	"	"	13	Do. C do.	100	235-240	..	5 8 4
725,000	"	30 Dec.	5	Do. 5 p. c. Deb. Stk.	100	142-146	..	3 8 6
60,000	Stock.	11 Mar.	11½	Tottenham & Edin'ton, "A"	100	225-230	..	5 0 0
WATER COMPANIES.								
729,331	Stock.	30 Dec.	10	Chelsea, Ordinary	100	252-257	..	3 17 9
1,720,252	Stock.	13 Apr.	8	East London, Ordinary . . .	100	197-202	+1	3 19 2
544,440	"	30 Dec.	4½	Do. 4½ p. c. Deb. Stk. . . .	100	136-140	..	3 4 3
700,000	50	11 Dec.	8½	Grand Junction	50	98-102	..	4 3 4
708,000	Stock.	12 Feb.	10½	Kent	100	260-265	+2½	3 19 3
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max. . . .	100	220-225	..	4 4 5
406,200	100	"	7½	Do. 7½ p. c. max.	100	187-192	..	3 18 1
279,700	Stock.	30 Mar.	4	Do. 4 p. c. Deb. Stk.	100	120-123	..	3 5 0
500,000	100	12 Feb.	12½	New River, New Shares . . .	100	325-335	..	3 12 4
1,000,000	Stock.	29 Jan.	4	Do. 4 p. c. Deb. Stk.	100	126-129	..	3 2 0
902,300	Stock.	30 Dec.	6½	S'hwk & V'xhall, 10 p. c. max.	100	148-153	+3	4 4 11
126,500	100	"	6½	Do. D 7½ p. c. do.	100	133-138	..	4 14 3
1,155,066	Stock.	11 Dec.	10	West Middlesex	100	242-246	-1	4 1 3

* Next dividend will be at this rate.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

THE
JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JUNE 7, 1892.

The Gas Industry Before the Labour Commission.

THE continuation of the evidence relating to the gas industry given before the Royal Commission will be found in another column; and there is more to report next week. Some interesting matter came out of the examination of Charles Wheeler, who spoke for the Beckton coalies. In most of the working-men witnesses who have told their tale before the Commission, it is easy to discover two voices—one with which they usually begin their story, and which is the studied, conventional voice, while the other is only heard when the speaker's real convictions are reached by a searching question or two across the table. Wheeler was like the rest in this respect. He came prepared to tell a smooth tale, and to express a formal distaste for strikes and all similar unpleasantnesses, which he was ready to ascribe to "misunderstandings" between employers and

employed. After this had all been duly placed upon record, Mr. Livesey took the witness in hand, and made him confess to a variety of performances by the Union men working at Beckton which can hardly be explained away as the result of any misunderstanding between employer and employed. There is very little "mis-understanding" about a refusal of coalies to discharge a vessel which happens to be boycotted by order of the Seamen and Firemen's Union. Of course, Wheeler is saturated with crude views about the necessity for an eight hours' day—for other occupations than his own—and various other Social Democratic fads for "taking up" the surplus labour. All the Union leaders, from Thorne downwards, have become warped by association with talkers and writers of the Aveling stamp, who never did a day's handiwork in their lives; and consequently their minds are muddled over obscure points of industrial, economic, and social polity, the rights of which neither they nor anybody else can ever hope to understand. If such men would but confine their attention to matters about which they may be supposed to know something—for instance, the organization of their own labour, the redress of grievances, and the improvement of members of their own order in reliability, steadiness, and the sense of responsible citizenship—they would do more good in the world than all the German dreamers and French fanatics ever did or ever can effect.

Mr. W. A. Valon, the President of the Incorporated Gas Institute, was the first of the band of witnesses before the Commission who authoritatively represented the gas industry. Mr. Valon, acting in his official capacity as head of The Gas Institute, has got together, at vast pains and labour, a valuable and interesting mass of evidence illustrating the conditions of labour in 110 gas-works situated in different parts of the United Kingdom, outside the Metropolis, and dealing with 13,510 men. This material Mr. Valon has analyzed and arranged with a view to bringing out many salient facts, which will be found in the report of his evidence, and which deserve the careful study of all works' managers and directors, whether contributors to the stock of information or not. One observation we must offer upon Mr. Valon's returns; and it is this: There is more inequality than we should have expected between the rates of wages paid to stokers in different places; and it would have been more satisfactory, in the interest of clearness, if at the same time it had been explained what is done for the money. There is reason to believe, as Mr. Valon himself says, that on the whole the men employed in gas making are as well paid as in most other manufactories, and better than in a great many. It would be a shame and disgrace to the proprietors of such protected establishments if anything could be proved to the contrary, in a general way. But it is impossible to regard all Mr. Valon's returns as equally satisfactory. We fear that in too many instances, even among those undertakings which have given information concerning their system of works' management—and the number will naturally be increased by many from which no returns have been supplied—the arrangements as to necessary leisure time, Sunday work, holiday pay, and so forth, are not as they should be. It can hardly be wondered at if a black mark is put against these backward establishments by those who know them. Mr. Valon publishes no names, nor any details which may lead to the identification of the works to which his returns apply. But we urge upon the directors or the committeemen, whoever they may be, of these lagging undertakings to seriously consider their position in the light of what is done in other places, and to ask themselves whether they are content to figure as harder task-masters than their fellows. This is a charge that comes home to every gas director—nay, to every shareholder having a voice in the general meeting of the company, and to every ratepayer in whose name a corporation gas undertaking is administered by the local authority. It is the supreme powers who are really responsible in this matter, not their agent, the works' manager, whose hands are oftentimes by want of means, short storage room, and other considerations. Directorial apathy is the obstacle in the way of amelioration in most cases of unsatisfactory labour conditions; and it is a pity that, where this exists, the offenders cannot be pilloried.

Mr. Valon explained to the Commission how he is able to arrange for his Ramsgate hands to have one complete day's rest in seven. The plan is undoubtedly a good one;

but it is not to be lightly conceded that any week-day is an equivalent for the Sunday. It does not appear that the Commissioners were greatly impressed with this Ramsgate plan. Mr. Valon had another suggestion for the establishment by statute of a General Superannuation Fund for gas-workers, the object of which, as he stated it, would be to remedy the weakness of the bonus or other pension systems in existence in being confined to individual works, generally large ones. Under the suggested plan, it was pleaded by the witness that the removal of a man from one works to another would not interfere with the amount of claim he would eventually have upon the general fund. But are such removals so general as to demand special provision for the protection of those engaging in the practice; and is the "rolling stone" kind of workman particularly worthy of so much attention? To Mr. Livesey, the witness confessed his dislike of, and disbelief in, profit-sharing, which he professed to be unable to distinguish from a variety of wage-paying. On the subject of the prevention and settlement of labour disputes, Mr. Valon expressed himself as favourable to the constitution of Joint Boards of Arbitration or Conciliation fairly representing both parties; but when pressed as to how such a Board could enforce its awards upon a revolted minority, he failed (like everybody else) to solve the insoluble; and so the idea remains a mere "pious opinion." Mr. Valon certainly deserved the thanks he received from the Chairman of the Section for his evidence, which must have cost him a great deal of trouble; and although work of this kind is perhaps to some extent a "labour of love" to men like the President of The Gas Institute, a busy engineer has plenty to do besides attending Royal Commissions for honour and glory.

The End of the Durham Strike.

AT last, after more weary weeks of sullen resistance to the inevitable than one likes to count, the strike of the Durham miners has come to an end. The precipitant in this matter was the Bishop of Durham; and his Right Reverend Lordship has been awarded unlimited *kudos* for the part he has played in bringing to an end one of the most disastrous industrial wars of modern times. We have no desire to rob Bishop Westcott of any portion of the glory which may be truly ascribed to him in connection with this matter. Indeed, his Lordship's goodwill towards both parties in the strife, and his desire for a happy termination to this deplorable dissension, have been prominent throughout. If the Bishop could have had his way, the strike would have been over long ago—it would not, indeed, have been entered upon; and since all that is really a man's own is his intention (the event being beyond his control), the Bishop of Durham as well deserved the praise of all wise and good men many weeks ago as he does to-day. However, without insisting overmuch upon this part of the question, we will admit that, thanks to the good offices of the Bishop of Durham, the miners' strike is at an end; the men having professed their willingness to go back to work on the reduction proposed by their employers in the early spring. It is true that they would have done as much some week or so ago; but then the employers declared that so much injury had been inflicted upon trade by the strike, that they could not resume working except at a further reduction of $3\frac{1}{2}$ per cent. in the rate of wages. Upon this declaration, the strike seemed to make a fresh start; and it has only now been terminated upon the withdrawal of the masters' later demands.

Thus peace has been purchased, as is generally the case, by a compromise; and now the only question concerning the miners' strike that is worth discussing is whether something cannot be done to prevent anything like a recurrence of such a terrible disaster. The men have lost—of that there is no manner of doubt. How much they have lost, it would be impossible to say. The strike has been marked by such manifestations of bitterness of spirit upon the part of the men as to render it memorable as an example of industrial warfare. There was no little violence; but this was quelled by the civil powers. Even more significant than their violence, moreover, was the doggedness with which the strikers prevented not merely draining operations and other services which could be described as directed to safeguard the coal owners' interest, but even such public works as the maintenance of water supply, the raising of fuel for soup kitchens, and so forth. To all intents and purposes, it was private war which the malcontent miners were carrying on—war, with all its miserable consequences

for the vanquished; with all its waste and cruelty. And the losers have to live on the battle-field! This is the saddest aspect of the whole wretched business. Whatever may be the loss they have inflicted on their conquerors, the heaviest suffering must still be theirs. If mines have been flooded and royalties and dividends placed beyond the owners' reach, the wages fund of the future has also been sapped. According to report "the stoppage has proved so disastrous to the mines, that it is estimated that over 20,000 miners will not be able to find employment for the next twelve months." Great is the spirit of Trade Unionism; but is not there something in this record to convince its most bigoted worshippers that industrial wars are a bad means of settling industrial disputes? It is not so long ago even in this country that rival barons (and on the Continent, rival towns) knew no better way for the settlement of their differences than an appeal to arms. Like our Trade Unions of to-day, they scouted the suggestion of mediation, whether from priest or layman, while they thought in their pride that they had within themselves the power to humble their adversaries and gain their own terms. It often happened then, as now, that after spending all their substance in the vain attempt to gain their point by force of arms, one or other belligerent admitted the mediation which they once despised.

We sometimes flatter ourselves that, in this blessed nineteenth century of halfpenny newspapers and other triumphs of civilization, we have outgrown all the follies of our coarse, rough, ignorant, skull-cracking ancestors; but have we? Are the striking miners or the locking-out pit-owners such a wonderful advance upon the hot-headed barons and swashbucklers of whose unamiable ways Scott tells us such exciting stories? Alas! ancient error changes its manifestations from age to age; but there is still almost as much of it as ever. We wish it were possible to believe that the recent mediation of the Bishop of Durham between the miners and coal-owners owed its success to something else besides the exhaustion of at least one of the parties. Still more ardently is it to be wished that some means could be devised for rendering strikes as obsolete as duelling, by the acceptance of some rational means of preventing disputes about rates of wages, and composing other difficulties of the industrial community as they arise. Unhappily, we cannot be said to be within measurable distance of any such consummation.

"The More Things Change, the More they Remain the Same."

WHILE we, in England, as already observed, are slowly and laboriously working over again the problems of our ancestors, and learning that if these old people were not altogether so foolish as modern Board School enlightenment would have us believe, we are not yet in a position to call them names, some odd news comes to hand (through an American newspaper) which goes to cheer us up, by showing us that there is at least one respect in which our transatlantic cousins are a generation or so behind ourselves. We allude, in these scarcely complimentary terms, to the report just to hand with reference to the "unique and interesting fight" that has been in progress in a locality bearing the romantic name of Celina, Ohio, between two rival Gas Companies. Not content with trying to ruin each other by selling gas at ridiculously unremunerative prices, the two undertakings have divided public feeling between their claims to such a depth that the town is actually in a state of uncivil war. "The citizens and business men, nearly all of whom are interested in one Company or the other, are arrayed in deadly strife against each other; and fights and quarrels among old neighbours and friends are of daily occurrence." Landlords endeavour to compel their tenants to patronize the Company in which they are interested; and on refusal they turn out the recalcitrant occupier. Business men boycott each other; and even the commercial travellers are told the hotels they must stop at if they wish to do business with particular merchants. "In fact, the town is in a demoralized state; and there is no telling where the war will end." This is quite romantic. Time was when, under an effete form of government, a harmless citizen taking a walk abroad might be stopped with the inquiry "Under which king, Bezonian? Speak, or die." And the family feuds of the Guelphs and the Ghibellines are matter of history, as well as of romance. Our friends across the water have changed the occasion, if not the nature, of their internecine quarrels. In Celina,

Ohio, they do not fight about a king; but only about a gas-meter. Who shall deny after this that the world does really move, and that as the poet sings—"The thoughts of men are widened with the process of the suns."

The Unearned Increment Again.

IN a recent number of the JOURNAL, we had something to say upon the vexed question of the "unearned increment," and the various attempts that are being made at the present time to capture this value for the benefit of the community. There is a good deal of incertitude in the public mind as to how problems of this kind should be treated. High-and-dry political economists pretend that the mere discussion of such topics is a sort of treason to the memories of Bentham and Mill and the rest of the kings of the ruling dynasty in economics. But, unless we greatly mistake it, the prevailing temper of mankind in this present age is to resist the presumption that wisdom died with Cobden and his disciples. Thus we ascribe the unquestionable influence of Mr. Joseph Chamberlain upon the men of his epoch partly to the fact that he is not afraid of recognizing the insufficiency of academic political economy, in face of some of the gravest consequences of the growth of wealth, to suggest remedies for evils which everybody deplures. What is to be done with the increase of values due to the great stability of modern government in this country, and to the concentration of populations in certain favoured spots? Is there any possibility of making these benefits public instead of private? Must individual ownership for ever intercept revenues which arise in general exigencies? People will not rest content with the assurance that the pocketing of the "unearned increment" cannot be helped; and it is because Mr. Chamberlain joins so heartily in the modern demand for something to be done to distribute the wealth of the nation more equally among the contributors to it, that he is in such a conspicuous degree a man of the time. Of course, Mr. Chamberlain does not expect to attain the impossible. He sees the growth of the "unearned increment" clearly enough; but between seeing and grasping it, there is a wide and at present an apparently impassible gulf. How difficult these problems of intercepting the "unearned increment" are, was made apparent in the course of the recent proceedings in the House of Commons respecting the Agricultural Holdings Bill. The question was this: Supposing a holding acquired under the powers given by the new law, for purely agricultural purposes, to eventually attain on other accounts an altogether superior value in the land market, to whom should this additional value belong—to the original seller under the Act, to the holder, to the local authority, or to whom? Now here we have the question of the interest in the unearned increment in its very simplest form. But what was the result of the debate? It was found impossible to get away from the plain equity of the rule that when a man buys land, or anything else, he must take his chance of its improving or depreciating in value. If the community are to inherit the "unearned increment," they must also take to the "undeserved decrement." Any tampering by Act of Parliament with conditions of sale, is attended with infinite consequences, reaching backwards through the seller as well as forwards through the buyer. And as it is with land, so it is with such a commodity as gas shares. It is easy to point to the present value of paying gas stocks (which were cheap enough at one time), and to orate respecting the iniquity of making the public pay still for the good luck or the foresight of the investors who in bygone days put their money into gas and kept it there. But when men bought this gas stock, they did so with the knowledge that they would have to stand all the consequences. It is at least an interesting question whether the capture of any possible unearned increment would turn out in the long run to be worth the expense in the shape of the sacrifice of the investors' expectations. If the speculator is to be deprived of his hope and left with his risk, what would become of speculation?

WATER AND SANITARY AFFAIRS.

THE Royal Commission on the Metropolitan Water Supply having last week completed the preliminary investigation of the statements of the Water Companies, now stands adjourned to Monday next, by which day the Commissioners hope to find the County Council ready with their evidence. At the sitting of the Commission last Wednesday, it was apparent that the County Council were by no means desirous of coming forward quite so early. For some reason or other, they were not ready to present their case, though the Commissioners only asked for evidence on one branch of the inquiry; the geological and some other expert evidence being left to a later period. It was perhaps a candid confession on the part of Mr. Cripps, that the Council were possibly less informed on the specific matters which the Commission had to inquire into, than many other parties to the inquiry. So Mr. Cripps suggested that the Commission might take the case of Hertfordshire next in order. But Lord Balfour of Burleigh, the President, remarked that the Commission had now been going on for two months and a half, and during that time the Council should have been preparing to submit evidence. Still Mr. Cripps fought for a postponement; and he proposed July 1 for the production of evidence from the Council. But the President was not to be baffled by such tactics, and signified that the Council ought to be ready at the next sitting. The unreadiness was doubtless a matter of policy. Yet at the same time we can quite understand that the Council are not altogether ready with their facts, although they have spent money enough in their water inquiries to be prepared with something like a preliminary case. If their case is a strong one, why are they hanging back? The Companies have been placed under the disadvantage of taking the initiative, and have been complimented by the Commission for their readiness and willingness in supplying information. What they have said will be the subject of attack; but they will be heard again by-and-bye, in the same branch of the inquiry, so far as they are prepared to refute the statements of their opponents. That the Companies have done well in their evidence down to the present time cannot be disputed, although some of their witnesses have been sharply questioned. But according to the plan laid down by the Commissioners, we are at present only in the first branch of the inquiry; and an entirely fresh array of evidence will be brought forward later on. So far, the points mainly dealt with have been those which relate to the ordinary statistics of the supply, coupled with the estimates of the Companies for the future. The second branch of the inquiry will be more distinctly of a scientific nature, including geological evidence as to the character of the Thames and Lea watersheds. The President has expressed the desire of the Commission not to waste a single day, or hour, in hearing unnecessary evidence; and for this reason it is required that all the statements shall first of all be submitted in documentary form, so that the Commissioners may see whether the evidence is worth having. We shall be curious to see how the County Council fare under this rule. An argument used by Mr. Hollams before the Commissioners was somewhat striking. He referred to the fact that the Royal Commission was instigated by the County Council. It was therefore in the order of things for the Council to come forward and show cause for this Commission. Some kind of accusation was naturally supposed to be in the background, in support of which the Council would produce evidence. But where was the evidence? The Companies had to defend themselves against an unknown indictment. It seems that the County Council would like to hold their indictment back still longer; but the President of the Commission is rightly intolerant of such delay.

The idea that the Metropolitan Water Companies are expending money on works, in order to increase the amount of their claim when a transfer takes place, is certainly not true in respect to the West Middlesex Company, whose Chairman (Sir. W. H. Wyatt) stated before the Commission that his Company would like to have a little more subsiding reservoir capacity, and would have had it long ago, but "they were waiting to see what the turn of events would be, before laying out money." It is quite likely that a similar feeling actuates other Companies; and assuredly the present aspect of affairs is not calculated to encourage the immediate construction of permanent works.

The Opening of the Vyrnwy Water-Works.—H.R.H. the Duke of Connaught has consented to take part in the inauguration of the Vyrnwy Water-Works at Liverpool. The ceremony will take place at an early date; and the Mayor is exerting himself to make the occasion an enjoyable one to as great a number of the citizens as possible.

If there is a prospect of long delay before any change takes place, urgent works must needs be executed. Sir W. H. Wyatt expressed a hope that "the results of this Commission would afford them some light." When the results appear, no doubt they will make the situation clearer than it is at present. We should be glad if some of the remarks made by the President were a little different in their tone. In examining Mr. W. C. Young, the Consulting Chemist to the Lea Conservancy Board, the President asked, "What do you say with regard to the water at the East London intake as being fit for conversion into a fluid suitable for consumption." This reads like a question put by an opposing Counsel. The witness was able to make a splendid reply, showing that in April last the Lea water contained less than four-tenths of a grain per gallon of organic matter. "Was that after filtration, as supplied?" asked the President. "No," responded Mr. Young, "it was just after it was drawn in at the intake." The President must have been somewhat enlightened. That the head of the Commission is perfectly open to conviction, we feel assured; and if his Lordship sometimes appears to handle the Companies a little roughly—as when he told Mr. Fraser, the Engineer of the Grand Junction Company, that "he was sorry not to be able to agree with him" concerning the depleting of the Thames—there will be the greater confidence on the part of the public in the conclusions arrived at by the investigating body.

Masonic.—Referring to the paragraph in the JOURNAL for May 24, as to the proposed "Emergency" meeting of the Evening Star Lodge, it has been arranged for it to be held on Monday, the 13th inst., at the Freemason's Hall, London, at 5 o'clock prompt. After the ceremony of initiation has been performed by the W.M. (W. Bro. Valon), the members of the lodge and visitors, will dine together at the Holborn Restaurant, at a charge of 5s. each, exclusive of wine. It is particularly requested that tickets be taken *as soon as possible*, in order that proper arrangements may be made for the comfort of the visitors. All, therefore, who desire to attend the dinner, should send a postal order for 5s. to W. Bro. Magnus Ohren, Lower Sydenham, S.E., who will return a dinner ticket by next post. No tickets can be issued after the 11th inst., as the room has to be engaged after the number to dine is known.

Rejection of the Swinton and Pendlebury Gas Bill.—This Bill, as amended by the House of Lords Committee (see *ante*, p. 623), came before the Police and Sanitary Regulations Committee of the House of Commons, presided over by Mr. H. T. Hinckes, last Friday week. Consideration of its details was continued on Monday; and on Tuesday, the Chairman intimated that it was the opinion of the Committee that effect must be given to the agreement entered into with the Corporation, and therefore they had come to the conclusion that the preamble was not proved. It was pointed out by Mr. Bidder (for the promoters) that the Committee had given a decision against him, after hearing evidence in opposition to the Bill, without affording him an opportunity of replying; and this was against the rules and practice of the House. The Chairman explained that the decision referred to the agreement, to which Mr. Bidder rejoined that that was only one part of the Bill, and he should respectfully retire. The Bill was therefore rejected; the view of the Committee being that the agreement did not compel the Salford Corporation to sell a portion of their undertaking in those districts, but only to part with the whole of the pipes, &c., in the districts in question.

Laying of a New High-Pressure Trunk Main by The Gaslight and Coke Company.—The great increase of the population of the Northern suburbs of London during the last few years, has rendered it incumbent upon The Gaslight and Coke Company to watch very narrowly the drain occurring every successive winter on their mains for supplying the large region in question which has to take its gas from a considerable distance. During the foggy week which ushered in last Christmastide, the pressures in this neighbourhood fell to a point which indicated that it would be necessary, before another winter, to reinforce the supply; and consequently, under the direction of Mr. G. F. L. Foulger, the Company's Distributing Engineer, a new 36-inch high-pressure trunk main, two miles long, has been laid this spring from a point in London Fields, where it is connected with the high-pressure main from Bow Common, to a valve-house now in construction at a point chosen with respect to the needs of the North-eastern district, where a pair of Parkinson's double cone governors will reduce the high-pressure gas to that at which it can be discharged into the local distributing mains. At a point near Dalston Junction, where the new trunk main crosses the North London Railway, the crossing is made by means of a steel-plate butt-riveted girder pipe, spanning the distance between the bridge abutments. It is carried outside the parapet, the change of alignment from and into the roadway being effected by special castings. This work is now being done by the contractors of the Company for main laying, Messrs Aird, Lucas, and Ellis.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1081.)

THE week just concluded has been only a mutilated one so far as Stock Exchange business is concerned. In addition to being the Derby week, it also contained a Jewish festival; and with the Whitsuntide recess imminent, it was subject to much interruption in the way of business. Speculative transactions were thus kept down to very small proportions; and the tendency generally was dull. There was a good demand, however, for the high-class securities in the earlier part of the week, and prices consequently ruled better; but as business gradually slackened, and with some disposition later on to realize, the best figures were not maintained. In regard to the Money Market, there is nothing fresh to note; the position remaining unchanged. The Gas Market has been quiet; and changes in quotation are few and slight. The principal feature is the continuous rise in the secured issues, in response to the demand for investments for money. Gaslight "A" is very steady. It opened at 209½, and afterwards never went below 208 or above 210—the final deal being marked at the middle price, 209. The debenture, secured, and limited issues were very buoyant; and nearly all of the preferred stocks have made moderate advances. There was a good deal more doing in South Metropolitans than there has been of late; and they had to encounter some degree of hostility. In the result, the "C" was put down 2½; and the "B," 1. But the "A" was left standing, although a bargain was marked at a low figure. Hardly anything was done in Commercials; and they showed no disposition to move. In Suburban and Provincial undertakings, there was scarcely a transaction; and everything remained stationary. The Bromley Company are inviting tenders for 400 new £10 shares at a minimum price of £15 2s. 6d., which is not too much to ask if they see their way to maintaining the old rate of dividend. Flatness was the feature in Continentals, as exemplified by Imperial, which fell 3; but nothing at all was apparent among the rest. In South Americans, Buenos Ayres continues to see-saw—going up one week and down the next. Monte Video have declared their reduced dividend at the rate of 5 per cent. The rest offer nothing to note. The Water Companies still continue to improve in value; the debenture stocks being especially in demand.

The daily operations were: Gas generally was quiet on Monday, nothing being touched but Metropolitan issues. South Metropolitan "C" fell 2½. Grand Junction Water rose 1. On Tuesday, business was almost at a standstill, except for a few dealings in South Metropolitan; the "B" fell 1. Gaslight "F" rose 2. There was a little more activity on Wednesday; but the only movement in price was a rise of 1½ in Gaslight "K." Business continued at a very low ebb on Thursday. Imperial Continental receded 2; and Buenos Ayres, ½. Friday was a little more animated comparatively, but transactions were still much restricted. Gaslight 10 per cent. preferences rose 2; and ditto "K," 1. But Imperial Continental fell 1. In Water, East London debentures rose 2; and Lambeth ditto, 1. Saturday was no busier than usual; and all quotations remained unchanged.

ELECTRIC LIGHTING MEMORANDA.

The Nomenclature of Units of Measurement—The St. Pancras Experiment—Proposed Electric Lighting for York.

WHETHER the new term "kelvin" is or is not destined "to catch on," and so come into habitual use among electricians and the public as a convenient designation for the Board of Trade unit, is a question which we do not pretend to be able to answer off-hand. Up to the present time, the electrical and engineering journals have not taken kindly to the word; and many prominent electricians have professed themselves heartily ashamed of the craze for naming units of electrical measurement after more or less eminent gentlemen of their own calling, living or dead. Our useful contemporary *Industries* declares that "electricians are a little apt to make themselves ridiculous in the eyes of others by calling things after members of their own profession. Imagine the Gas Acts being altered, so that instead of '1000 cubic feet' the householder would be charged so much per Livesey." We cannot imagine anything so utterly fantastic; and should not care to suggest such a false compliment to the gentleman chosen by our contemporary to represent the gas industry as Lord Kelvin does that of electrical supply. We have often complained of the cumbrousness of the denomination of the commercial unit used in the sale of gas, and have desired, for convenience' sake, that some convention could be devised that should spare writers and speakers about coal gas the trouble of always mentioning three words to signify what is really meant to be a unit expression. The attempt has been made more than once to get the word "mil," or "mille," sometimes printed with a capital M, adopted for this purpose; but without success. Some American newspapers try to save type by always printing it 1000'. But this is confusion; for the tick ' already means something else, and nothing is gained by omitting the word "cubic," which is an essential part of the term. In truth, it is no easy matter to find acceptable names for units of

measurement. People will not always use a single word when offered for the purpose in preference to two or three words which convey the idea better. Thus, even in the case of the metric system—which is nothing if not concise and labour-saving—the French themselves, with all their fine sense of logical symmetry, have never taken to the word *stère*, but always use the two words cubic metre. Nomenclature is in truth a puzzle, like man himself, who, being full of contradictions, will never speak a logically symmetrical language.

A strenuous attempt is being made by the St. Pancras Vestry to reduce the idle time which, in the ordinary way, would absorb the prospective profit upon the night working of their electric lighting plant. In the hope of somewhat equalizing the load upon their generating machinery, they have decided to offer a day supply of electricity for power purposes at the "perfectly ruinous price," as a speculative draper would put it, of 3d. per unit, or just one-half of the charge for the night service. The efficacy of a cheap day supply in equalizing the consumption of gas has often been debated by gas managers; but here they will be able to watch a crucial experiment on the same lines in respect of a kind of undertaking which suffers more from inequality of loading than any gas-works. It has to be seen whether trade will be attracted by this risky policy of the St. Pancras Vestry. The electro-motor is practically unknown in this country, because it compares so unfavourably with the gas-engine; and we are doubtful whether the St. Pancras Vestry will be able to make it popular in their electric lighting district. The attempt will, however, be interesting to watch in any event. Of course, a great parade has been made of the "success" that has actually been achieved by the St. Pancras experiment; but so far as we can see, the word only means that Professor Robinson's plans have been carried out to the satisfaction of the Vestry, which, seeing that they closely follow the St. James's Company's arrangements is nothing very wonderful. We shall hardly learn all the truth about the commercial side of this venture for some years; because, as Mr. Garcke told the Bradford people the other day, local authorities never confess a loss if they can help it, and they have many resources for covering up a leak. If electric lighting can be made to pay in St. Pancras, it ought to pay almost anywhere.

The usual fuss is being made locally over a proposal to introduce electric lighting into the City of York; and there is every probability that the money of the ratepayers will be squandered here, as in other places, in order to find work for touting electricians. There must be quite a settled plan of campaign for the guidance of the electricians who work this class of business. At any rate, there is a remarkable likeness between the manoeuvres which in different parts of the country lead up to a municipal electric lighting "experiment." Not to put too fine a point upon it, the most effective weapons in the hands of the electricians who lay siege to our provincial municipalities are usually lies, evasions, and misrepresentations. We do not say, of course, that men like Mr. Crompton, who has advised the York Corporation, are to be put in the same category with the Brush and House-to-House emissaries, who care little what they say so long as they can snap up a contract here and there; but even Mr. Crompton, when he is put to it, prefers, for obvious reasons, to talk of Bradford, and of the Westminster and Pall Mall Companies, rather than to dwell upon the experience of the Massingham speculations. And there is in most towns some rabid town councillor who is ready to urge, in season and out of season, that in the sacred name of Progress his native place must plunge headlong into the first plausible electric lighting scheme that comes recommended by learned professor or respectable engineer. These things must be; but it is not our fault if readers of the JOURNAL in these threatened localities fail of their duty and neglect to keep their fellow-citizens alive to the existence of that "other side of the shield" which is regularly exhibited in these pages for the benefit of all whom it may concern. So far as York is concerned, it must be acknowledged that in the York Gas Company, the electricians and their friends in the town council have as powerful a rival to meet as they could find anywhere in the Kingdom.

A Large Steel Water-Pipe.—The works for conveying the water from La Vigne and Verneuil to Paris are now in process of construction. They consist, first, of an aqueduct which brings the water from the department of Eure-et-Loire, to St. Cloud; secondly, of a reservoir at the latter place; thirdly, of a conduit for bringing the water from St. Cloud to Paris. The conduit itself is of mild rolled steel, 5 feet in diameter inside; the thickness calculated so that the stress does not exceed 3·8 tons per square inch. It has been made slightly thicker in order to allow for oxidation. The maximum thickness will, however, be 0·235 inch. According to the conditions imposed in the specification, the rivets, which are also of mild steel, may stand out on the inside if the heads are round. The tubes may be lap-jointed; but the inside diameter must be 5 feet. The supports, which are of cast-iron, are to be close enough together to prevent any sag of the tube under the pressure of water. The elbows are to be of cast iron, and the cramps of wrought iron. Two discharge-tube 15·6 in. in diameter, will be arranged at the lowest points of the conduit, closed with sluice-valves; while the air-valves are at the highest points.

THE WATER COMPANIES (REGULATION OF POWERS) BILL AND LOCAL AUTHORITIES.

WE print on another page the proceedings which took place in the House of Lords on the report stage of this Bill, when the Earl of Wemyss moved an amendment to extend its provisions to Corporations and other Local Authorities supplying water. We called attention in the JOURNAL for the 24th ult. to the one-sided character of the Bill, which purports to be for the protection of water consumers, and yet only includes those supplied by Water Companies. Lord Wemyss characterized the Bill "as illogical, inconsistent, and one-sided;" and the House agreed with his views of it. But Lord Henniker, speaking on behalf of the Local Government Board, suggested that the Bill should be allowed to pass in its present form, and that a Bill should be introduced next session providing for the extension indicated by Lord Wemyss. His Lordship, having stated that he was satisfied with the strong expression of opinion made by the House in favour of the principle of his amendment, then withdrew it.

The Bill has now passed the House of Lords, and is down for second reading in the House of Commons for Tuesday next; and although, in view of the coming dissolution, it is not likely to pass this session, no efforts should be spared on the part of Water Companies and Local Authorities supplying water, to secure the defeat of a measure, the effect of which, if it became law, would be to promote endless litigation and disputes, and entail enormous trouble and expense on the Companies, with no compensating advantage to any honest consumer. We have said that Local Authorities are interested in the Bill; and this undoubtedly is the fact, although its provisions do not directly apply to them. But from the proceedings in the House of Lords to which we have just referred, it is evident that, if the present Bill passes, a Bill to extend its provisions to Local Authorities will be introduced next session. Such a Bill would probably consist of one clause; and it is unlikely that any amendments would be made in it. The argument against doing so would be that an Act already existed protecting every consumer supplied by a Company, and that he was entitled to have the same protection if supplied by a Corporation.

We think, under the present circumstances, that the Bill, being admittedly incomplete, ought to be at once withdrawn; but if this is not done, it behoves all local authorities supplying water to use their utmost endeavours to defeat it, so as to enable them to have an opportunity of considering a complete Bill in all its details, if one should be introduced in a future session. By doing so, they avoid being drawn under the provisions of the present Bill, in the manner suggested by Lord Henniker.

FRENCH RULES FOR LIGHTING.

IT was stated, in the course of the notice of the work of Dr. Palaz, upon Industrial Photometry, which we gave last week, that this book contains a scholarly chapter upon "Lighting." It would hardly be respectful to the author or to the subject to dismiss this portion of Dr. Palaz's work with a single remark; and so we propose to separate the author's treatise upon the "Distribution and Measurement of Lighting" from the rest of his writings, for the purpose of giving our English readers a succinct epitome thereof, which may without much risk of error be regarded as the latest expression of French science in this regard.

Dr. Palaz remarks that, in order to determine the value of any system of lighting, it has long been deemed sufficient to multiply the number of centres of light by their luminous intensity, and then to divide the gross total of luminous units by the illuminated area. It is hardly necessary to point out that this method is only capable of giving very imperfect results; because different kinds of lights send out their rays differently. Thus, it is inadmissible to compare in this way gas with electric lighting, whether by arc or incandescence. The intensity of the luminous radiations varies so with their direction, that the effects of two different gas-lamps cannot be fairly compared by this method, much less those of gas with an electric arc lamp. From the practical point of view, says Dr. Palaz, what we want of any system of lighting is that the illuminated surface shall receive over its whole extent a minimum quantity of light per unit of area—that is to say, that its illumination shall not fall below a certain given limit. In order to compare the values of two systems of lighting, it is therefore necessary to consider the character of the lighting produced by each and study the variations; the system which gives the highest average lighting with the least variation being adjudged the better.

The photometrical elements of a luminous source being known, it is possible to theoretically deduce the value of the lighting afforded at any point of a given surface exposed to this light, provided that the position and height of the source are also known. It may even be calculated what distribution of such sources will produce the most favourable result. However, the problem is not really so simple as it appears to be; because it is necessary in practice to take account, not only of the more or less regular variations of luminous intensity according to the direction of the rays, but also the phenomena of

absorption and reflection of light. The influence of reflection is almost insensible in the lighting of a large plane surface; while it plays an important part in the lighting of interiors and enclosed areas. The absorption of light by the medium through which it passes, only operates practically in the case of public street lighting. It may therefore be neglected; because this phenomenon (of absorption) only attains sensible proportions in foggy atmospheres, which must be regarded as exceptional conditions not to be taken into account in settling the data of lighting for ordinary circumstances. Calculations relating to the distribution of lighting over a surface are simple when single light sources, supposed to radiate equally in all directions, are alone in question; but when it is a general problem relating to the lighting effect of many sources, whose illuminating power varies according to the direction of the ray, the study of the distribution of light becomes very complicated.

The quantity of light dq received by an element of surface ds , of which the normal makes an angle i with the direction of the luminous ray, is proportional to the cosine of the angle, and inversely proportional to the distance d from the source.

Whence we have the ratio $dq = \frac{I ds \cos i}{d^2}$. We call the *intensity*

of lighting of a given point of the surface the quotient of the quantity of light dq received by the element ds of this surface, by the superficies of this element ds . Therefore $e = \frac{dq}{ds} = \frac{I \cos i}{d^2}$

Considering ds as unity ($ds = 1$), we may also call the intensity of lighting the quantity of light received by a unit of surface.

The distinction between the expressions *intensity of lighting* and *lighting*, introduced by M. Wybauw, is very useful, for it enables us to speak of the intensity of lighting in a given point whilst only considering the lighting of a surface. The intensity of lighting is a mathematically defined quantity, $e = \frac{dq}{ds}$; while lighting is a physical, or even a

physiological notion. It is necessary to define the unit adopted to express the intensity of lighting. It is a unit ($e = 1$) made up by taking the intensity of lighting produced under the normal incidence ($i = 90^\circ$) by the unit of luminous intensity ($I = 1$) placed at the distance 1 ($d = 1$). Thus, the unit of the intensity of lighting is brought to the unit of luminous intensity. If the latter is the carcel, and metric measurements are followed, the unit of the intensity of lighting will consequently be the *carcel-metre*. If the standard is the candle, and the measurements stated after the English fashion, then the unit will be the *candle-foot*. M. Hospitalier has proposed to express the intensity of lighting in candles per square metre, and not in candle-metres, because the intensity of lighting is inversely proportional to the square of the distance, which does not appear from the expression; but Dr. Palaz does not regard this criticism as being well founded.

Dr. Palaz thus gives the fundamental rule for determining the lighting of a horizontal plane: Let I be the luminous intensity of any source of light, placed at a height h above the horizontal plane which is to be lighted. The intensity e of the lighting at any point P in this plane, situated at a distance x from the foot of the lamp-post, is to be found by the formula $e = \frac{I \sin a}{h^2 + x^2}$,

where a is the angle formed with the horizontal by the ray joining the source of light and the point P . Simple transformations permit us to give to this formula any of the following shapes:

$$(2) e = \frac{I \cos^2 a \sin a}{x^2}; (3) \frac{I \sin^3 a}{h^2}; \text{ and } (4) e = \frac{I h}{(h^2 + x^2)^{\frac{3}{2}}}.$$

From inspection of which formulæ some very interesting conclusions are to be drawn.

For example, the third formula shows, among other things, that the variation of lighting in the horizontal plane—the light-source being at a constant height—is proportional to $\sin^3 a$. This lighting is therefore at its maximum at the foot of the lamp-post—that is to say, for $a = 90^\circ$. By the aid of the second formula, we easily ascertain the height at which the light source should be placed in order to obtain the maximum intensity of lighting at the distance x . It suffices for this purpose to make the derivative of the second member of the formula equal to zero. This gives the equation $\frac{I \cos a}{x^2} \cdot (\cos^2 a$

$- 2 \sin^2 a) = 0$; which works out to $\tan a = \sqrt{\frac{1}{2}}$. The angle a therefore corresponds to $35^\circ 16'$; the corresponding height h is given by the formula $h = x \tan a = \frac{x}{\sqrt{2}} = 0.707x$. In words, to

obtain the maximum intensity of lighting at a point of the horizontal plane situated at the distance x from the feet of the lamp-post, the latter must be fixed at a height equal to $0.707x$. The fourth formula allows of the solution of an analogous problem—to compute the radius x of a circumference which receives lighting of a given intensity e , the height of the lamp-post being stated. Here $x^2 = \left(\frac{I h}{e}\right)^{\frac{2}{3}} - h^2$. Or we may suppose

h to be variable, and calculate the greatest value of the radius x corresponding to a stated intensity of lighting e . It suffices for this to make zero the derived value of x , obtained by the help of the third equation. We shall then have for a the condition $\sin^2 a = \frac{1}{3}$; $\cos^2 a = \frac{2}{3}$; or $\tan a = \frac{1}{\sqrt{2}}$. This angle is the same

as that in the former problem. It is therefore equal to $35^\circ 16'$, and corresponds to $h = \frac{x}{\sqrt{2}}$. The distance x thus becomes, by substituting for $\sin a$ and $\cos a$ their proper values, $x^2 = \frac{2}{3\sqrt{3}} \frac{I}{e} = 0.385 \frac{I}{e}$.

Dr. Palaz next proceeds to open up a discussion of the subject of the mean lighting of a surface; but since this is no more than a mathematical expression, it is not necessary to reproduce what he says about it. He also debates the question whether, in calculating the effect produced by a source of light, the determination should be made with reference to a horizontal plane or a plane normal to the luminous rays. Some specialists take one view, others the contrary; among the latter being Mr. Wybauw, who claims that it is in effect the lighting of the normal plane which plays the principal part in the actual distribution of light. Mr. Wybauw argues that "It is not generally the geometrical horizontal plane properly so called that has to be lighted, but the objects which are found upon this plane. Upon the public thoroughfares, these are the wayfarers, the carriages, the prominences and holes of the pavement; and it may be said in general that the bodies which must be lighted most commonly present faces and forms differing from the horizontal plane. Thus, there is no reason why we should consider the lighting of a horizontal plane more than any other." This argument Dr. Palaz dismisses, very justly as we think, upon the objection that the horizontal plane of the road surface is after all the principal feature of it, and regulates the apparent positions of everything upon it. If lighting is to be judged by a fresh standard—that of *useful effect*—it is possible to show, both by calculation and by observation, that any particular example of street lighting is really better than computation after the rule of the cosine makes it appear. Not only do prominences, sharp edges, passengers, vehicles, &c., actually receive more light from a distant source than the horizontal surface from which they stand out, and therefore exhibit themselves in greater relief as compared with the latter; but the rule of the cosine (which gives the intensity of lighting as the quotient of the illuminating power of the light source, multiplied by its height and divided by the cube of the slant distance) takes no account of a variety of considerations which exercise an important influence upon the apparent lighting. Among these, is the reflecting power of the surface itself. Any horizontal plane appears more highly lit as its reflecting power is increased. A plate painted black appears less illuminated than a white one receiving the same amount of light; and objects detach themselves less clearly from the first than from the second. It has been usually admitted that the law of photometrical emission was rigorous, or at least as exact as possible; but some recent researches by Herr Seeliger, of Munich, have proved that the greater part of the substances employed in building construction do not follow, even at a great distance, the theoretical rule. Divergencies of 20 per cent. have often been found, with inclinations of from 20 to 25 degrees. It follows that "calculations of lighting based upon the law of the cosine cannot give rigorously exact results; we must be contented with results more or less approximate."

It consequently becomes reasonable to take account in lighting problems of two methods—that of lighting properly so called, and that of the useful effect of the light. Dr. Palaz concludes that the intensity of lighting, as deduced from the fundamental laws of photometry, represents the inferior limit of the lighting obtainable in any case; while the useful effect, as defined by M. Wybauw, would be the superior limit of the same quantity. Dr. Palaz shows how the so-called Wybauw effect is to be computed; but we shall not repeat the demonstration here, being convinced that it possesses no appreciable practical value.

(To be Continued.)

The Projected Gas-Works Extensions at Belfast.—Mr. Corbet Woodall and Mr. W. Foulis have recently visited Belfast for the purpose of examining and reporting upon the various sites which have been proposed for the extension of the gas-works. Their reports will shortly be laid before the Council.

The Austrian Gas Industrial Union.—The twelfth annual meeting of this Society was held in Vienna, on the 27th and 28th ult., under the presidency of Herr C. Bauer, of the Imperial Continental Gas Association. The meeting was attended by about 70 members, who took the opportunity of inspecting the gasholder at the Imperial Continental Gas Association's works at Tabor. This holder—the largest on the Continent—was erected last year by Messrs. S. Cutler and Sons, from designs by Mr. Corbet Woodall. A visit was also paid to the Association's works at Erdberg, where two experimental furnaces with inclined retorts were seen in action. A prize of 100 florins for the best paper read before the meeting was unanimously awarded to Herr F. Bossner, the Central Inspector of the Austrian Gas Company, for an interesting and instructive communication on the new form of the "Welsbach" light, which is now largely in use in Vienna. Herr Bauer was re-elected President; and it was decided to hold the next meeting at Pressburg.

NOTES.

The Separation of Carbonic Oxide from Water Gas.

Another process for separating carbonic oxide from water gas has been invented; the patentee being Mr. Henry S. Blackmore, of Mount Vernon, New York. Mr. Blackmore's process consists in a method of exposing the water gas to the action of a caustic alkali, heated to the point of fusion. For this purpose, he prefers to place his caustic alkali in a cauldron, which is set in a part of the generator where it can be heated by the spent heat of the furnace gases. As the alkali melts, it runs out of the cauldron into the top of a vertical structure like an ordinary water gas superheater, packed with neutral material—the object being, in technical language, to “scrub” the nascent water gas with fluid alkali. Mr. Blackmore avers that in his process the reaction between the gas and the alkali is divided into two stages, the first resulting in the production of a formate of the alkali employed, followed by further action which produces free hydrogen and a carbonate of the alkali. This latter, being still in a fused state, escapes from the gas generator into a trap; whence it is finally washed out by the steam, to be restored to its original causticity by treatment with slaked lime. The alkali used in this process may be potash or soda, or a mixture of the two materials. There is a great likeness between this process and the earlier one of Professor W. Crookes, of which Mr. Blackmore probably never heard.

The Character of Sulphur.

Some little excitement has been caused among chemists by the circulation of a rumour, which is repeated by the *Chemical News*, under all possible reserve, to the effect that the elementary character of sulphur has been called in question. It is stated that Dr. Gross has been for many years engaged in extensive researches upon sulphur; and that certain of his results have been disclosed at a meeting of the Berlin Physical Society. Among other phenomena, it is reported that, after passing a powerful electric current by means of a platinum wire through a mass of barium sulphide fused in a silver crucible, it was observed that the barium had combined with the platinum to form a new compound, while some 50 per cent. of the sulphur had disappeared, leaving a corresponding quantity of a new substance in its place. Dr. Gross therefore considers that sulphur is no element, but is merely the hydride of the new body, whatever it is. The suggestion is a very startling one; and if Dr. Gross's suspicion turns out to be well founded, the discovery may have a variety of practical effects in different quarters. But for the present, it will be as well to reserve any question on the subject until the results of further research have appeared.

The Radiating Effect of Hot Air.

Some interesting experiments to determine the radiating effect of hot air have been made by Mr. C. C. Hutchings, and are described in the *American Journal of Science*. The author caused a stream of hot air to pass in front of one of the faces of a thermopile at a distance of 3 centimetres, causing the deflection of a galvanometer needle. The normal working of the arrangement was secured by placing in its vicinity a large Leslie cube, containing water at the temperature of the laboratory. There was no sort of agreement between measures made on eight different days, to determine the absolute radiating power of a column of air 1 centimetre thick at a temperature near to 100° C. Tyndall's result—which shows that the radiation depends upon the amount of moisture in the air—was confirmed; but no exact relationship between the two factors was found. This was probably because the air contained varying quantities of accidental impurities. The increase of radiation was found to be proportional to the rise of temperature. There was a small increase of radiating power when sheets of air more than 1 centimetre thick were used; but no difference was detected for sheets of less than this thickness. These experiments hardly do more than touch upon the fringe of a highly important subject.

The Best Colour for Artificial Light.

It is a question of great physiological interest, whether artificial light, by the use of which the activity of the human eye is prolonged after sunset, should be of the same colour as sunlight or daylight, or should have a distinct “tone,” whereby the nerve-elements of the eye which are strained all day long may be allowed to rest. There is a notorious difference, for instance, between the colour of gas or candle light and that of the electric arc light. The latter is usually called a blue light—sometimes with the addition of the uncomplimentary adjective “ghastly.” In daylight, however, the electric arc does not appear to be blue, but rather reddish. Arguing on these premisses, some partisans of electric arc lighting have contended that is only by comparison with the yellow gas and lamp light that the former appears blue; when relieved of this contrast, they claim that the arc light no longer strikes the eye as bluish. Consequently, it is pretended that the right way to redeem the character of the arc light for whiteness is to use it freely, if not exclusively, so that the eye may become habituated to take it for the standard of comparison instead of gas or lamp light. The whole question, it is said, turns upon a point of physiological prejudice. When we are more used to gas or lamp light, then the light of

the infrequent arc strikes us as bluish; if the latter preponderates in our experience, then we see the former as dull and yellow. Still, the question remains, which is the best artificial light—something which carries on the physiological effects of daylight, or something which is complementary to it? The query affects not only the competition between the electric arc and other kinds of light, but also that between the Welsbach incandescent and other forms of gas-burner. The problem may be attacked on one side by any reader or writer by gaslight, who will take sufficient trouble to experiment on himself with the naked light and with red or green glasses respectively.

Oil Fuel at Chicago.

Some authoritative figures respecting the comparative values of solid and liquid fuel come out in connection with the tender by the Standard Oil Company, for the contract for the supply of fuel to the Chicago Exhibition. Upon the assumption that three barrels of 42 (United States) gallons of oil are equal in heating power to a ton of coal, the Standard Oil Company sent in tenders to the Exhibition authorities offering to furnish all the fuel needed by them for 1892 and 1893 at 70 and 72½ cents. per barrel for the two years respectively. Various estimates of the quantity of coal required during the two years had been put forward. The lowest was 75,000 tons; so that the Standard Oil Company would have to deliver at Jackson Park at least 225,000 barrels of fuel oil, and in all probability much more. The tenders for coal ranged from \$2.44 to \$3.95 per ton; as against the Standard Oil Company's oil at \$2.10 and \$2.175. The bait is tempting; but the Exhibition authorities are reported to be hesitating between the two kinds of fuel. There are more reasons than one why the adoption of oil fuel for the Exhibition should be thoroughly well considered.

COMMUNICATED ARTICLE

COAL GAS: ITS MANUFACTURE, DISTRIBUTION, AND CONSUMPTION.

A Series of Articles for Gas Students.

(Continued from p. 704.)

PURIFICATION.

Before proceeding further, it will be well to consider something as to the composition of the crude gas as it issues from the retort. Most students are well aware that this is no simple or elementary gas, nor yet a compound gas of definite composition; but it is a mixture of different gases—each being a more or less complex compound of other substances.

In the crude gas will be found (*vide* Watts)—

Removed, wholly or in part, by purification.	Ethylene or olefant gas (C_2H_4)—the most valuable.	Diluents.
	Acetylene (C_2H_2).	
	Vapours of volatile liquid hydrocarbons.	
	Methane or marsh gas (CH_4)—the most abundant.	
	Nitrogen.	
	Hydrogen.	
	Carbon monoxide.	
	Tar and volatile oils.	
	Water.	
	Ammonium salts—sulphates, sulphides, and chlorides.	
	Ammonium cyanide and thiocyanate.	
	Sulphuretted hydrogen (H_2S).	
	Carbon dioxide (CO_2).	
	Carbon disulphide (CS_2).	

The proportions present of the constituents of crude coal gas here enumerated will be found to vary considerably in different works, and at different times in the same works. They will be affected by the changing temperatures employed for carbonization, and by other working conditions. Different coals, too, will necessarily give different results. Thus it is impossible to tabulate these proportions; but the following paragraph, dealing with the subject approximately, is very interesting. It is from the pen of Professor Wanklyn, in his “Gas Engineer's Chemical Manual”—a book that should be in the hands of every gas student:—

As it leaves the retort in which it is generated, coal gas is very impure. It is accompanied by rather less than one-third its weight of tar, by nearly half its weight of watery vapour, by about 1-50th of its weight of ammonia, by a little more than 1-20th of its weight of carbonic acid, by from 1-50th to 1-20th of its weight of sulphuretted hydrogen, and by from 1-300th to 1-600th of its weight of sulphur in the condition of sulphuret of carbon and organo-sulphur compounds.

The bulk of the heavy tar is deposited in the hydraulic main; and the lighter portions, still retaining the gaseous or vapour form, are condensed down by cooling. Some of the tar is present in the form of minute vesicles or globules, each enclosing its own volume of gas. These tarry vesicles, which impart to the crude gas its dense smoke-like appearance, can be discerned on examination by the aid of a microscope. The method of dealing with them will be referred to later on.

The term “purification,” as applied to coal gas, may be held to mean the removal therefrom of not only actually deleterious compounds, such as sulphuretted hydrogen, bisulphide of carbon, carbonic oxide, &c., but also the separation of all substances which are foreign to the purified gas of commerce, such as tar, water, &c.

The Condensers.

Of appliances specially designed to the above end, the condensers are the first with which the gas issuing from the retort

is confronted, unless, indeed, the foul main be included in this connection. Where this main is carried round the retort-house, it is frequently designated the primary condenser, while the condensers proper are termed secondary condensers. The object of the condensers is two-fold—direct and indirect; the latter following as a sequence to the former. In the first place, the temperature of the gas must be reduced sufficiently to allow of the ready elimination of ammonia, carbonic acid gas, and other substances, the extraction of which would be much impeded, or rendered impossible, by heat. Following this reduction of temperature is a deposition of much, but not all, of the tarry matter, which at ordinary temperatures assumes the liquid form (not all, because the presence of some of the richer hydrocarbons assists in retaining, holding in suspension, and actually carrying forward, some of the lighter hydrocarbons, which, if alone, would be deposited). Also a large quantity of aqueous matter which itself has absorbed quantities of ammonia (free, and in combination with sulphur compounds, and carbonic acid, forming soluble salts), carbonic acid, and sulphuretted hydrogen. Thus an important part of the purifying work is done in the condensers.

It is not well, however, to reduce the temperature to below (say) 50° Fahr. as a safe limit, owing to the liability of the gas to deposit the valuable hydrocarbons just referred to, and being proportionally reduced in its illuminating power. Moreover, in the event of the gas being lowered to 40° Fahr., it is doubtful whether the various chemical changes that should be taking place in the calcium or oxide purifiers will not be seriously interfered with, or brought to a standstill altogether. Hence excessive cooling is to be avoided. Bearing in mind the minimum stated, it is the better plan to work so that the heat of the gas on leaving the condensers may be within a few degrees of the atmospheric temperature.

Another consideration is that if the gas be passed through the various purifying appliances, and on through the station meter, at a temperature differing materially from that at which it will be measured in the consumers' meters, the registration of the latter, according to the law of Charles—i.e., the law of the relation of the temperature of gases to their volume—must register differently from the station meter, with resulting discrepancies in the manager's ultimate returns of gas made and gas sold. As intimated in a previous article, the process of cooling must be very slow and gradual; otherwise, similar conditions to those noted as attending excessive condensation—as regards the deposition of hydrocarbons—may be experienced. These are: Loss of illuminating power, and the carrying capacity of gas impaired, with the deposition of those lighter hydrocarbons which should have been taken forward by the richer series—some being deposited in the liquid form in the district syphons, others in a solid form, as naphthalene, in the mains, services, public lamps, meters, and consumers' fittings, giving endless trouble to consumer and producer alike, not to speak of constant stoppages on the works from the same cause.

There are in use many forms of condenser; the cooling agencies employed being air or water, or both. Air is now chiefly used; but the early pioneers of gas lighting had one or two very simple contrivances where water was utilized for the purpose. In some arrangements, the condenser consisted of a serpentine pipe, surrounded by a tank of water. John Malam had a condenser (now often spoken of as "Malam's washer") which answered the further purpose of the scrubber of the present day. It consisted of a cast-iron case, in which were placed a series of horizontal trays, one above the other, not quite the length of the case; the space between the end of tray and the case alternating right and left with each successive tray. Water brought in at the top filled No. 1 tray, which overflowed into No. 2; and this being filled, overflowed into No. 3, next below it, and so on until all were filled down to the bottom tray, whence a suitable outlet for the water was provided. Gas, entering at the bottom, passed over the surface of the water in the bottom tray, through the space referred to, to the next tray above, over the water in this tray, and on to the next, until ultimately it found its way to the outlet at the top; being considerably cooled by the constant contact with water, and having lost much of its ammonia by the same means.

In order to fully observe the necessary precautions relative to gradual condensation, facilities must be provided for graduating the extent of cooling to be accomplished in accordance with the varying requirements of the winter and summer seasons. The use of water as a cooling medium probably offers the most perfect means of thus graduating the temperatures; but it is not always the most convenient or economical agent to employ. Where air is utilized alone, provision should certainly be made for regulating the supply of cooling air to the condensers; also for effectually protecting them from the extremes of summer's heat and winter's cold. There should also be provision for regulating the area of cooling surface to be employed in accordance with the make of gas, which, of course, varies much during the year. If such arrangements are well and carefully made, there is surely no reason why atmospheric condensing should not be adjusted to the greatest nicety. It will be an advantage to provide, on the inlet and outlet of the condensers at least, thermometers suitably made for ascertaining instantaneously the temperatures of the gas.

Of atmospheric condensers there are three principal forms—the annular, the ordinary plain pipe form, and the battery. The

cooling of the gas is effected by the radiation from their outer surfaces, of the heat imparted to the pipes by the gas itself.

In preparing the following description of the various types and designs of condensers referred to, much assistance has been derived from a very excellent article dealing with this subject in "King's Treatise on Coal Gas."

The Annular Condenser.

This apparatus consists primarily of a series of upright pipes of large diameter, placed (in the ordinary form) on boxes or troughs for the reception of the condensed tar and liquor; or, as in improved forms to be described later on, on their own foundations—the tar and liquor being carried away direct. Within each of the larger pipes is placed a smaller one open top and bottom to the atmosphere. (When the box referred to is used, this smaller pipe will pass right through it, and is open at the bottom.) The annular space thus formed is closed at the top—and when the box is dispensed with, at the bottom also—by circular ring-plates bolted on to the flanges at the ends of both pipes.

The gas passes along this annular space. Entering at the top of the first condenser, it passes downwards to the lower end, then, by means of a pipe placed diagonally, it finds its way to the top of condenser No. 2, down the annular space there provided, through another diagonal connecting-pipe to No. 3, and so on right through the series—the flow of the gas through the condensers being thus always in a downward direction. The smaller inside pipe forms a sort of shaft through which the air, entering at the bottom and absorbing the heat, becomes rarified; and on ascending causes a current or draught, which is considered the great advantage of this type of condenser. While the gas is passing downwards in the annular space, the air is ascending in the pipe within. The reduction of temperature effected is thus intensified by the upward rush of the cold air. This is, of course, quite supplemental to the considerable cooling area provided by the surface of the outside pipe of large diameter. It is usual to provide a circular disc or throttle valve, either secured by a hinge or loose, by which the current of air up the inner pipe can be regulated at will, or shut off altogether if desired. Thus the available duty of this condenser is perhaps more at command than in any other of the atmospheric type.

(To be continued.)

TECHNICAL RECORD.

INSTITUTION OF CIVIL ENGINEERS.

The Annual General Meeting of this Institution was held last Tuesday, when the report of the Council for the session 1891-92 was presented.

It commenced by stating that the objects of the Institution were so widely known, had been so frequently referred to, and appeared to be so largely appreciated, that they might be passed over without comment. The constitution had remained unchanged since December, 1878, when the class of Associates was divided into two groups—one being Civil Engineers, to whom corporate privileges were granted, and who were distinguished by the title "Associate Members;" the other being non-corporate Associates, described as "persons able, from their connection with Science or the Arts, or otherwise, to advance professional knowledge." The Council had carefully guarded the admission of new members to every class; and the qualifications of all candidates had been subjected to rigid scrutiny. It was believed that a strict inquiry into each candidate's career was better than any system of examination. With regard to the changes in the roll of the Institution, it was stated that 59 Associate Members had been transferred to the class of Members, and there had been elected 3 Honorary Members, 28 Members, 324 Associate Members, and 7 Associates, while 4 Associate Members had been restored to the register. These additions together amounted to 366. After deducting 155 names from deaths, resignations, and erasures, there was an increase of 221, bringing up the total number on the register to 5371, as against 5150 at the corresponding date last year. This enumeration was irrespective of the Students; but including them, the total number on the books was now 6239, as against 6064 twelve months ago.

Allusion had been made on several occasions, the report continued, to the fact that, as the Institution included all classes of Civil Engineers, it must be expected that the "Minutes of Proceedings" would be gradually modified and developed, so as to meet the wants of its more diversified membership. Having regard to these considerations, it would be found that in constructive engineering, five papers had been read last session. Two of these—"The Bishop Rock Lighthouses," by Mr. W. T. Douglass, and "The Illumination by Gas of Tory Island Lighthouse," by Mr. D. C. Salmond—referred to sea-coast works of supreme importance to every maritime nation. The three communications on "Portland Cement" and "Portland Cement Concrete," by Messrs. Bamber, Carey, and Smith, related to a material fast becoming indispensable to the constructive engineer. Two papers directly connected with municipal engineering, were submitted for discussion, namely—on "The Sale of Water by Meter in Berlin,"

by Mr. Henry Gill, and on "The Sewage-Farms of Berlin," by Mr. H. Alfred Roechling. Both bore witness to the advanced condition of sanitary matters in the capital of the German Empire. The elaborate paper by Mr. Alex. R. Binnie, "On Mean or Average Annual Rainfall," must also be classed with this branch of engineering, as referring to one of the data upon which the water-works engineer based his calculations. After alluding to the other papers read, the report finally referred to some questions of importance belonging primarily to the domain of physics, and which required to be attentively studied by all engineers; and especially was this the case in respect to the operations connected with the measurement of light and heat, dealt with in the papers by Mr. A. P. Trotter, on "The Distribution and Measurement of Illumination," and Professor W. C. Roberts-Austen, on "The Measurement of High Temperatures."

To the authors of some of the communications, the Council had made the following awards: A "George Stephenson Medal" and a "Telford Premium" to Mr. Alex. R. Binnie; "Telford Medals" and "Telford Premiums" to Mr. A. P. Trotter and Mr. W. T. Douglass; and "Telford Premiums" to Messrs. H. Alfred Roechling, A. H. Curtis, W. Airey, H. Gill, and Professor W. C. Roberts-Austen.

The papers which had been deemed suitable for printing without being discussed included the description of the "Nagpur Water-Works Extensions," by Mr. E. Penny, and of "The Southampton Water-Works," by Mr. W. Matthews; also that by Professor W. C. Unwin, on "The Transmission and Distribution of Power from Central Stations by Compressed Air."

The Howard Quinquennial Prize had been awarded to Sir Isaac Lowthian Bell, Bart., F.R.S., for his treatise on "The Principles Involved in the Manufacture of Iron and Steel."

The report, after discussion, having been adopted, cordial votes of thanks were passed to the President, to the Vice-Presidents, to the Members of Council, to the Auditors, and to the Secretaries and Staff.

The Scrutineers then announced that the following gentlemen had been elected to serve on the Council for the ensuing year: President, Harrison Hayter; Vice-Presidents, Alfred Giles, M.P., Sir Robert Rawlinson, K.C.B., Sir Benjamin Baker, K.C.M.G., LL.D., F.R.S., and Sir Jas. N. Douglass, F.R.S.; Other Members of Council, W. Anderson, D.C.L., F.R.S., J. Wolfe Barry, Alex. R. Binnie, E. A. Cowper, Sir Douglas Fox, J. C. Hawkshaw, M.A., Charles Hawksley, Sir Bradford Leslie, K.C.I.E., George Fosbery Lyster, James Mansergh, Sir Guildford L. Molesworth, K.C.I.E., W. H. Preece, F.R.S., Sir Edward J. Reed, K.C.B., F.R.S., M.P. William Shelford, and Francis W. Webb.

OHIO (U.S.A.) GASLIGHT ASSOCIATION.

The Annual Meeting at Columbus.

(Continued from p. 847.)

Mr. J. Faux, of Pittsburgh, Pa., read a paper on "Gas-Burners and the Gas Companies' Interest in them." He commenced by enlarging on the importance of good burners, and the waste of gas and unnecessary vitiation of the atmosphere, with perhaps injury to eyesight, due to defective ones. After describing the flat-flame and the Argand burners, the importance of avoiding excessive pressure at the point of combustion was noticed, and also the precautions to be observed in dealing with different qualities of gas. The author went on to lay down the principle that in each town the suppliers of gas ought to supply burners suited to its combustion, and also to see that they were kept clean. Good burners would not give satisfactory results if allowed to become choked or corroded. The Siemens-Lungren regenerator and the Welsbach incandescent gas-burners were also considered, at some length. A discussion followed, in the course of which there was a general agreement as to the desirability of gas companies turning their attention to this question, by seeing that their customers were supplied with proper burners, and that the same were kept in good order.

A paper on the relation of holder capacity to output was read by Mr. G. N. Clapp, of Middletown, Ohio. After remarking that the stockholders' view of this question was "How small a gas-holder can you get along with?" he instanced the disadvantages of working with insufficient storage; and arrived at the conclusion that the gasholder capacity should be equal to the maximum output per 24 hours. It was followed by a short discussion, in the course of which Mr. Humphreys claimed that, by using a water-gas plant as an auxiliary, a very much less storage capacity could be safely depended upon than was practicable where coal-gas plant only was worked. This plan also admitted of higher quality gas being supplied, which would meet a very general demand.

The next paper was read by Mr. A. F. Nash; and it dealt with the prevention of errors in reading meters. Many of these were, he said, due to the awkward location of the meter, which, so far as was possible, should be situated in a dry, light place, easy of access. A light, clean, and well-ventilated cellar was a suitable place for the meter; but a dark, damp one, was not. A careful, intelligent man, provided with a good lantern, should be sent to read the index; the employment of incompetent meter inspectors was a mistake.

Mr. W. H. Anson, of Columbus, Ohio, followed with a paper entitled "Should Gas Companies do all the Gas-Fitting?" In reply to the objection that it involved keeping a large stock, the author pointed out that it was necessary in any case to have a stock sufficient for the service laying and meter fixing. In cases where competition had to be met, it was particularly desirable that the Company should be alive to every possible means of advancing their own interests. Then, it had been said that the plumbers and gas-fitters had a direct personal interest in acting as canvassers for the gas company; and this would be lost if the gas company entered into competition with them. This question was dealt with at some length from the author's experience; and he affirmed that in many towns skilled plumbers or steam-fitters looked down upon the gas-fitting, which was done by inferior men at a lower rate of wages. In the case of one plumber he had worked for, the apprentices were left to do gas-fitting jobs. The gas-fitters did the work, but the companies' men had to attend to complaints; and he considered that a man with some experience in the latter department would make a better gas-fitter than one who had not. The gas company, moreover, were much more interested in making a satisfactory job than the plumber. As regarded the question of supervision, it frequently happened that the architect, contractor, or builder, who superintended the construction of a building, had no practical knowledge of gas-fitting. Some instances were cited, in which consumers had applied to the gas company to undertake gas-fitting work, giving as a reason the high prices charged, or the incompetency of gas-fitters. For these and other reasons, he was of opinion that the gas-fitting should be in the hands of the gas company.

Mr. G. G. Ramsdell, in opening the discussion, insisted on the importance of having a set of rules and seeing that they were complied with before fixing the meter. He thought that the plumber or gas-fitter was of very little value as an ally in getting new business; and believed in the gas company undertaking the gasfittings. Mr. Penn agreed with the conclusions arrived at by the author of the paper, as his experience had been much the same. In some cases, the consumers, not having pipes of sufficient size, did not use half the gas they would otherwise take. Mr. Starr also thought that when the gas company did the work, it was much better done. Mr. Anson had formulated a set of rules, but found it difficult to get them carried out. The plumbers would allow the pipes to be laid and plastered over before giving him notice to inspect. Mr. Phillips not only supported the previous speakers, but advocated doing the fitting at as near cost as possible.

"The Present and the Future Tar Market" was the subject of a paper read by Mr. C. H. Welch, of Athens, Ohio, who commenced with a brief historical notice, ranging from the time when tar was regarded as valueless, up to the present, when so many uses exist for it. The prices paid in 1891 had ranged as high as 23s. per barrel net to the seller; and the average price received in the State of Ohio was over 16s. 8d. These high prices were caused by competition amongst the distillers, due to an impression that there would be a scarcity of coal tar. But the enactment of the McKinley law removing the tariff from the importation of tar and pitch, and putting both of them on the free list in 1890, had led to the importation of large quantities from England. At the present time, the country was well stocked with foreign tar and pitch; and there was evidence of a remarkable concert of action on the part of tar distillers. The result was that their wells were overflowing, and the prices offered for 1000 barrel lots early in 1892 ranged from 7s. to 9s. per barrel net. The tendency of the market for the immediate future was for lower prices still. But after the present year, the supply would be decreased by the progress of water gas and electricity in replacing coal gas. In England, also, the cheap Russian oil was displacing the dearer kerosene. On the other hand, the demand for tar was increasing. It was used for two and three ply roofing, roofing cement, tarred straw board, roofing felt, and paving cement, besides by the distillers. It was hardly fair to blame the free tariff law for the demoralized condition of the tar market, seeing that the duty previously charged was only 10 per cent. on tar and 20 per cent. on pitch. English tar was at present being laid down in New York at less than 12s. 6d. per barrel; and it would continue to be imported and govern the American market, as long as there was a surplus for disposal. The annual production in the United Kingdom was approximately 2,000,000 barrels; in the United States, 700,000 barrels; and in Ohio, 70,000 barrels. It was worthy of consideration whether the establishment of works for dealing with the latter quantity at some central point, by the united action of the gas companies, would not be a good thing. But failing this, the present position might be strengthened by increasing the storage capacity to two years' output, by acquiring facilities for loading on railways, and by dealing with large quantities through a common agency.

Discussion being invited, Mr. Nash spoke in favour of united action to bring about better prices, and of increasing the storage capacity. Mr. Penn agreed, saying that "the devil should be fought with fire;" and that as there was a combination to keep prices down, it should be met with one to force them up. In 1891, the tar paid half his coal bill; so it was an important item. He was going to increase his storage. If less than 8s. 4d. per barrel was the price, it was better to burn the tar.

Mr. Printz agreed with this; and had arranged to store his tar for a year or two, if necessary, in hopes of a rising market. Mr. Padan rather questioned this policy; and thought works large enough to deal with the Ohio production would be impracticable. Mr. Clapp preferred to burn his tar if he could not sell it to advantage. Mr. Marden pointed out that the imported tar was not good for roofing, as the lighter oils had been taken out. In a year's time, he believed prices would be as good as ever. On the motion of Mr. Taylor, a Committee was appointed to get information on this subject, and report at the next meeting.

A paper by Mr. Fred Bredel, of Milwaukee, Wis., on the subject of the "Determination and Regulation of the Proper Proportions of Primary and Secondary Air and Steam in Regenerative Furnaces," was next read. In it, the part played by air and steam respectively in the production of heat in the furnace was followed throughout, and illustrated by analyses of gases taken in practical working. When steam was not used, the author found that the air supply should be divided pretty equally between the primary and secondary inlets, but with a slight excess on the former; and with steam, 40 per cent. at the primary and 60 per cent. at the secondary. The questions of loss of heat by the escaping products of combustion, and of additional heat required for generating steam, were followed out exhaustively. The author's views are in favour of not using more steam than is necessary to facilitate the removal of clinker. In the course of a short discussion, the paper was appreciatively referred to as a useful work of reference for all who were interested in this subject.

After this, a communication from the Society of Gas Lighting, on the subject of uniformity in castings, was read. It was similar to that submitted to the New England Association; and a similar line of action was followed—viz., the appointment of a Committee to co-operate with other Associations in the matter.

Attention was then directed to the "Question Box." In considering the question "Is a gas-engine satisfactory for furnishing power for a small electric light plant?" Mr. Ramsdell referred to the use of gas-engines as large as 100-horse power for that purpose; and Mr. Humphreys stated, on the authority of Herr Oechelhäuser, that engines up to that size had been installed in Germany with eminent success. Mr. Penn raised the question as to whether gas-engines were steady enough; and the President gave instances to show that the "Otto" was perfectly satisfactory in this respect. Colonel Dell's experiences agreed with this; and Mr. Shelton mentioned several places where gas-engines were in use. In reply to a request for information on the proper position of the condenser and scrubber in a water-gas plant, Mr. Shelton said that the United Gas Improvement Company invariably put the scrubber first; so as to remove all the heavy impurities while the gas was hot. In answer to "What is the proper way of making cement joints in street-mains?" Mr. Gwynn said that he first caulked in about an inch of yarn, then put in cement and yarn, and finished off with neat cement. He used pure cement, without admixture with sand. In replying to another question, Mr. Chol-lar described his plan of using oil as an enricher. An ordinary $\frac{3}{4}$ -inch pipe was carried to the back of a retort, and raised a little at the end, so as to keep the pipe full of oil. The gas was tested at the ascension-pipe by being allowed to play on a piece of white paper. A light spot showed too little oil or too much heat, a black spot the reverse; so the heat and oil supply were regulated to give a brown spot between the two. The wrought-iron pipe would last a year. Mr. Thomson was trying three concentric pipes, so as to cause the oil to travel three times the length of the retort before escaping; but he had not used the arrangement long enough to speak definitely about it.

Several other questions were discussed; and the meeting was brought to a close, after the usual votes of thanks had been heartily accorded.

REGISTER OF PATENTS.

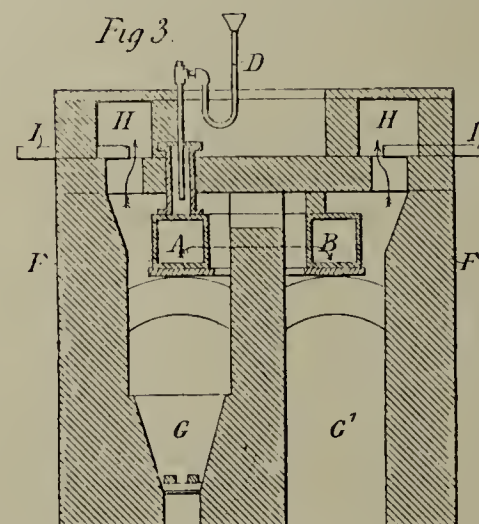
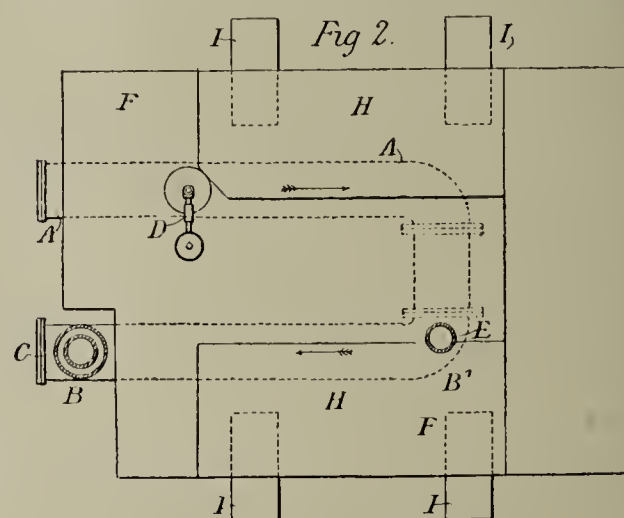
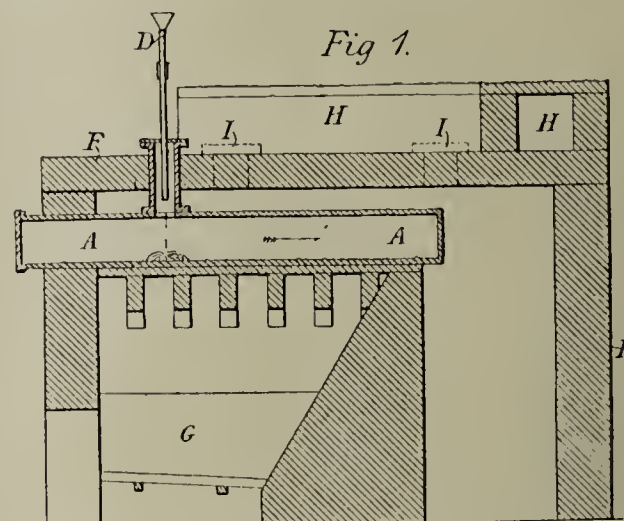
Manufacture of Illuminating and Heating Gas.—Wilson, W. H., of Waterloo, Lancs. No. 5468; March 28, 1891.

This invention refers to the manufacture of gas by the distillation of tar introduced into a heating chamber or duct, and mixing the resulting gases with coal gas in a chamber or duct at a comparatively low temperature. The coal gas is thus "subjected to such a temperature as will effect the required combination, but will not have any deleterious effect upon its illuminating qualities."

In carrying out the invention, according to one mode the tar is introduced into an externally-heated duct or chamber at a high temperature and gasified; while the illuminating coal gas is introduced into a different or separate portion of the same duct or chamber, which is maintained at a much lower temperature (under or about a dull red heat), and there mixes or combines with the gases resulting from the distillation of the tar, which will be still hot—that is, they are not materially reduced in temperature at the moment they combine with the coal gases. In a modified form of apparatus, the combination of tar gases and coal gas may be effected in an entirely separate and distinct duct or chamber maintained at the required low temperature; the tar gases being led thereto by suitable conduits from the tar-distilling chamber or duct; while the coal gas is conveyed thereto in any suitable way—the two gases being so introduced as to effect a proper combination. The gases should, in this case, be artificially cooled upon leaving their ducts or chambers.

Fig. 1 is a sectional elevation of the apparatus; fig. 2 is a plan showing the plant; and fig. 3 is a transverse section.

A is the retort or chamber in which the distillation of the tar takes place; while B is where the coal or other gases used to combine with the tar gases are introduced. C is the conduit by which the combined tar and other gases are led away, and wherein they are cooled artificially by fluid externally applied. D is the trap device by which tar is introduced into the apparatus. E is the pipe by which the combining coal gas (or other hydrocarbon gas) is led into the apparatus. F is the brickwork of the outer wall, in which the apparatus is set. G is a furnace. H are the flues. I are dampers or valves therein, by which the temperature of all parts of the apparatus may be maintained at the required heat.



As will be seen, the tar is distilled in the portion A of the retort; and it is subjected, practically, to the full heat of the furnace gases. Under any circumstances, it must be kept at such a heat as will cause the distillation of the tar to be thorough and effective. From the portion B of the retort—that is, from the point at which the mixing gas is actually delivered into it, to the point of outlet—the retort is surrounded or covered with brickwork, by which this portion of it may be the more easily maintained at a sufficiently low temperature to prevent any destruction or deterioration of the illuminating properties of the gas taking place. The temperature of this part (B) may be kept at, say, about 900° Fahr., or even less. In order to keep comparatively cool this portion of the retort, the heating gases, after they have been used to maintain the retort A at the requisite high temperature, simply pass from the furnace or chamber G to the chamber G', within which the retort B is disposed; and from this chamber, the gases pass away to the flue H. It is immaterial, generally speaking, as to what method is adopted in creating the difference of temperature in the various parts of the apparatus, so long as the differential temperatures are such as to effect the ends sought.

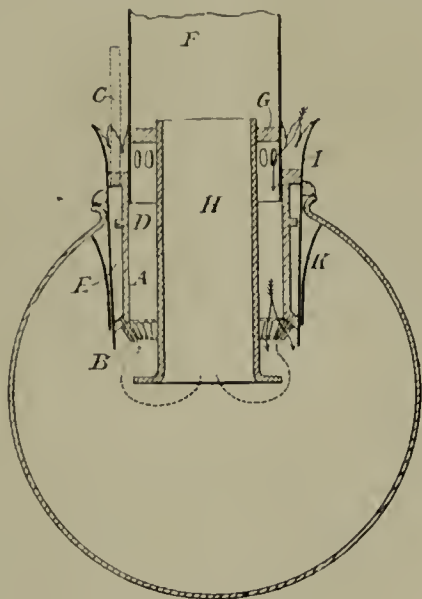
In Fig. 2 a twin retort is employed; tar being introduced and distilled in A, and the hydrocarbon gas introduced and mixed with the tar gases in B.

In some arrangements, whether continuous or separate retorts be employed, the retort or part A may be set at an inclination, and provided at its lower end with a pipe, by which any tar remaining undistilled when it has reached the lower end drains away; the pipe having a liquid seal at its lower end.

Gas-Lamps.—Higginson, W. J., of Liverpool. No. 9370; June 3, 1891.

Lamps under this invention are of the class in which inverted ring-burners within a closed globe are used, in which the flame passes from the burner up a central tube or chimney, and air to support combustion enters the globe through passages surrounding a central chimney.

It is claimed that a lamp constructed according to this patent has the following novel features: (1) An annular casting perforated at its lower end and provided with an inlet way at its upper end, and with one or more partition pieces, all so disposed that, when a tube is driven through or around the casting, an annular gas reservoir and a burner are formed. In some cases the tube also serves as a chimney. (2) An annular deflector is suspended within the chimney; so that air in its passage to the burner flows between the deflector and the walls of the chimney. (3) Passages are arranged, so that air on its way to the burner first descends between the deflector and a partition, and then ascends until it reaches a space from which there are descending passages leading to the interior and exterior of the burner. (4) The fitting of the exterior ring of the lamp with upwardly-extending springs, so disposed as to retain the globe in position, and yet allow of its easy withdrawal.

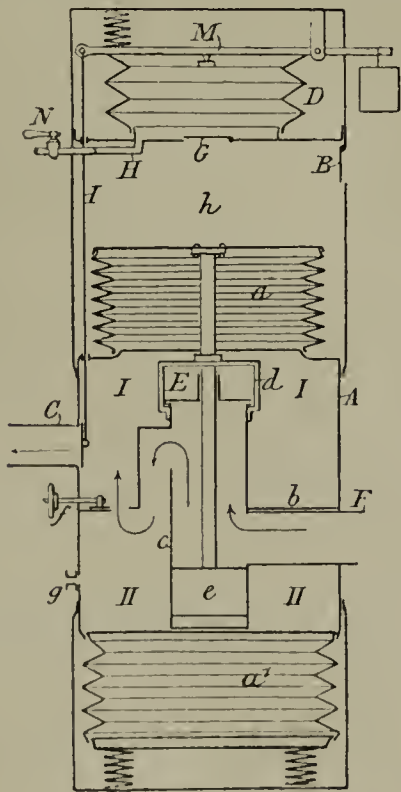


An illustration is given of a lamp more particularly illustrative of the first, second, and fourth parts of the invention. A is an annular casting perforated at B below to form the burner, provided with an inlet way C at its upper end, and having a partition piece D between the inlet and the perforations. E is a tube driven around the annular casting, so as to make tight joints at top and bottom. F is the chimney, which forms a continuation of the annular casting. Within the chimney is suspended from a ring G a deflector H; and air-ways I are made through the chimney, so that air to support combustion may flow down to the burner between the chimney and the deflector. The globe is held in position by upwardly-extending springs K secured to the tube E, which here forms the exterior ring of the lamp. The air, in its passage down to the burner, becomes heated; and the gas flowing from the inlet way C to the perforations B, is obstructed by the partition piece D, so that the flow is regular and uniform.

Pressure Regulator for Gas-Engines.—Held, H. G., of Almelo, Holland. No. 11,628; July 8, 1891.

This invention relates to a gas-pressure regulator for the purpose of supplying gas-engines with gas under constant pressure, so as to ensure the formation of a constant explosive mixture. In addition to this, the regulator allows the application of a contrivance which prevents the flickering of the little flame which serves for the ignition of the explosive mixture while the cylinder of the machine is being exhausted, and so prevents the accidental extinction of the flame, and the consequent interruption of working. It also regulates the working of the motor in such a manner that any regulators "become entirely superfluous."

In the vertical section of the regulator, the apparatus is shown to consist of a cylinder A, ending at the top and bottom in bellows *a* and *a'*. In the lower part, this cylinder is divided by a partition *b*, so as to form two chambers I and II. The upper chamber is connected to the cylinder of the engine, by a short tube C; and the lower one to the gas-delivery pipe, by the tube F. The chambers communicate by a tube *c*, which is open at the top, and is capable of being closed by a valve E. When the upper bellows *a* expand, the valve is lifted up; but when



they contract, the valve closes the cylinder *c*, thereby preventing the gas-delivery pipe from being affected, or the igniting flame from being thrown into a flickering motion, during the operation of exhausting the engine. The cylinder *c* communicates, on the one hand, with the gas-delivery pipe by the tube *F*; and, on the other hand, with the lower bellows chamber through an opening leading from the upper part of the cylinder. To the top of the cylinder is fixed the guide-piece *d*, in such manner as to allow the valve *E* to move up and down. Inside the cylinder *c*, the piston *e* is situated; its piston-rod passing through the valve *E*, and being secured to the upper side of the bellows *a*. The valve *E*, which is provided with a guiding tube, is fitted over this piston-rod in such manner that, either the friction between the guiding tube and the piston-rod alone, or friction procured by means of a spring, causes it to participate in the upward or in the descending movements of the piston-rod, without, however, interfering with the independent motion of the piston-rod alone. Thus, when the piston is descending, the valve *E* comes into contact with, and closes the upper opening of, the cylinder *c*. The partition which divides the two chambers I and II contains furthermore an opening the area of which can be regulated by a slide-valve *f*. The short tube *g* is for the purpose of conducting the gas out of the regulator to the ignition flame.

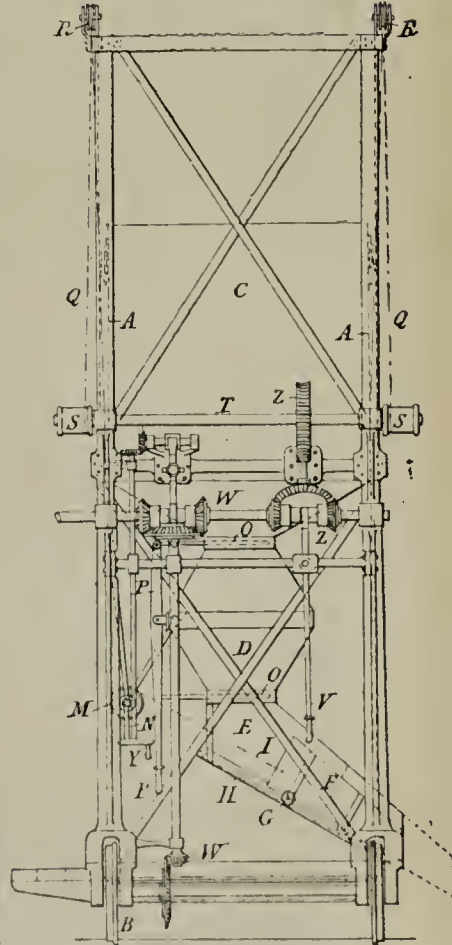
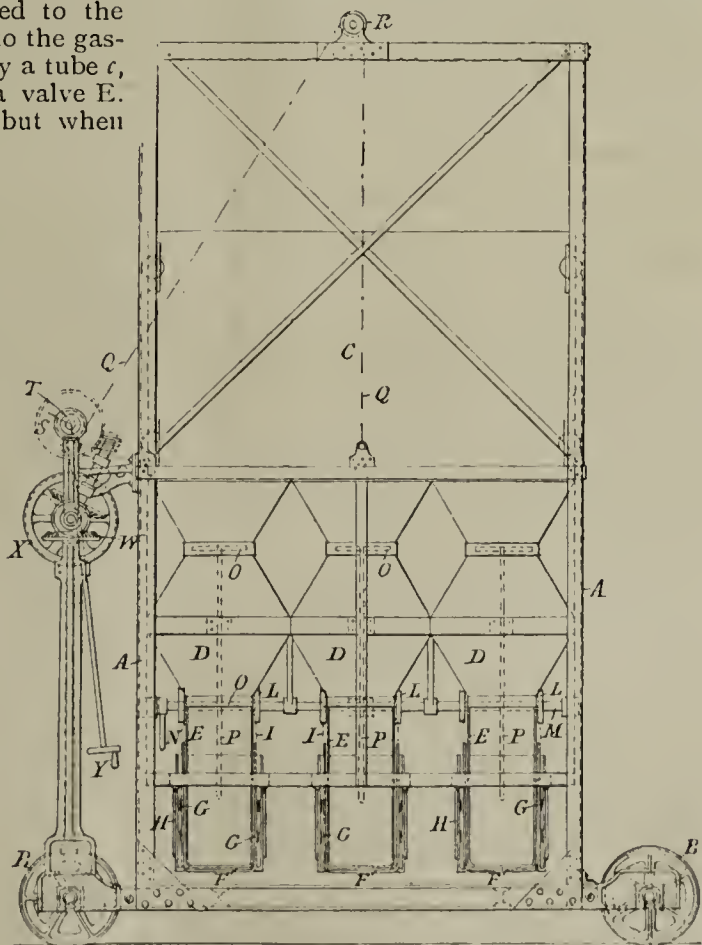
When the motor is in operation, the gas escapes from the supply-pipe into the cylinder *c*; and from there into the chamber II. through the opening *m* and the channel *i*. From the chamber II, the gas passes into the chamber I, through the opening provided in the partition *b*, and causes the upper bellows to expand. In consequence of this, the upper side of these bellows moves upwards, and with it the piston-rod; and as thereby the valve *E* is carried along with it, the cylinder *c* becomes open at its upper end. The gas, therefore, can freely pass from the upper end of the cylinder *c* to the chamber I. As a consequence of the continuance of the upward movement of the upper bellows, the piston *e* becomes shifted so as to block up the opening in the cylinder; and the gas can now penetrate into the upper chamber I only through the opening provided in the partition *b*. Communication therefore between the gas-delivery pipe and the motor is nearly entirely cut off; and the feeding of the ignition flame out of the chamber II takes place in consequence of the pressure which the springs situate below the chamber bring to bear upon the lower bellows *a'*. At the same time, the passing of gas from chamber II into chamber I, maintains the balance of pressure, and supplies chamber I with the gas required for the engine.

For the purpose of regulating the working of the motor, a valve B is situated at the side, and in the interior, of the casing of the partition *b*; and on the top of this casing is a valve G, by means of which this partition stands in communication with the bellows D. The expansion and contraction of these bellows causes the pipe C, that conducts the gas to the engine, to become partially or entirely closed or re-opened; and so the working of the motor is modified.

As has been shown, the bellows *a* contract when the engine is being exhausted; and, in consequence of this, air is drawn into *h*, through the valve B, which subsequently, when the bellows *a* are made to expand by the gas pressure, is pressed through the valve G, into the bellows D, which also expand, whilst the valve B closes. In order to allow the air to escape, these bellows D carry a tube H provided with a stopcock N, through which air can pass more or less freely according to the adjustment given to the stopcock. When the engine moves rapidly, the bellows *a* also expand and contract rapidly; and if the a stopcock N is so adjusted that the air inhaled cannot pass through it as quickly as it is taken in, the bellows D are made to expand and press up the lever M, which acts upon the slide-valve K through the rod J, thereby shutting up the tube C. Consequently, the quantity of gas flowing to the engine is diminished, and its working made slower. The velocity of the engine can, therefore, be regulated solely by adjusting the stopcock N.

Charging Inclined Gas-Retorts.—Stevenson, G. E., of Manchester. No. 12,572; July 24, 1891.

This apparatus, for the charging of inclined gas-retorts, is shown by the accompanying illustrations, in front and side elevation.



It consists of a quadrilateral framework A, mounted on wheels B capable of running upon a rail or tramway laid in front of the retorts at their upper end. Within the framework is a primary, or principal, coal-hopper C, which communicates with three secondary hoppers D below it; each terminating in a fixed shoot E and a sliding shoot F. The sliding shoots are made slightly larger than, but of the same shape as, the fixed shoots; so that they fit outside the latter, and are of sufficient length to bridge the space between the ends of the fixed shoots and the mouthpieces of the retorts. They are mounted on wheels G, running on rails or in channel-iron guides H set at the same angle as the fixed shoots; and they are raised or lowered diagonally and independently of the remainder of the apparatus by chains I attached to their sides, with the other ends wound round drums or wheels L fixed on a shaft M, actuated by a handle N. At the top of each secondary hopper, and also at the bottom (where the fixed shoot commences), are valves O operated by a lever P, and so arranged that, on the upper one being opened, the lower one is closed by a single operation; thus allowing coal to fall from the upper into the lower hopper. By a reverse action of the lever, the upper valve is shut, and the lower one opened, thereby permitting the coal in the secondary hopper to fall into the shoot, and from thence into the retort. Both the principal hopper C and the secondary hoppers D, together with the shoots E and F, guides H, and connected parts, are suspended by chains or ropes Q fastened to the principal hopper, and passing over pulleys R fixed on the top of the outer frame, and then attached to the drums S on the shaft T, so that the hoppers with their shoots are made to rise or fall by rotating the shaft.

The action of the machine is as follows: The hoppers D having been filled with coal, the machine is placed in front of the retorts, and the hoppers are raised to the appropriate height by rotating the shaft T. The sliding shoots F are then allowed to slide forward, so as to enter the mouthpieces of the retorts; whereupon the lever P of each secondary hopper is operated upon, so as to open the lower and close the upper valve O, when the coal will fall into each retort as desired. The lever P being then reversed, the hopper is re-charged with coal; and on the withdrawal of the shoots, the machine may be moved to the next set of retorts to be charged, and the lids applied to those already done.

The machine is made to travel to-and-fro on the rails either by hand or by power. When by power, an endless rope or band passes round a wheel or drum X on the machine, and is driven by any suitable motor. The motion of this wheel or drum is conveyed to the travelling wheels by bevel or other gearing W; the motion being stopped or reversed by a clutch worked by the handle Y. The hoppers and shoots are raised and lowered by hand or power. When by power, the vertical movement is effected from the drum X, through the bevel and worm gearing Z; the motion being stopped or reversed by a clutch worked by the handle V.

APPLICATIONS FOR LETTERS PATENT.

- 8722.—MARTIN, E. G., "Safety gas-governor." May 9.
 8877.—HAWKINS, T., "Gas-engines." May 10.
 8892.—ROGERS, H. J., "Manufacture of gas for lighting and heating, and for use in gas-engines." May 11.
 8957.—STABLES, J., "Gas-stoves for heating purposes." May 11.
 9114.—OAKMAN, R. N., jun., "Gas-producing plant." May 13.
 9131.—PEASE, E. L., "Maintaining telescopic gasholders in their working positions." May 13.
 9161.—ROBINSON, H., "Gas or combustible vapour engines." May 14.
 9221.—WILLIAMS, H., "Gas motor engine." May 16.
 9254.—HERON, T., "Globe-holders and sight protectors for gas or oil lamps; also smoke-consuming and other globes." May 16.
 9265.—HILL, F. B., and BRETT, R. D., "Utilization of liquid hydrocarbons for lighting and heating purposes." May 16.
 9415.—THOMPSON, W. P., "Gas-regulators admitting gas to gas engines, meters, and the like." A communication from C. Bourne. May 18.
 9419.—WILLIAMS, H., "Exhausting or drawing away and washing or purifying gas or gases, or products of combustion." May 18.
 9439.—BEUGGER, A., "Petroleum and gas motors." May 18.
 9455.—VELNA, G. DE, "Emulsion of petroleum or analogous hydrocarbons and of compounds thereof with carbonaceous material suitable for fuel, and for the manufacture of gas." May 18.
 9459.—FOULIS, W., "Obtaining cyanides from illuminating and heating gas." May 18.
 9474.—FOULIS, W., "Obtaining cyanides from illuminating and heating gas." May 18.
 9620.—BOWING, J., "Manufacture of coke and recovery of tar products." May 20.
 9624.—WELCH, W. H. J., "Gas-burners." May 20.
 9664.—GOODMAN, J., and BARKER, A. H., "Gas, petroleum, and other hydrocarbon or liquid fuel engines." May 21.
 9674.—MAGEE, J., "Gas motor engines." May 21.
 9698.—GRUBB, J., "Sliding gas pendants." May 21.
 9766.—LOEB, B., "Apparatus for breathing air containing dust, smoke, or irrespirable gases and vapours, and the like." May 23.
 9772.—TAYLOR, G. H., and LOWE, W. O. A., "Self-contained gas-fired steam generators." May 23.
 9779.—HECKEL, F., "Water-supply taps." May 23.
 9798.—FRASER, J., "Gas or oil engines." May 24.
 9829.—COWAN, W., "Apparatus for automatically varying the load and pressure of gas-governors." May 24.
 9849.—PICKUP, J. H., BYROM, J., and RIGBY, W., "Gas-lamps." May 24.
 9878.—THOMSON, J., "Water-meters." May 24.
 9910.—SHREWSBURY, C. P., and DOBELL, J. L., "Apparatus for electrifying air, gas, or vapour for various useful purposes." May 26.
 9938.—BAECKER, W., "Process for treating coal tar, to render the same suitable for the production of light gas." May 26.
 9985.—GARTRELL, J. H., "Appliances for indicating and regulating fluid pressure." May 26.
 10,016.—LITTLE, G., "Conveyors." May 26.
 10,036.—IRVINE, A. K., "Apparatus for heating by means of combustible gas or vapour." May 26.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

Monday, May 30.

WATER COMPANIES (REGULATION OF POWERS) BILL.

On the report of amendments to this Bill being brought up,

The EARL of WEMYSS moved an amendment, the effect of which would be to apply the provisions of the measure to corporations supplying water as well as to water companies. He said that, as it at present stood, it was, in his opinion, illogical, inconsistent, and one-sided; and he invited the House to remove these defects. Its object was to give water consumers security against the arbitrary exercise by water companies of the powers they possess under the present law. But the Bill only applied to consumers dealing with companies, and excluded those obtaining a supply from corporations. It was thought, however, only right that the same protection which it was proposed to extend to the customers of companies should be extended to those of corporations. Taking the case of London, his Lordship pointed out that if next year the undertakings of the Water Companies were acquired by the County Council, Londoners would, under this Bill, lose all protection. His noble friend who had charge of the Bill (Lord Camperdown) said the remedy was in the hands of the ratepayers when the elections took place; but he (Earl Wemyss) did not think it mattered much to the consumer whether his water was cut off by Lord Rosebery or by the chairman of a water company. Another consideration entering into this issue was that of private enterprise—of personal *versus* municipal effort. It was private enterprise which had made the country great, and which had brought the water to London. But for this Londoners might now be drinking a decoction of sewage instead of pure water. It was a strong point, when Parliament, in 1847, passed a Bill for regulating the powers of water companies, that no distinction was drawn between the private companies and the corporations. He hoped their Lordships would accept the amendment he had put forward.

The EARL of CAMPERDOWN said the Bill did not originally relate to corporations; and it was now proposed to introduce them for the first time. The result would be that the measure, which no one could deny was expedient, would have no chance of passing into law this year. The proper course for the noble Earl to pursue to effect his object was, he submitted, to introduce a Bill next session, placing corporations on the same footing as private water companies; and this would give corporations the opportunity of being heard.

Lord GRIMTHORPE supported the amendment. He said that they were face to face with this question—whether the British ratepayer was likely to be better protected against corporations than against companies. A corporation was always on the spot to watch any action of the companies, and had no difficulty now in appearing before Parliament. But, on the other hand, when the corporation had a water supply in their hands, there was no controlling power whatever over them; and the ratepayer might feel that he was spending his money at both ends. He (Lord Grimthorpe) did not think it wise to encourage corporations to become the owners of water and gas undertakings. There was greater power, and greater means of exercising tyranny, in the hands of corporations than in those of companies. There was no body more arbitrary than a Bumble corporation. The noble Lord had said that, in case of abuse, the public would have the remedy in their own hands; they could turn out the corporation. But, practically, there was no remedy except by a small man fighting a battle against a great corporation. With regard to what had been said about a postponement of the Bill, if there was to be legislation next year, why not wait until then for a complete Bill?

Lord HENNIKER, in opposing the amendment, said the Bill was generally in accordance with that which was passed in 1885, and with regard to which the Water Companies were heard. There was a clear distinction between the case of a company, whose chief object must necessarily be to secure profit, and a sanitary authority, as the latter were more likely to have regard to considerations affecting the health of the district. It might be that there were cases in which the sanitary authority might unduly exercise their powers of cutting off water; but the Local Government Board had no facts before them which would support any such contention. It was not unreasonable that, before a measure of the nature of the present Bill was passed, some evidence should be adduced, and the authorities attacked have an opportunity of replying to any allegations made against them. Looking to the period of the session, he might point out that, if the amendment were accepted, it would undoubtedly delay the passing of the Bill; and it was very expedient that it should become law, as it would be of undoubted advantage. In all the new Bills which came before the House, the arbitrary powers of water companies in regard to cutting off the supply were always struck out.

Lord HERSCHELL said, if the amendment was inserted, the Bill ought not to be passed, because it was introduced as affecting water companies only, and the other bodies now sought to be included had not had an opportunity of making any representation.

Lord NORTON approved of the proposal that the matter should be deferred until a separate Bill could be brought in.

The EARL of MORLEY agreed that reason was on the side of the noble Lord who moved the amendment; but he could not support him, because it was inexpedient to wreck the Bill.

After further discussion,

Viscount CRANBROOK urged the Earl of Wemyss not to press his amendment to a division, but to accept the almost unanimous opinion of the House that the principle should be extended to corporations. It might be mentioned, in favour of the Bill as it stood, that the water companies did not oppose it.

The EARL of WEMYSS expressed his willingness to rest satisfied with the strong expression of opinion in favour of the principle, and withdrew his amendment.

The report of amendments was then agreed to.

Tuesday, May 31.

WATER COMPANIES (REGULATION OF POWERS) BILL.

This Bill was read the third time without discussion, passed, and sent to the Commons.

The following progress was made with Private Bills last week :

Bills read the first time : Birmingham Corporation Water Bill ; Exmouth and District Water Bill ; London Water Bill.
Bills read a second time : Electric Lighting Orders Confirmation Bills (Nos. 4, 5, and 6). ; Gas Provisional Orders Bill.
Bills reported : Airdrie and Coatbridge Water Bill ; Gas Provisional Orders Bill.
Bills read the third time and passed : East Grinstead Gas and Water Bill ; Gas Orders Confirmation Bill ; Ormskirk Gas Bill ; Rhyl District Water Bill.

HOUSE OF COMMONS.

Tuesday, May 31.

BIRMINGHAM WATER BILL.

On the order for the third reading of this Bill,

Mr. T. ELLIS moved to re-commit the Bill in respect of clause 53, in order that he might propose to leave out that clause, and insert another, saving certain fishing rights to the inhabitants of the town of Rhayader and district.

Mr. CHAMBERLAIN opposed the motion.

After discussion, the House divided.

For the amendment	67
Against	125
Majority against	—58

On the question that the Bill be read the third time,

Sir H. VIVIAN moved its rejection, on the ground that the constantly increasing population of Wales should be secure of a future water supply.

The amendment was, however, negatived without a division ; and the Bill was read the third time.

The following progress was made last week with Private Bills :—

Read the first time : Gas Orders Confirmation (No. 2) Bill ; Water Companies (Regulation of Powers) Bill.
Read a second time : Uttoxeter Water Bill ; Western Valleys (Mon) Water (Gas Purchase) Bill.
Reported : Ashton-under-Lyne, Stalybridge, and Dukinfield District Water Bill ; Glasgow Corporation Water Bill ; Pontypridd Water Bill ; Swansea Corporation Water Bill ; Swinton and Pendlebury Local Board Bill (Lords)—Preamble not proved.
Read the third time and passed : Birmingham Corporation Water Bill ; Exmouth and District Water Bill ; Ipswich Corporation Bill ; Kilmarnock Corporation Water Bill ; London Water Bill.

HOUSE OF COMMONS COMMITTEE.

Friday, May 6.

(Before Mr. CAMPBELL-BANNERMAN, Chairman ; Sir W. HOULDSWORTH, Sir H. STAFFORD NORTHCOTE, Mr. R. K. CAUSTON, Mr. S. GEDGE, Mr. P. STANHOPE, Mr. POWELL WILLIAMS, Mr. W. JAMES, and Mr. E. H. LLEWELLYN.)

BIRMINGHAM CORPORATION WATER BILL.

On the re-assembling of the Committee this morning,

Professor Hull was cross-examined by Mr. BALFOUR BROWNE. He said he advised on the deep-well water system of Birmingham, and was asked to do so with Mr. Hawksley on the King's Vale and Aston bore-hole. The important matter in well sinking was to choose the site judiciously ; but engineers generally made a mistake. They themselves selected sites, and then called in geologists to give their support to them ; instead of first asking the geologists to select the sites, and then carrying out the work afterwards. Reminded that Mr. Hawksley had stated that one eminent geologist had said the King's Vale well would yield 6 million gallons of water a day, and it had only produced 3 millions, witness expressed surprise. He said he was not aware that it was in consequence of the failure of the King's Vale well that Birmingham had to go to Parliament very soon afterwards to get leave to take water from the Blythe and Bourne. Asked if it did not look as if well water was not the proper kind, when they had to go to over-ground waters, witness said it did not convey this conclusion to his mind. If he had had the selection of the wells for Birmingham, he did not think there was one, except that at Aston, which he would have selected. The sites were too far west. They ought to have been brought considerably further east. Witness was then cross-examined as to the various districts in regard to which he had given evidence, and as to whether or not he was aware of the extent to which they were already drawn upon by surrounding authorities and companies.

The CHAIRMAN : You say that, if the Birmingham people went farther afield, they would get plenty of water ; but for that purpose they would have to obtain parliamentary powers. If this was done, would not the people in the districts upon which they sought to encroach offer opposition ?

Witness : In cases of that kind, it is usual to come to terms.

The inhabitants of every individual place would have the right to pump for themselves, I should think. It would be difficult to see how the Birmingham people could encroach upon their grounds ?—The plan to be adopted is to keep a distance between the wells of two or three miles.

If they go to Wales and take water that can be spared, no one objects to the water being taken as long as other interests are preserved ; but in the case you suggest, there would not be the same free hand given you.—What I should say is that, if you select a site for a well, you ought to keep at a sufficient distance to make it certain that you are

not interfering with the supply of existing wells for the sake of yourself as well as others.

In reply to further questions of the CHAIRMAN, witness said he was not prepared to admit that a larger quantity of water might not be obtained from the existing wells by boring from the bottoms of the wells, or by driving out headings ; and if this had been done, he had no doubt the present area had been pretty nearly utilized.

Mr. R. Smaliman said that he was a mining engineer, and had had 40 years' experience in the coal-fields of South Staffordshire, Warwickshire, Leicestershire, and Derbyshire. In the course of his investigations, he had to consider the question of the underground water. He was engaged in sinking a shaft at Exhall Colliery, near Coventry, and at a depth of 106 feet they came to sandstone, which yielded 1.44 million gallons of water a minute. At a depth of 223 to 321 feet, they came to three layers of sandstone, and altogether they yielded 1500 gallons of water a minute. This was the main water-bearing rock in the neighbourhood. Below the water-bearing sandstone they came to marl and clay which overlay the coal formation, so that it was possible to get the coal under those water-bearing rocks. The 1500 gallons of water a minute would represent 2 million gallons a day ; and this went on the whole of the time the shaft was being sunk. The water was good soft water. He had proved these water-bearing rocks along the line of the Warwickshire coal-fields, and found an ample supply of good water. The total sandstone area in the whole district was 200 square miles, and the total capacity was 30 million gallons a day. He estimated that the Birmingham Corporation were pumping daily 10½ million gallons ; from private wells some 3½ million gallons were drawn ; the South Staffordshire Company pumped 7 million gallons ; Wolverhampton, 3½ million gallons ; and others, 2½ million gallons—making 27 million gallons. The surplus would be 53 million gallons a day for the supply of the district.

Mr. F. W. North, F.G.S., said that, if the permian beds were pierced by any wells or pits after they had dipped under Birmingham, he was certain they would be found saturated with water. Water was never reached in sinking through the outcrop of strata ; when the shafts were sunk deeply into the strata, water was met with. Care was necessary in fixing the sites for wells in the permian sandstones. He had heard, and entirely disagreed with, the evidence of Professor Lapworth. He said—and he knew it to be an absolute fact—that there were vast quantities of water in the pebble beds lying to the east of Birmingham ; and he was certain that, by a system of deep wells sunk therein, an ample supply of water could be obtained for a long period. He could not accept the area of 35 miles as the whole district within the range of the Birmingham sphere of influence. He quite agreed that, if the area of these deposits stretched wide enough to catch a sufficiently large rainfall, Birmingham would have plenty of water from them alone ; and as this could not be, he would propose that the enormous rainfall running to waste off the adjoining impervious rocks of keuper marls should be collected at suitable points, and distributed into a series of wide shallow reservoirs, made without puddle upon the porous rocks, so that 100 per cent. more rainfall should be made by artificial means to rest upon the land where it would be so valuable. By this means, the increased percolation would drown all the existing pumps.

Professor Wanklyn said he had studied the Birmingham wells for five years, and had never had any polluted water from them of which he could find any record. So far as his inquiries went, the well water was free from pollution. The Digbeth artesian well, which was situated in the very centre of the city, was a deep spring of water ; and he should place it in the first class of his very severe classification of drinking water. To a person who was accustomed to London water, it would appear soft. The immediate hardness was about 6° ; but there was a secondary hardness taking a long time to develop, which ultimately would bring it up to about 8° further. If it were desired to soften this water, it might be done perfectly by the Clark process. But for a town supply nothing was needed. He had analyzed the water from the Perry and Witton wells of the Corporation. These waters were a very little harder than the Digbeth water ; but in other respects they were everything that could be desired for a town supply. As regarded the alleged deterioration of the well waters, if there was any change at all, deep wells, if they were freely drawn, were expected to yield water containing less mineral matter than when not freely drawn or pumped, unless, as in Liverpool, they were next the sea. As to the quality of the water of the Elan and Claerwen, he had listened to the evidence as to the analyses which had been made, and he said most distinctly that they were utterly inadequate, for the following reasons : The first objection to the analyses of the Welsh waters was that on only three days in the year had samples been taken—only 1 per cent. of the days in the year ; and no samples during the summer months. On at least 30 days should samples have been taken. The only two streams—the Elan and Claerwen—had been examined. There must surely be a multitude of streamlets which would feed the proposed six reservoirs. No analysis was made of the untreated storm water. There was no record of any testing for lead and copper in these waters. It was not easy to detect lead in peaty waters ; but it could be found. There was a possibility of traces of arsenic being met with in the water ; though he did not know that any had been discovered. Commenting on the tabular statement of analyses by Professors Frankland and Dewar, he said the statement conveyed very little information as to the quality of the 25 samples of water, the analysis of which it professed to set out. He objected to the Welsh water because it was peaty, and peaty water produced diarrhoea.

Mr. PEARSON : It is said there would be a great saving in soap by the use of this Welsh water. What is your opinion of the statement of Professor Dewar and Mr. Mansergh as to a saving of £60,000 or £100,000 a year ?

Witness (emphatically) : It is nonsense. There will be very little saving in soap. In the first place, Dr. Dewar's estimate was a miscalculation, and the figures come out very much lower than he said ; but the principle upon which he made his calculation was a much worse blunder. He neglected to consider that human beings are intelligent ; and that by the skill we have in using soft water and hard water, we can contrive to produce a lather with very little consumption of soap. As a matter of fact, the substitution of soft water in a hard-water town would cause hardly any saving at all. This Birmingham

water belongs to the softer variety of water, and is not hard in the ordinary sense.

Cross-examined by Mr. BALFOUR BROWNE, witness said he objected to surface water containing peat, and to surface water generally. Loch Katrine was a peaty water; and he did not approve of it. He did not believe that the Vyrnwy watershed was comparable to the Welsh. He had not been to the Elan and Claerwen; but he had heard that a lead mine had been working there for many years, and that lead would be distributed in the streams, and it was quite certain that it would get into the water. Witness's method of analysis was by the albuminoid-ammonia process.

Mr. BALFOUR BROWNE: But do you not know that all the Government analyses are now made by another process?

Witness: Yes, by Dr. Frankland's; and his process is absolutely worthless.

Mr. JAMES: Does Dr. Frankland have the public confidence?

Witness: He is one of the most eminent living chemists, and his general work will live for ever; but his water work will not.

Mr. E. Chesshire, F.R.C.S., was afterwards called, and gave evidence as to the excellent quality of the deep-well water in Birmingham.

The Committee then adjourned till the following Monday.

Monday, May 9.

This morning, further evidence was submitted in support of the case of the Birmingham opponents of the Bill.

Mr. G. Heaton, the Chairman of the Birmingham Water Company at the time the works were acquired by the Corporation, explained, in answer to Mr. PEARSON, the conditions under which the transfer took place, with the view of controverting a statement circulated that the new water scheme could be carried out "without coming upon the city rates for a penny." He said he negotiated the sale of the works to the Corporation after the passing of the Act of 1875; the consideration being perpetual annuities to an amount to be agreed upon, or, failing agreement, to be settled by arbitration. There was a provision in the Act that the Corporation should, within 95 years from the time it was passed, set apart a sufficient sum for the redemption of the annuities. There had been redeemed £652, and a further sum of £1567 had been set aside up to Dec. 31 last. This was not equivalent to a year's dividend. The annuities outstanding amounted to the sum of £53,789 a year; their market value, according to the last quotation, being 31½ years' purchase, whereas the Corporation had estimated them at only 25 years. Asked what sum he considered should have been set aside during the past 15 years for the redemption of annuities, witness said that, in accordance with section 27 of the Act of 1875, the Corporation should have made provision, either by instalment or sinking fund, for the redemption of the annuities, so as to be in a position to extinguish them within 95 years from the passing of the Act. This provision ought to have commenced at the expiration of five years from the passing of the Act. The five years expired on Aug. 2, 1880. Up to March 31, 1891, there had expired more than ten full years after the five years mentioned, or more than one-ninth of the remaining 90 years; and consequently provision should have been made for the extinction of one-ninth of the annuities outstanding. The original annuities amounted to £54,491, one-ninth of which would be £6054; leaving a further redemption to be provided for the next ten years of £5422. The Stock Exchange quotations to buyers of these annuities was at least 31½ years' purchase, or representing an approximate value of at least £170,163. Towards the redemption of these annuities, there appeared, by the Corporation accounts to March 3, 1891, to have been appropriated, as he had said, only about £1567; leaving a proportionate deficiency to that date of something like £168,596. At present buyers' quotation, the £1567 represented an annuity of about £50 only; which left the extinction of £53,789 annuities to be provided for out of the water undertaking or borough rate in the remaining 80 years from March 31, 1891.

Mr. PEARSON: Having regard to the reply you have given, do you think it possible for that sum to be provided out of the revenues of the water undertaking without coming on the rates? In your opinion, will there be a further charge on the rates?

Witness: I think there must be a further charge on the revenues of the water undertaking or the borough rate towards the redemption of the annuities. I do not consider that the position of the annuities is strengthened by this scheme.

In further examination by Mr. PEARSON, witness said that, personally, he was not in favour of the scheme, as he considered it was not financially sound. Beyond that, he did not think the quality of the water would be so good as that of the present supply. He did not approve of relying on distant sources of water, as there was liability to interruption by frost, accident, or malicious interference.

Mr. Beriah Shepherd, a civil and mining engineer, said he agreed with the evidence given by Professor Hull, Mr. Smallman, and Mr. North, as to the development of the local sources of water. He believed the Corporation might profitably and successfully sink 15 or 20 more deep wells within their present area. He thought with Mr. North that there was an immense volume of water passing to the rivers which might be caused to flow into reservoirs, and then percolate through them into the earth. If the sources he had mentioned failed, there would be an alternative in the double-service system, by which the river water would be supplied by a duplicate main, and used for watering streets, flushing sewers, and manufacturing purposes. There would not, as had been supposed, be two taps in one house. This system would, however, be the last resource. He estimated the expense of duplicating the mains at about £1000 per mile; so that to put down 250 miles of them would cost a quarter of a million of money. He had been consulted by members of the Town Council as to sinking wells, because they said they would not pay another penny for water if the new scheme were carried out.

Mr. GOUGH: It has been represented that by the scheme we shall save £20,000 a year in pumping. Have you any opinion as to that?

Witness: I think the Corporation might save £10,000 a year now out of the £20,000, if they went the right way to work. If you take the proposed scheme, the cost of the present works is put down at £2,014,000, and the projected new works at £6,600,000; making a total capital of £8,614,000. Taking this at 3 per cent., it works out to about

£258,420 for interest. Now, take the scheme of the Birmingham people who are opposed to the Corporation. They put down the present works at the same as the Corporation; and 15 wells and plant at £40,000 each would bring the amount up by £600,000, or a total of £2,614,000. The cost of pumping 40 million gallons of water a day from the streams would cost £41,062; and he estimated that there would be a balance of £138,838 in favour of pumping. The money could be spent as required.

In cross-examination, witness admitted that what he had done in connection with pumping had been in his capacity of a colliery engineer. His suggestion was that there should be reservoirs in which the water would be collected, and that these should be leaky, so as to allow the water to pass through into the earth, whence it could be pumped at some distance below. This notion, he acknowledged, had the merit of originality. With regard to the dual supply which he had advocated as a last resource, he admitted that all the machinery would have to be provided before the system could be used; but, if not wanted, it would not be put down. The desire of the opponents of the Bill was to show the Water Committee that they had ways and means of supplying themselves, without putting the population to the extra expense of £210,000 per annum.

Mr. W. Matthews, M.Inst.C.E., Water Engineer to the Corporation of Southampton, said that during the eight years he had held this position a duplicate system of water supply had been in use in the town. Since 1883 the secondary system, which supplied the water used for sanitary purposes, had been largely increased. There were now about seven miles of mains in use for this supply. The domestic water was derived from deep chalk wells; and it was pumped, after being softened, to Southampton. The water for sanitary purposes was derived from the drainage from Southampton Common, and from a well situated at the same place. It was unfit for domestic use. It was sent into the town by gravitation, at a low pressure. The daily average supply for domestic purposes was 2,250,000 gallons per diem; and for sanitary purposes, from 50,000 gallons daily in winter, to 200,000 gallons in summer. Only about one-eighth of the total number of streets had the secondary mains—the supply being insufficient to serve more; otherwise he should be glad if it could be extended all over the town. The working expenses were very small. Where available, it provided for flushing sewers, cleansing courts and alleys, and watering roads. It was also an auxiliary supply for fire brigade purposes. The secondary supply was absolutely confined to the streets; but he saw no objection to its being taken into the houses for use in water-closets. It was also fitted for manufacturing purposes. In the year 1884, Deacon's waste-water meters were introduced; and the average daily consumption had been reduced 50 per cent. He was of opinion that it was quite possible to introduce similar meters in Birmingham, where they would effect a great saving of water. He thought, for the purpose of a dual supply for Birmingham, an additional length of 250 miles of mains and branches would be sufficient, the cost of which would not exceed £250,000. He had examined the deep wells; four of which—at Aston, Witton, and King's Vale—he was informed, practically yielded 7 million gallons of water a day. There were a large number of private wells in the neighbourhood, from which he learnt that considerable quantities of water were pumped daily. He was told the Aston well overflowed if pumping were suspended. There was also the Perry Colliery shaft overflowing in the neighbourhood; and the Dighbeth well also overflowed. The fact that those overflows took place after years of persistent pumping of the large quantity of 7 million gallons per day, proved that the limit of pumping from these sources had never been anything like reached. He was certain that a large supply of water could still be obtained from that neighbourhood. He thought two more wells might be sunk in suitable positions; and if headings were driven from them, they might be reasonably expected to yield 3 million gallons each daily. The water of the Tame at Bescot was, in his opinion, fit for the purposes of a secondary supply.

Cross-examined by Mr. BALFOUR BROWNE, witness said he had only spent three days in Birmingham, and did not communicate with Mr. Gray, or any of the officials of the Water Department. He would not recommend a dual supply for such a town as Southampton. The cost of the double-service system—£1000 per mile for 250 miles of pipes—was not for leading, but distributing mains. They would not necessarily need more than one leading main.

Mr. H. Lane, a mechanical engineer, of Birmingham, gave evidence with respect to the state of feeling in the city concerning the scheme. He said the people were alarmed at it; and 90 per cent. of the ratepayers would vote against it if called upon.

Mr. E. Fletcher corroborated the statement that the feeling against the scheme was now very strong.

The CHAIRMAN said it was possible, when the evidence given by the parties opposed to the Bill was completed, the Committee might call one or two witnesses on the general question—possibly from a Welsh point of view. It would be well, he thought, that they should give their evidence before Mr. Pope replied. The Committee had listened very carefully, and with great interest, to all that had been said as to the possibility of finding water in or near Birmingham; and he had to state to Mr. Pope that they thought it would be unnecessary for him to bring rebutting evidence as to the possibility of augmenting the present supply from this locality. The general question, however, was still left open.

Tuesday, May 10.

To-day the case of the Birmingham dissentients was closed.

Mr. GOUGH said he should like to call a witness or two as to the quality of the Welsh water. He had called Mr. Wanklyn; but that gentleman had not been over the ground, and could only speak in general terms. Mr. Lloyd, barrister, who had appeared in several cases before the Committee, was perfectly well acquainted with the Welsh watershed; and he (Mr. Gough) thought his evidence would be material.

The CHAIRMAN said he did not think the Committee could take evidence of that kind. He might add that he had arranged with Sir Hussey Vivian, M.P. for Glamorganshire, and Chairman of the County Council, to attend on the following day to give evidence as to his views

on the matter from a Welsh stand-point. Certain other witnesses would be called; and their evidence would cover all Mr. Gough desired. He (the Chairman) thought it would be better to get it in that way. If Mr. Gough wished to give technical, expert, or chemical evidence, he did not suppose the Committee would refuse; but he did not consider that any other testimony would be of value.

Mr. E. W. Forrest, a chartered accountant, of Birmingham, was then called and examined by Mr. GOUGH. He produced tables to show that the calculations of the promoters were erroneously based. He said the income in the future, judging by the experience in the past seven years, would not grow in anything like the same ratio as the consumption. In preparing the tables, he had taken the promoters' own figures as to consumption and expenditure. The result was that, instead of an accumulating surplus equivalent to a reduction of 10 per cent. as from 1932 to 1943, and to a reduction of 20 per cent. as from 1943 to 1955, as appeared by the promoters' table, there would be no surplus at all, but a deficiency of £1,469,754 at the end of the period. The promoters' table assumed that every gallon of water would be paid for at the same rate as at the present time; but past experience did not, he said, justify this.

Mr. GOUGH announced that this concluded his case. He added that, with regard to the Birmingham opposition, it had not been in any sense a factious one. The opponents sincerely believed that there had not been sufficient inquiry into the possibility of developing the local sources of water. But for the Birmingham opposition, there would have been no real obstacle in the way of the Bill; and he had been able to put before the Committee a number of facts which he thought it necessary for them to know in order to enable them to arrive at a right conclusion. He asked the Committee to take into consideration the question of paying his costs.

Mr. POPE said Mr. Gough was obviously not aware of the practice of Parliament in regard to these matters. The Committee could not allow costs.

The CHAIRMAN said the Committee, the promoters, and all the parties to the Bill, were indebted to the Birmingham opposition for the facts they had brought forward, and the light they had thrown upon their side of the question.

The Committee then adjourned until the following day, when Sir Hussey Vivian, Bart., M.P., Mr. T. Howard Ellis, M.P., Dr. E. Frankland, Professor Dewar, and Mr. J. Mansergh were examined. The Committee adjourned till the following Friday, when Mr. Pope replied for the promoters. At the close of his address, the Committee passed the preamble of the Bill in an amended form. On the 17th and 18th ult., the clauses were considered; and the Bill was subsequently reported to the House. Its further progress is recorded elsewhere.

LEGAL INTELLIGENCE.

HOUSE OF LORDS.

Monday, May 16.

(Before Lords HERSCHELL, WATSON, MORRIS, and FIELD.)

Young and Beilby v. The Hermand Oil Company, Limited.

This was an appeal from the Second Division of the Court of Session in Scotland, lodged by Messrs. William Young and George Thomas Beilby against the respondent Company under the following circumstances: The Hermand Oil Company, in March, 1886, took out a licence from Messrs. Young and Beilby to use four of their patented inventions, on terms of paying a royalty of 10 per cent. "on the value of the excess of sulphate of ammonia obtained from the ammonia distilled or manufactured in apparatus or retorts made or worked according to the principles of the inventions set forth in the patents." Under this licence, the Company erected 160 shale retorts, which, it was alleged by the present appellants, were worked according to the principles of their inventions; and they therefore claimed the royalty mentioned. This the respondents refused to pay, on the ground that the retorts in question were not within the licence; and their contention was sustained by a majority of the Court of Session. Hence the present appeal, which resulted in a reversal of the decision of the Court below, with costs; the House of Lords declaring that "the retorts in question are within the principle of the patents which the respondents are entitled to use, and that the case be remitted to the Court of Session with this declaration, in order that the amount of royalties due to the respondents upon the produce of these retorts may be ascertained."

Lord HERSCHELL, in the course of an elaborate judgment, said that although the licence extended to four patents, it was only necessary to call attention to two of them—Mr. Young's patent (No. 1587) of 1881, and Mr. Beilby's (No. 2169) of the same year. In order to appreciate properly the patents which had to be considered, it was necessary to bear in mind what was the process of shale distilling in use prior to 1881. The retort commonly used was a vertical one, about 10 feet in length, through which the shale passed in about eight hours. The only object in view was the production of oil; and it was endeavoured to keep the retort at a temperature suitable for the distillation of oil. The temperature appropriate for that purpose was said by Mr. Beilby to range from 650° to 800° or 900° Fahr., though one of the defenders' witnesses put the range considerably higher. If an excessive temperature was applied, the oil produced was deteriorated in quality. In the process of oil distillation, a certain quantity of ammonia was produced by the combination of the nitrogen and hydrogen constituents found in the shale. It was the practice to introduce steam into the lower part of the retorts, with the object of sweeping the oil vapours rapidly out of the retorts, so as to avoid their decomposition. But while the object of the introduction of the steam was merely mechanical, it would appear to have added somewhat to the production of ammonia, owing to the combination of a small portion of its hydrogen with the nitrogen of the shale. Another retort in use prior to 1881 was known as Henderson's. It was about 15 feet in length; and the shale remained in it a longer time subject to heat. In its working, it did not

differ very materially from the common vertical retort; but there was an increased yield of ammonia, though the increase was not very marked. Under these circumstances the idea appeared to have occurred to Mr. Young and Mr. Beilby at about the same time that, if a temperature in excess of that which would be appropriate to the distillation of the oil could be applied to the shale after it had parted with all or most of its oil, a largely increased yield of ammonia would result, without prejudice to the oil distillation; the higher temperature being more favourable to the decomposition of the steam, and thus setting free the hydrogen for combination with the nitrogen of the shale. Inasmuch as the judgments adverse to the pursuers had been founded upon a construction of their specifications with which he found himself unable to concur, his Lordship said it would be necessary to examine somewhat minutely their language. There was abundant evidence that, by the use of Messrs. Young and Beilby's retorts, the yield of ammonia was practically doubled, and this without any diminution of the quantity, or deterioration of the quality of the oil obtained; and in addition to increased yield of ammonia, there was a very great increase in the volume of the uncondensable gas set free. In the Henderson retort, the volume of uncondensable gas set free per ton of shale was 2500 to 3000 cubic feet; while in the Young and Beilby retorts, it was augmented to 10,000 to 15,000 cubic feet per ton. To his mind these facts established the existence of a new factor in the process of distillation by means of the latter retorts. In proceeding to an examination of the specifications of the patents of 1881, his Lordship, at the outset, remarked that Young's patent appeared to embrace, not only a particular form of retort, but a process to be applied in the distillation of shale, together with the appropriate apparatus; and Beilby's, he thought, showed an improved method of carrying out the process. This was very material, because, in considering whether the use of a particular apparatus would be an infringement of the patent or was within the licence, the conclusion might be different if the patent covered a process to what it would be if a form of apparatus merely were claimed. His Lordship then read Mr. Young's own statement of his invention, and observed that it was only necessary for their Lordships to concern themselves with the process as carried out in a single retort. As described by Mr. Young, it was an intermittent process—that was to say, the whole of the lower half of the retort was emptied at once, and the contents of the upper part were then let down into the lower. Beilby proposed operating on the shale in a practically continuous manner; small portions of the exhausted material being removed at the bottom, and fresh material introduced at the top at frequent intervals. But the system was avowedly the same. In his specification, Mr. Beilby acknowledged that, after he had applied for letters patent, he learned that it had been proposed to effect the distillation of shale or other similar substances at two temperatures; and then he stated his claim as follows: "The improved system or mode of distilling shale or other oil-yielding minerals, wherein the materials are passed through the retorts in a practically continuous manner, and wherein the distillation of the oil is effected in the upper parts of the retorts at a suitable moderate heat, wholly or to a great extent by the heat or action of vapours or gases passing up from the lower parts of the retorts, in which lower parts the 'spent' shale is being subjected to a comparatively high heat for the purpose of increasing the yield of ammonia, and thereby enhancing the value of the aggregate products." It was clear that Beilby saw in Young's specification the disclosure of a new system of distillation. What was that system? The Lord Ordinary regarded as claimed the application of two distinct temperatures, each applied to its own portion of the retort—one uniform temperature appropriate to oil distillation in the upper part of the retort, and a second uniform temperature appropriate to the production of ammonia in the lower part of the retort. Lord Rutherford-Clark took much the same view. It was evident that both the learned Judges thought it was the essence of the system that each half of the retort should be kept heated throughout to the same temperature—that of the lower half exceeding greatly that of the upper. They saw, of course, that it might be impossible that there should be any distinct line of separation; but they thought that the object of the patentee was to obtain this result, and that the apparatus was designed to secure it. He (Lord Herschell) might say at once that, with all respect, he was unable to agree with this. To keep each half of the retort heated throughout to the same temperature, would be a physical impossibility. Supposing a line to be drawn across Beilby's retort where the fire-clay construction ended and the iron began, the heat of the shale immediately above and below that line must, of necessity, be substantially identical. All that the patentees could desire would be that the temperature in the upper half of the retort should be within, and not in excess of, the range suitable for oil distillation. In the lower half, on the other hand, it was desirable that the heat should exceed the oil distillation range—not necessarily to the very top of that half of the retort, for this might cause the temperature in the upper half to be unsuitably high, but in a sufficient portion of it for the successful acquisition of the ammonia. This, he believed, was the system the patentees intended to describe; and the end they sought to attain. In considering next the nature of the retorts at the Hermand works, and the mode in which they had been used, his lordship said the hopper arrangement differed somewhat from that of Messrs. Young and Beilby, and the products of distillation were led away at a different part. But it was not suggested that these variations were material. No stress was laid, or could be, on the fact that the distilling column was about 5 feet longer. Nor was it suggested that there was any substantial difference in the lower half of the retort, or in the place at which, or purpose for which, the steam was admitted. Reliance was placed upon the contrast presented by the upper half of the retort to the Young and Beilby arrangement. Instead of this part being made of iron, it was constructed of fire-brick, and the hot gases were led round the retorts by a series of flues reaching to the top of the distilling column. It was true that there would be a gradation of heat in the upper part of the retort, and that there would be no sudden change in temperature in passing from the lower to the upper half. But precisely the same must be the case in the Young and Beilby retort; and, as he read the patents, nothing different was indicated. It appeared certain that, with suitable firing, the Hermand retort might be so worked that in the upper half the temperature should

rise to, and never exceed, the range of temperature suitable for oil distillation; while in the lower half the range of temperature should be much higher, so as to secure there an active decomposition of steam. If, as he thought, this was the process first made known by Messrs. Young and Beilby, the changes made in the form or substance of the retort would be wholly immaterial. The question remained, Had the Hermand retorts been in fact worked according to the principle of the pursuers' inventions? The first fact to be remarked was that the results produced with the Hermand retorts, so far as the products were concerned, were identical with those obtained in the Young and Beilby retorts. The defenders, who had used the retorts at Hermand for a considerable time, had not given the amounts of ammonia and oil which they yielded as compared with the produce from the same shale distilled in the Young and Beilby retorts. But there was evidence that the uncondensable gas generated was substantially the same; and one of the defenders' witnesses said he thought it might be taken that the results obtained by the Hermand and the Young and Beilby retorts were practically identical both as regarded the yield of oil, ammonia, uncondensable gas, and ammoniacal liquor. This was strong evidence, and showed that the same process was employed in both sets of retorts, and that they were worked in precisely the same way. The identity of the result obtained was not without its bearing too on the contention that the increased yield of ammonia in the Young and Beilby over the earlier retorts was to be attributed to the increased length of the retorts, and the longer period during which the materials remained under treatment in them; for the distilling column of the Hermand retort exceeded the Young and Beilby in length by 5 feet, and the shale was under treatment for 42 instead of 18 hours, without any change in the result. A witness, whose evidence was adopted in one of the judgments below, stated that he examined the heat in the Hermand retorts through the spy-holes; and at the bottom it was a very bright red heat, almost approaching white, at the top it was a faint red heat, and in the intermediate spy-holes the heat appeared to gradually diminish towards the top. This indicated that the temperature in the lower parts of the retorts was much higher than in the upper. Again, pyrometric tests were applied, at which both parties were represented, to ascertain the temperature in the flues at various points, both of the Young and Beilby and the Hermand retorts. The flues of the Hermand retort divided its length into six approximately equal parts. In the lowest of these, the temperature was 1550° ; in the second, 1340° ; in the third, 1125° ; in the fourth, 1070° ; and in the fifth, 970° . The sixth was not accessible; but, judging from the temperature at the flue, it was put by Mr. Beilby at 930° . In the Young and Beilby retort at Oakbank, the temperature in the two lower flues, which did not extend quite half way up the retort, was 1450° and 1400° degrees respectively. In the upper chamber, it was 1050° at the bottom, and 750° near the top. Thus, in the Hermand, the mean of the three upper temperatures was 990° Fahr.; and the mean of the upper part of the pursuers' retort was 900° Fahr. The mean temperature of the three lower compartments in the defenders' retorts was 1465° Fahr.; and in those of the pursuers, 1425° Fahr. The maximum temperature at the lower part of the upper half of the retort was, in the Hermand 1070° , as against 1050° in the Young and Beilby; whilst the temperature in the lower part of the other half, was 1550° as against 1450° . If, then, the outside temperatures were any approximate indication of those prevailing inside at the same part of the retort, it was impossible to deny that there was a marked correspondence in the two retorts. But it was contended that this was not the case, that the heat inside the lower part of the retort was not the greatest, and that the shale was not at any stage of its progress subjected to the heat indicated in Young and Beilby's patents. It was said, further, that in the Hermand retorts the distillation of the oil and the production of the ammonia proceeded concurrently throughout the whole of the retort—that the oil was not first distilled, and then the ammonia obtained at a heat greater than would be suitable for oil distillation, and that therefore the pursuers' process was not adopted. The defenders explained the alleged fact that the temperature inside the lower part of the retort did not correspond with the high temperature exhibited in the flue outside, by the suggestion that the steam which was admitted to that part of the retort not being superheated would have a cooling effect. This was no doubt true; but whether—considering the high temperature prevailing outside, and the great heat of the material inside, with which the steam came in contact—the effect would be very substantial, was matter of theory. In support of the theory that it was so, the defenders relied upon certain pyrometric tests in the interior of their retorts, and upon the condition in which some shale was found to be when drawn from the lower part of the retorts. But no opportunity was given to the pursuers of being present when those tests were made; and, under the circumstances, he could attribute little or no weight to that evidence. It was alleged by defenders' witnesses that shale drawn almost from the bottom of the retorts when the process was nearly complete was found to be full of oil. This was certainly a remarkable phenomenon; but how came it, asked his Lordship, that the shale, if it had been subjected for forty hours to the temperature spoken of, should remain thus full of oil? None of the witnesses, to his mind, gave even a plausible answer to this question. It was also said that the heat applied at Hermand was below that which the specifications directed should be applied to the Young and Beilby retorts. The words relied on were to be found in Beilby's specification, where he stated that his object in applying a bright red or slightly higher heat to the fire-clay tubes was that all, or a large part, of the fixed carbon remaining in the shale "might be converted into carbonic oxide." It was alleged that analysis showed that the heat applied was not sufficient to evolve a large quantity of carbonic oxide; the product being principally carbonic acid. Looking at the whole specification, his Lordship was unable to regard it as of the essence of the invention that the heat should be sufficient to ensure the bulk of the product being carbonic oxide and not carbonic acid. The heat to be applied was described as "bright red, or slightly higher;" and there was distinct evidence, as he had pointed out, that at the bottom of the Hermand retort it was "a very bright red heat." Moreover, and this was, he thought, conclusive, Mr. Young, who first described the process, indicated as the result of the decomposition of the steam the formation

of carbonic acid and carbonic oxide gas. Supposing Beilby was under the erroneous impression that the bulk of it would be carbonic oxide, that was, in his Lordship's opinion, wholly immaterial. He had carefully studied the whole of the evidence; and the result had confirmed his opinion that the Hermand retorts were worked according to the principles of the invention set forth in the pursuers' patents, and that the interlocutors must be reversed, and the cause remitted with this declaration, in order that the royalties to which the pursuers were entitled might be ascertained.

LORD WATSON, in his judgment, said the two patents which had been referred to must be construed as one for the purposes of this case; and when so read, he was of opinion that they included a process for the effective recovery of the maximum amounts of oil and ammonia obtainable from the distillation of shale—a process which consisted in passing the shale, more or less continuously, through a single retort, in which it was first exposed to a range of temperature suitable for distilling oil, and secondly, to a range of higher temperature suitable for producing ammonia—and that they were not limited to apparatus for carrying that process into effect. It was not disputed that these inventions had attained the object which the patentees had in view, and that they were, consequently, of great practical value. There was abundance of uncontradicted testimony to that effect; and their commercial utility was demonstrated by the fact that in July, 1890, at the time when the proof was taken, twelve of the leading companies or firms (including the respondents) who distil shale in Scotland, were using, by licence from the appellants, no less than 3252 of their patented retorts. According to the construction which he attached to the appellants' patents, the retorts, for the produce of which the respondents refused to pay royalties, constituted a plain infringement of the patented process of distillation. He thought it was equally clear, upon the evidence, that the respondents' retort was merely a colourable imitation of Mr. Beilby's retort, which was one of the patented methods of carrying out the process. On comparison, he could find no substantial difference between the two, either in their construction, in the principle upon which they worked, or in the results which they produced. Concerning the construction, the two retorts were absolutely identical, with this exception only, that in the zone of the respondents' retort fire-clay was substituted for iron, and the fire gases were brought into contact with the upper as well as the lower zone. Now the mere substitution of fire-clay did not, in his opinion, constitute an essential *differentia*; and the continuation of the course of the fire gases to the top of the retort, which was, no doubt, rendered necessary by the fact that fire-clay was less pervious to heat than iron, was a device described in Beilby's specification. As regarded the principle of working, the heat tests taken by the pyrometer, in presence of both the parties, showed that, starting from the top of the respondents' retort and going downwards, the temperature of the upper zone (which nearly corresponded with the iron part of Beilby's retort), ranged from 910° Fahr. to 1070° Fahr., and that of the lower zone from 1070° Fahr. to 1550° Fahr. These temperatures gave a suitable oil-producing heat in the upper, and a suitable ammonia-producing heat in the lower zone, which was the very marrow of the appellants' invention. Professor Foster, one of the respondents' witnesses, who had examined the working of the retorts, as well as that of the appellants' retorts at Pentland and elsewhere, on being asked whether there was any difference between the two processes, candidly replied that the process was similar to that practised in the distillation of shale and the like, and quite contrary to anything he expected to find. Lastly, the results yielded by the two retorts were practically the same, as one would naturally expect to find if they were worked with the same degree of care. Another of the respondents' witnesses (Mr. W. Fraser), who had had great experience in the manufacture of shale oil, said he thought it might be taken that the results obtained by the Hermand and the Young and Beilby retorts were practically identical, both as to the yield of oil and the yield of ammonia. In conclusion, his Lordship said he thought they ought to reverse the interlocutors appealed from; to declare that the retorts in question were within the principle of the patents which the respondents were licensed to use; and to remit the case to the Court of Session in order that the amount of royalties due by the respondents upon the produce of these retorts might be ascertained, and decree for that amount pronounced in favour of the appellants. The appellants, in his opinion, ought also to have their costs of this appeal and their expenses of process in both Courts below.

LORD MORRIS and LORD FIELD concurred in the above judgments.

Monday, May 23.

(Before the LORD CHANCELLOR, and Lords WATSON, MACNAGHTEN, MORRIS, and HANNEN.)

Sir Robert Herron and others v. Rathmines and Rathgar Improvement Commissioners.

The Construction of Reservoirs on the Dodder.

This was an appeal from an order of the Court of Appeal in Ireland, reversing a judgment of the Master of the Rolls. The original action was brought by the appellants on behalf of themselves and all other persons in the Rathmines and Rathgar Water Act, 1880, called the upper mill-owners, for an injunction to restrain the present respondents from continuing to carry on certain works, and from interfering with the flow of water in the River Dodder. The question before their Lordships was the construction to be given to certain sections of the Act, which authorized the respondents to impound water from the Dodder and its contributory streams, and for this purpose to build certain reservoirs, the design, capacity, and position of which were duly specified in the Bill. The appellants contended that the reservoirs and other works that have been constructed by the respondents did not satisfy the conditions set out in the Act; that their rights in the water supply to their mills were insufficiently secured; and that the motive power to the mills would be injuriously affected.

The ATTORNEY-GENERAL (Sir R. E. Webster, Q.C.), and Mr. R. M. BRAY appeared for the appellants; Mr. RIGBY, Q.C., Mr. FITZ GERALD, Q.C., and Mr. D. FITZGERALD for the respondents.

The case was heard by their Lordships at the previous sittings, when judgment was reserved.

The LORD CHANCELLOR pointed out that the case involved the principle of construction of all Private Bills, and that Parliament, in passing a Private Act, looked to the public advantage and security and to the interference with private rights. He fully agreed with the Master of the Rolls that deviation from plans could not mean deviation from that which was not alone shown on the plans, but was the subject of express enactment of words and definition by measurement. If a power were intended to be given of altering the site or diminishing the capacity of the intended compensation reservoir, subject only to the test that it should enable the Commissioners to give a sufficient supply of compensation water in the terms of the Act, nothing could have been easier than to say so in plain terms. Undoubtedly the design and purpose of the Act, as expressed in its own terms, was that No. 1 reservoir should supply drinking water to the district—while the design of No. 9 reservoir was specially for compensation water to the mill-owners; and he could not place a construction on this statute which was never contemplated by its author. He therefore moved that the order of the Court of Appeal be reversed, and that the injunction ordered by the Master of the Rolls be restored.

Lords WATSON and MACNAGHTEN, in their judgments, concurred with the opinions expressed by the Lord Chancellor.

Lords MORRIS and HANNEN dissented.

The appeal was therefore affirmed; the respondents to pay the appellants' costs, both here and in the Court below.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Wednesday, June 1.

(Before Baron POLLOCK and Mr. Justice VAUGHAN WILLIAMS.)

In re an Arbitration between the Kirkleatham Local Board and the Stockton and Middlesbrough Water Board.

This was a special case stated for the decision of the Court under the following circumstances: In the year 1876 an Act of Parliament was obtained by the Stockton and Middlesbrough Corporations for the purpose of acquiring the then existing local Water Company, with power to supply the whole of the district covered by the Corporations, which included amongst others the parish of Kirkleatham. There was a provision, however, that any of the outlying districts—that is to say, districts not included within the limits of the boroughs of Stockton and Middlesbrough—were to be at liberty, on giving notice to the Joint Water Board, to supply their own district with water, in which case they were to purchase the mains, pipes, and fittings in the district at a price to be fixed by an arbitrator in case the parties could not agree. The Kirkleatham Local Board, in 1891, acted upon this statutory power; and accordingly the matter was referred to the arbitration of Mr. Henry Law to decide on the price to be paid for the mains, pipes, and fittings. The Kirkleatham authorities were not satisfied with the price he fixed, and obtained an order for him to re-state his award in the form of a special case for the opinion of the Court; and this he had now done.* He stated that he had fixed the price at £25,424; the parties bearing their own costs and paying half the costs of the award. There were two rival contentions put before him, as to the principle on which the price should be ascertained. It was contended on behalf of the Kirkleatham Local Board that the basis of calculation should be merely the value of the mains, pipes, and fittings regarded as plant *in situ*, capable of earning profit, which was to be arrived at by taking the cost of the mains, laying them down, making good the ground, &c., deducting a certain sum for depreciation; and that he had no jurisdiction to take into consideration at all the present or prospective earnings of these mains and fittings. On the other hand, it was contended, on behalf of the Water Board, that the value must be taken as the value to the seller, not the value to the buyer; and as the sale was coupled with an obligation on the part of the Board to supply water within the Kirkleatham district, what the Joint Water Board were really parting with was the power of earning revenue from the supply of water, and that at all events the value to them of the mains and pipes was to be measured, not by the cost of manufacturing and laying them down, but by the returns obtained from them. The Arbitrator held that, having regard to the whole scheme of the Act of 1876, it seemed to him that the contention of the Water Board was the correct one; and he had, therefore, capitalized the average net revenue earnings by the Board in the Kirkleatham district for the seven years ending August, 1891—making all proper deductions for working expenses, maintenance, and so on, and further deducting the Kirkleatham district's proportion of the revenue earnings. This brought out the figure £25,424, which did not include any amount in respect of prospective increase in the revenue. If the Court should be of opinion that this was the correct basis, the award would stand for that amount; but, on the other hand, if the basis contended for by the Kirkleatham Local Board should be held to be correct, the amount would then be reduced to £8006.

The ATTORNEY-GENERAL, Mr. BALFOUR BROWNE, Q.C., Mr. SCOTT FOX, and Mr. CLAUDE BAGGALLAY appeared for the Joint Board. Mr. FINLAY, Q.C., and Mr. WOOD, of the Chancery Bar, appeared for the Kirkleatham Local Board.

The question having been argued at some length by the ATTORNEY-GENERAL, by Mr. WOOD, and by Mr. BALFOUR BROWNE in reply,

Baron POLLOCK, in giving judgment, said the question submitted to the Court very clearly by the Arbitrator was whether or no he had assessed the amount to be paid by the Local Board on the correct basis. In the year 1876, there being an existing Water Company, and there being a desire on behalf of two Corporations who were interested in the joint supply of water made by that Company to acquire for themselves the power of supply, and Parliament being minded to give to the two Corporations the power of being their own suppliers of water, an Act was passed whereby the two Corporations were empowered to acquire the whole undertaking, property, rights, and powers of the Company. That might be called the first object of the Act. By section 4 it was provided that the limits of this for the

supply of water should comprise the previous Company's present limits and certain parishes and townships mentioned in the schedule; and in that schedule was included the parish of Kirkleatham. Then came the important proviso: "Provided always that the Joint Board shall, when so required by the Sanitary Authority of any district beyond the boundary of the boroughs of Stockton and Middlesbrough sell to such Sanitary Authority all mains, pipes, and fittings belonging to the Joint Board within that district (excepting any mains, pipes, and fittings used for service beyond the limits of the district) at a price to be fixed, in default of agreement, by arbitration; and after such sale the Joint Board shall cease to supply water within such district." Under this clause the arbitration took place; and two contentions were placed before the Arbitrator. It was contended on behalf of the Kirkleatham Local Board that the basis of calculation should be merely the value of such mains, pipes, and fittings regarded as plant *in situ*, capable of earning a profit. The second contention was that the price must be ascertained by reference to the value of that which was parted with; but that it must be treated as the value to the seller and not the value to the buyer, and it was to be arrived at by the value of the revenue the Joint Board was able to earn by these mains and fittings. That was the rule adopted by the Arbitrator; and he confessed for some little time he was much impressed by the argument which seemed to be supported by what he thought to be the equity on behalf of the Joint Board. But, not without some little regret, he (Baron Pollock) had come to the conclusion that the Arbitrator's decision could not be supported under the terms of the Act of Parliament. The whole matter was entirely the creature of the Act of Parliament; and it must have exactly the same construction as any other Public or Private Act, although the position of the parties might no doubt assist one in construing it. The first duty of the Court was to look at what was the plain and clear language of the statute; and if they found that the same statute when dealing with one subject used one kind of language, and when dealing with another subject used another kind of language, it certainly was the duty of the Court to give effect to that which seemed to have been the intention of the Legislature in accordance with the language used. In the present case there were two things to accomplish. The very essence of the Act was to enable the two Corporations of Stockton and Middlesbrough to acquire the interest of the Water Company. They were to take over from the Company all its powers; and in section 15 the words were extremely clear. They were to require the Company to sell all their undertaking, property, rights, powers, and privileges, as the same existed at the time of the delivery of the notice; and they were to pay a sum for compulsory sale, and also for the prospective value of the Company's undertaking. This indicated as clearly as possible that the two Corporations were purchasing for the benefit of the residents within their ambits, and were to take over the whole concern and undertaking of the Company—its property, rights, powers, and privileges. The second object was this: There being many outlying districts—such as Kirkleatham—if it became desirable at any time (not necessarily immediately), such outlying districts must give a certain notice, and take over—not the undertaking or any portion of the undertaking, but they should be allowed to be unfettered, to destroy the monopoly as it existed, by providing water for their own district, and making such arrangements as might be necessary for the purpose. But then it would naturally come to pass that the mains, pipes, and other matters which belonged to the Joint Board, so far as that particular district was concerned, would become useless; and, on the other hand, the Local Board acquiring power to supply their own water would find a use for these mains and pipes. Accordingly, it was provided that the Joint Board should sell to such Sanitary Authority all mains, pipes, and fittings at a price to be fixed by arbitration; and after such sale, the Joint Board should cease to supply water within such district. This showed clearly that the supply was a matter provided for by Parliament, and was not to be dealt with by the arbitration. All the Arbitrator had to find was the proper price of the mains, pipes, and fittings used for the service; and he certainly had not to consider that there had been any sale of the undertaking, property, rights, powers, and privileges, as if it had been under section 15. He had no right to consider what the Corporation could earn by these pipes. They could only earn what the Legislature said they could earn; and this was limited by section 4, which enabled any outlying district to give notice and put an end to the power of supplying the district. Remembering the course the thing had taken before the Committee of the Houses of Parliament, he (Baron Pollock) did not see there was here any real hardship. It had been stated, in the course of the argument, that these pipes were being treated merely as so much old iron; but that was not the fact. The contention on the part of the buyers was that they should pay—not merely the value of the iron, but the value of that *plus* any cost of digging the ground, putting them *in situ*, engineering, surveying, and so on. The amount fixed by the Arbitrator on that basis was £8006; and it seemed to him (Baron Pollock) that this was the sum for which the award should be given.

Justice WILLIAMS delivered judgment to the same effect.

Sales of Gas Annuities and Shares.—At a sale by auction at Bolton last Thursday week, five lots, each consisting of six perpetual annuities of £1 rs. 5½d. connected with the Bolton Corporation Gas Department realized £160 per lot.—Twenty "A" shares in the Camborne Water Company were disposed of, at a public sale last Thursday, at prices ranging from £20 8s. to £22 11s. 6d.—At a sale by auction at Maidstone last Thursday, 130 £10 shares in the Maidstone Water Company realized from £16 to £17 10s. each.

The Gas Accounts of the Knaresborough Gas Undertaking.—The Balance-sheet and accounts of the Gas Department of the Knaresborough Improvement Commissioners for the year ending March 25 last, have just been issued by the Gas Manager (Mr. W. Stansfield); and they show a very satisfactory result. The receipts on revenue account amounted to £2702; and the expenditure to £2459—leaving a balance of profit of £243. During the year, there has been a considerable outlay in additions and alterations, which have been charged to revenue. The gas made was 17,391,400 cubic feet; the average illuminating power being 18·31 candles. The price charged is 2s. 6d. per 1000 cubic feet, which is very low for such a small make.

* See p. 1078.

MISCELLANEOUS NEWS.

THE ROYAL COMMISSION ON LABOUR.

Monday, May 26.

(SECTION C.—Present: The Right Hon. A. J. MUNDELLA, M.P., Chairman; the DUKE OF DEVONSHIRE, Mr. M. AUSTIN, Mr. J. C. BOLTON, Mr. LEONARD COURTNEY, Mr. G. LIVESEY, and Mr. TAIT.)

The Evidence Relating to the Gas Industry.

In the JOURNAL for the 24th ult., the evidence so far given before the Commission was reported; and to-day the first witness called was a representative of the Coal Porters.

Mr. C. Wheeler, as representing the Beckton Coal Porters' Branch of the Gas Workers' Union, replying to Mr. MUNDELLA, said that although the coal porters had had disputes with The Gaslight and Coke Company, these had always been settled without strikes. The business of the coal porters was to unload ships from the North of England, and land the coals on the wharves of the Company.

Mr. MUNDELLA: What are your wages for that work?

Witness: I could not specify any wages whatever, because we are paid according to the amount of coal we have to unload. Sometimes we earn scarcely anything in a week, and at other times we earn a great deal. It is according to the weather and the season of the year. The number of hours and days that we work, depends entirely upon the arrival of the ships.

You cannot control the winds and the waves. In fine weather, I suppose the vessels arrive numbers together; and then in bad weather there are no arrivals?—At the present time we are earning scarcely anything; there are no arrivals whatever.

That is owing to the strike at the Durham collieries?—Yes.

How do you suggest that strikes should be avoided?—Speaking with an experience of 47 or 48 years, I never knew of a strike in my life but what arose through a misunderstanding between the employers of labour and the labourers themselves. There has always been a third party connected with the affair; so that the masters and the workmen could not get together to reason the matter over. We have had just as big a struggle, and as much trouble with The Gaslight and Coke Company as we have had anywhere else. But through the channel being open to Horseferry Road direct (from the labourers to the Directors themselves), we have settled our disputes without a strike; and the men and the masters are quite as comfortable to-day as they ever were. In the case of the firm of Burt, Boulton, and Haywood, who have the liquor from our works, directly the middleman was cleared out, the men got a rise of wages of 2d. an hour; and the Company have not only more work done, but it is more profitable.

Your contention is that, where masters and men are brought in direct contact with each other, a good understanding is easily arrived at; but you say there is a third party. Is he the sub-contractor?—What we term the "sweater."

Are sub-contractors employed now in connection with the coal porters?—No, we all share alike; each man has the money that he earns.

How was it then that, without sub-contractors, you were so near a strike?—It was for an advance of wages of a halfpenny per ton, which we obtained.

Have you any other suggestion to make for the prevention of strikes?—My suggestion is that Boards of Arbitration should be formed, composed of workmen and employers, which should meet at least once a month, and receive reports from various quarters as to anything likely to cause a disturbance, so that they could deal with it at once.

Have you ever had any practical experience of Boards of Conciliation and Arbitration?—No; we have never arrived at that yet.

Do you object to strikes as being disastrous to the workmen?—I think they are disastrous not only to the workmen, but, outside the workmen, to all concerned; and for that reason our Unions are formed on the basis of avoiding strikes if possible, and bringing about a better understanding between the workmen and their employers.

Do you speak authoritatively on this point?—I speak authoritatively from the men whom I represent, and the Union likewise.

Examination continued: The coal porters had at the present time a small grievance, which they would like to see remedied; and that was as regards the carrying capacity of the vessels that came with coals to the Beckton station. Although they had been fortunate enough to have only one accident through the breakage of machinery, it was built to suit vessels the largest of which was 1200 tons, whereas at the present day they had vessels carrying 2400 tons, which the cranes were too short to unload, and they wanted cranes on both sides. The suggestion which the coal porters put forward was that the Gas Company should build their own vessels and run them themselves for their own trade.

Mr. MUNDELLA: You want to make the Company the carriers of their own coal?

Witness: Yes. If the cranes were altered to fit the larger vessels, then they would not fit the smaller ones; and it would be a very great addition to the safety of the workmen if the coals were always brought in vessels of one size.

Mr. LIVESEY: You say that you have had no strike. Surely you did strike at the time of the Dock Strike?

Witness: No; we did not strike—we asked leave to suspend work for a week.

In sympathy with the dockers! You cannot deny that?—We stopped for an increase of wages; the coal porters had no Union at all then.

But they stopped in the first instance in sympathy with the dockers, and then a few days afterwards they said: "We won't go to work unless you give us an increase of wages." Was not that it?—Not as I understand it.

You say they came out because they demanded a halfpenny per ton extra all round. Did they not come out in the first instance in sympathy with the dockers?—Not to my knowledge.

What wages would coal porters get for unloading a 1200-ton steamer, which would take about ten hours?—They would earn about 16s. 8d. each for a day's work.

How often do you get that in a week?—Sometimes two days, and sometimes four or five days.

Do you not get on an average from four or five days every week?—Only in the winter time.

What do you get in the summer ordinarily?—About 30s. a week.

Only two boats a week?—That is all.

Do you remember in the case of a steamer called the *Black Diamond*, that the Seamen and Firemen's Union sent word to stop her, and the porters refused to unload her?—Yes; and we should do it again, because we contend that we are in the same branch of labour with the miners, and in that case the coals were scraped up by men whom we call "blacklegs."

Do you know that the strike at the Silkstone Colliery was brought about because the Miners' Union wanted to force the deputies into the Union; and the owners were not willing to have it?—Yes. I do not believe in forcing anyone into a Union.

Yet you would not allow any steamer to be unloaded by members of the Seamen's Union?—The same sort of men as brought the coal we should. They were not seamen; they were any men that they could pick up in the streets.

In December, 1890, the *Emerald* came from Sunderland, manned by a non-Union crew. If she had come to Beckton, would you have refused to unload her?—Perhaps, if she had come there, and the men behaved like other men, we should have unloaded her, and the men would have joined the Union by persuasion, as they did in another case.

Mr. MUNDELLA: You took up the cause of the miners of the North, not because it interfered with you and reduced your wages, or for anything that you knew at all about those men, except that you were told they were non-Unionists?—We were told that they were not sailors and firemen. But it would not be done again.

Why would it not be done again?—Because we have learned better.

You think you have done wrong?—We might have done wrong.

Examination continued: If it could be brought about, the coal porters would like work to cease at 4 o'clock on Saturdays; and they thought it would be reasonable at any rate not to start the unloading of a vessel after that hour on Saturday.

By Mr. TAIT: He was in favour of a legal eight-hour day on railways, in gas-works, chemical works, and so on; but it would be impossible to put it in force in the case of coal porters, because sometimes it would take less than eight hours to discharge a ship, and in other cases it might take twenty hours. He would like to see their trade restricted to 48 hours a week.

Mr. MUNDELLA: You want a legal eight hours day for other people, but you do not want it for yourself?

Witness: I should like it for myself; but it is impracticable.

Mr. W. A. Valon, President of the Incorporated Gas Institute, was the next witness. Having described the constitution and objects of that body, he said they had taken special steps for the collection of information to place before the Commission, in order that reliable information might be obtained with regard to the present state of the labour market in gas-works of the United Kingdom. With a view of obtaining statistical information which was not easily accessible, the Institute issued a series of queries to works carbonizing about 5000 tons of coal and upwards per annum, and making (about) 50,000,000 cubic feet of gas and upwards. These inquiries were issued in all to 170 gas undertakings in Great Britain, Ireland, and the Channel Islands, carbonizing altogether 4,380,090 tons of coal per annum. Returns were received from 110 of these works, carbonizing 2,886,501 tons of coal per annum; and of these returns the following synopsis had been prepared:—

SYNOPSIS OF RETURNS.

	Forms Issued.		Forms Returned.		Forms Not Returned.	
	Number of Works.	Tons of Coal Carbonized Last Year.	Number of Works.	Tons of Coal Carbonized Last Year.	Number of Works.	Tons of Coal Carbonized Last Year.
England and Wales . .	152	3,947,554	101	2,544,807	51	1,402,747
Scotland . .	11	286,702	7	236,693	4	50,009
Ireland . .	5	134,248	2	105,001	3	29,247
Channel Isles	2	11,586	—	—	2	11,586
Totals . .	170	4,380,090	110	2,886,501	60	1,493,589

NUMBER OF MEN EMPLOYED.

	In the 170 Works to which Forms were Issued (Partly Estimated).	In the 110 Works from which Forms were Returned (From Returns Furnished).	In the 50 Works Not Returning Forms (Estimated).
Yardmen . .	8,442	5,570	2,872
Mechanics . .	1,720	1,124	596
Stokers . .	9,196	6,067	3,129
Firemen . .	1,099	749	350
Totals . .	20,457	13,510	6,947

YARDMEN AND LABOURERS.

The wages of yardmen and labourers ranged from 15s. to 26s. per week, as follows:—

In 39 works, pay lay between 15s.	and 20s. per week.
" 48 " " " " 20s. 3d.	" 22s. "
" 16 " " " " 22s. 2d.	" 24s. "
" 7 " " " " 24s. 9d.	" 26s. "

The working hours ranged from 49½ hours to 72 hours per week, as follows:—

In 90 works the hours were between 49½	and 57½ per week.
" 18 " " " " 58 " 60 "	
" 1 " " " were 61 " "	
" 1 " " " 72 " "	

Overtime was paid for as follows:—

In 61 works at the ordinary rate	
" 44 " " time and a quarter	
" 5 " " " " half	

Sunday labour was paid for as follows:—

In 48 works at the ordinary rate	
" 20 " " time and a quarter	
" 34 " " " " half	
" 7 " " double time	
" 1 " " special terms	

The percentage of increase in wages since 1887 was as follows:—

No. of Men.					
377	In 9 works the increase was under 5 per cent.				
749	" 17 " " " between 5 and 10 per cent.				
1553	" 20 " " " " 10 " 15 "				
203	" 4 " " " " 15 " 20 "				
241	" 2 " " " " 20 " 25 "				
229	" 5 " " " " 25 " 30 "				
4	" 1 " " decrease was 9·8 per cent.				
1214	" 52 either no return or no increase				
4570	110				

MECHANICS AND ARTIZANS.

The wages of mechanics and artizans ranged from 22s. to 39s. 9d. per week, as follows:—

In 9 works, pay lay between 22s. and 25s. per week.	
" 54 " " " 25s. 9d. " 30s. "	
" 31 " " " 30s. 6d. " 35s. "	
" 9 " " " 35s. 6d. " 39s. 9d. "	
" 7 no returns	

The working hours ranged from 49½ hours to 84 hours per week, as follows:—

In 82 works the hours were from 49½ to 57½ per week.	
" 16 " " " 58 " 60 "	
" 5 " " " 61 " 84 "	
" 7 no returns	

Overtime was paid for as follows:—

In 65 works at the ordinary rate	
" 40 " " time and a quarter	
" 5 " " " " half	

Sunday labour was paid for as follows:—

In 58 works at the ordinary rate	
" 15 " " time and a quarter	
" 30 " " " " half	
" 7 " " double time.	

The percentage of increase in wages since 1887 ranged from 3 to 38·6 per cent.

No. of Men.					
256	In 11 works the increase was under 5 per cent.				
322	" 26 " " " between 5 and 10 per cent.				
95	" 15 " " " " 10 " 15 "				
75	" 6 " " " " 15 " 20 "				
53	" 3 " " " " 20 " 25 "				
43	" 5 " " " " 25 " 38·6 "				
280	" 44 either no returns or no increase.				
1124	110				

STOKERS.

The wages of stokers ranged from 22s. 6d. to 44s. per week, as follows:—

In 1 works, the pay was 22s. 6d. per week.	
" 7 " pay lay between 25s. 6d. and 28s. "	
" 22 " " " 28s. 9d. " 32s. "	
" 36 " " " 32s. 6d. " 35s. "	
" 39 " " " 36s. " 40s. "	
" 4 " " " 40s. " 44s. "	
" 1 no return	

The working hours ranged from 48 hours to 90 hours per week, as follows:—

In 49 works the hours were from 48 to 58 per week.	
" 22 " " " 62 " 72 "	
" 31 " " " 73½ " 84 "	
" 1 " " " 90 " "	
" 7 No returns.	

Sunday labour was paid for as follows:—

In 59 works at ordinary rate.	
" 11 " " time and a quarter	
" 2 " " " " third	
" 36 " " " " half	
" 2 " " double time.	

Percentage of increase in wages since 1887 ranged from 3 to 50 per cent.

No. of Men.					
359	In 4 works the increase was under 5 per cent.				
1090	" 20 " " " between 5 and 10 per cent.				
761	" 18 " " " " 10 " 15 "				
962	" 15 " " " " 15 " 20 "				
111	" 4 " " " " 20 " 25 "				
227	" 7 " " " " 25 " 30 "				
1074	" 9 " " " " 30 " 35 "				
99	" 2 " " " " 35 " 40 "				
84	" 3 " " " " 40 " 45 "				
716	" 6 " " " " 45 " 50 "				
584	" 22 either no returns or no increase				
6067	110				

FIREMEN.

The wages of firemen ranged from 25s. 8d. to 37s. 6d. per week, as follows:—

In 5 works, pay lay between 25s. 8d. and 30s. per week.	
" 9 " " " 30s. 4d. " 35s. "	
" 3 " " " 36s. " 37s. 6d. "	

The working hours ranged from 48 hours to 90 hours per week, as follows:—

In 12 works the hours were from 48 to 57½ per week	
" 5 " " " 60 " 90 "	

Sunday labour was paid for as follows:—

In 6 works at ordinary rate	
" 1 " " time and a quarter	
" 10 " " " " half	

Percentage of increase in wages since 1887 ranged from 6 to 50 per cent.

No. of Men.					
155	In 3 works the increase was between 5 and 10 per cent.				
196	" 3 " " " " 10 " 15 "				
34	" 2 " " " " 15 " 20 "				
62	" 2 " " " " 20 " 25 "				
194	" 3 " " " " 30 " 35 "				
6	" 1 " " " " 35 " 40 "				
45	" 1 " " " " 45 " 50 "				
57	" 2 no returns				

The comparatively small number of firemen given in the returns was due, the witness remarked, to the fact that, in the generality of cases, the stokers acted as firemen. Efforts made to increase the number of returns met with no success; and it might therefore perhaps be fairly assumed that the works not complying with the request of the Institute in this respect were at present undisturbed by labour troubles, and were unwilling to run the risk of creating them by furnishing the particulars asked for. Sufficient information had, however, been collected to give a fair representation of the provincial gas industry.

Mr. MUNDELLA: In connection with the inquiries issued by your Institute, is there any special point to which you wish to draw attention?

Witness: In nearly every instance the company or corporation making the return, has not objected to the publication of the particulars themselves, but does object to the publication of the name of the town or works to which the particulars refer. In order, therefore, to respect such wishes, special reference to particular works has been divided, and the large amount of information supplied has been utilized in the formulation of merely general deductions.

In reference to the inquiry made by your Institute as to whether any system exists providing for conciliation, arbitration, sliding scales, or other means of preventing or arranging labour disputes, what was the nature of the replies received?—Amongst the 110 returns made, 25 replies were given to this query. In only one case was anything known of a Board of Conciliation in connection with gas-works; and that was a local effort which had not been called into action. In one case reference was made to a Local Trades Council having objects similar to those mentioned in the question; and in several replies reference was made to the Boards of Arbitration and Conciliation in connection with the iron and other trades.

What was the nature of the replies received to your question: "Can you suggest any means of avoiding or arranging labour disputes and promoting cordial relations between employers and employed in gas-works?"—Many of the replies merely referred to the desirability of creating sympathy between employers and employed, without specifying definitely the course to be pursued. In those cases wherein a specified course of action was mentioned, the most general suggestion was that Conciliation Boards should be formed, either locally or otherwise, on which employers and employed should be fairly represented. Other suggestions were made—such as payment by results, the adoption of some system of bonus or profit-sharing, like that practised at the South Metropolitan Gas Company, and the formation of a superannuation fund, to which employers and employed should equally contribute.

With respect to your inquiry, "Have you any system of holidays or other privileges to workmen, deferred pay, sick payment, pension, pecuniary assistance in case of accident, or other insurance fund?" what was the general nature of the replies?—To this query, the 110 returns contained 101 replies. In almost all works, holidays were given, ranging from three to ten days during the year, with payment during absence. In a large number of cases, assistance was given in case of accidents to men on duty, and during prolonged illness. Extra pay for Christmas Day and Good Friday was usual; as also the payment at the annual excursions of all expenses and loss of time. The returns showed considerable range with respect to holiday arrangements; some works being fairly liberal in this respect.

What do you gather from the replies received to the question, "Do you make deductions by fines or other forms of stoppage?"—It was answered in the negative by 85 works out of 110; showing that fines are the exception, and not the rule.

As to Sunday rest for men employed seven days to the week, what have you to say?—In most cases definite efforts seem to be made to reduce Sunday labour as much as possible. At the change of shifts, a spell of rest came to each of the stokers in turn—in some works on alternate Sundays; in others, on every third Sunday; and in others, at longer intervals. In the summer months, Sunday labour can be reduced to a minimum. Of the works making returns, three stopped from 6 a.m. to 6 p.m.; and two from 6 a.m. to 10 p.m. on Sundays; but none of the works seem to have the system of a seventh day rest, which is in operation at Ramsgate.

What was the nature of the replies received in response to your request for general remarks on strikes, or any subject of interest connected with the Labour Commission?—Several advocated legislation on the subject, with the more stringent application of punishment in cases of picketing or intimidation. Some suggested mutual forbearance, kindness, and firmness. Other recommendations were the formation of a Board of Arbitration and Conciliation, for which the Institute should be requested to furnish some members; agreements for long terms; combination amongst employers; profit-sharing and bonus granting; and facilities for the discussion of grievances by representatives of employers and employed.

Have you any personal views of your own which you would like to submit to us?—After carefully considering the information supplied by the returns, I am strengthened in my opinion that the weak point discoverable in most gas-works is the attempt to carry on continuous work, night and day, for seven days without rest. I recognize the difficulty of entirely stopping the manufacture of gas; and I do not agree with the system adopted in those works where a partial attempt is made to do so. My experience points to a different solution, by means of the plan adopted in the works under my charge at Ramsgate, where one day's rest in seven is secured for every person engaged.

Will you describe this plan?—Labour in gas-works may be classified under the headings continuous and non-continuous. Under "continuous" labour (working seven days per week) would be comprised stokers, firemen, coal wheelers, coke stackers, engine-drivers and their labourers,

valve-men, and various gangers and foremen superintending these men. Under "non-continuous" labour (working six days per week) would be comprised the officers and men employed in the outdoor department, artizans or mechanics and their labourers, and yard labourers. The "continuous" class are engaged in the carbonizing department proper; and they are those who cannot be relieved of duty without a personal substitute or a stoppage of the works. The "non-continuous" class are engaged on much the same work, and under similar conditions, as outside labour of corresponding nature. The method employed at Ramsgate for giving one complete day's rest in seven to all included under the "continuous" class, is by the introduction of personal substitutes. This necessarily requires the employment of one-seventh more men in the carbonizing department—that is to say, to allow of continuous work being carried on without any man working more than six days in seven, eight men must be retained instead of seven. This plan is worked by simply allowing a seventh of the stokers and other seven-day men to stand off in rotation for one day, whether employed on day or night work. Without modification, this plan would result in the man, whose relief came on Monday, always being relieved on Monday; and the man whose relief started on Tuesday, always being off duty on that day; and so on with the other men throughout the week. But, by a simple system of interchange, it is, at the Ramsgate works, so arranged that a free Sunday comes to every man in his turn, once in seven weeks—the free days in the interim falling consecutively from Monday to Saturday. I find that the system of giving a seventh day's rest does not increase the cost of carbonization. The men are physically and morally better; and they do their work more cheerfully, and with an enjoyment which men who work seven days right off cannot feel. Such men become jaded, downhearted, and weak; and the continuous work ages them prematurely.

Are you of opinion that it is necessary in gas-works that the work should be continuous?—It is impracticable to stop a works so as to give a clear 24 hours' rest on Sundays; and unless the men can stand off for 24 hours clear, the stoppage is of little practical use. The men who are changing to night duty have their Sundays spoilt by having to spend the greater part of the day in bed, in order to prepare themselves for the Sunday night's work. The extra labour and anxiety of having to start a "dead" works is so great as to lead, in my experience, to a request being made to the manager that work should be continued under the ordinary everyday routine.

You are aware that the advantages of Sunday rest to a working man is that his family are resting on that day as well as himself; and it is the day which he can spend with his family or with his fellow workmen, so that a day off on any other day of the week is not a satisfactory substitute?—That is the weak part of it. But, of course, his being at work does not interfere with the rest of his family.

Is there just the same amount of work on Sundays as on other days?—Just the same.

But you say every man has a day off one Sunday in seven?—Yes.

And your practical experience is that this is the best method of conducting gas-works?—I have thought it over in every direction; and I cannot see any other way out of it.

What do you mean when you speak of there being extra labour and anxiety in starting a "dead" works?—The men having stopped, we have to shut off certain valves and meters connected with the gas-holders; and when they have to be started again, there is a great deal of anxiety, especially in winter-time, when the men have more or less to move about in the dark.

Mr. COURTNEY: Do the men work six days out of seven, or seven days out of eight?

Witness: Six days out of seven. The men have to change from night to day either once a week or once a month, according to the custom of the works; and it is arranged in such a way that they rest one day in seven.

Mr. MUNDELLA: As you have had a life-long experience of the gas industry, what do you say about the wages which are generally paid?—In my opinion the men are as well paid as in most manufactories—if not even better paid. There is now nothing very arduous in the work; the wear and tear on this score having to a large extent disappeared. Regenerator furnaces, by which the retorts are heated by gaseous fuel, have done away with the worst and most laborious work—namely, that of clinkering the fires; and stoking machinery has taken the place of heavy hand-scoops. Where machinery is not used, the heavy scoops formerly employed, which had to be lifted by selected men, have given place to lighter and more easily handled appliances. I am therefore of opinion that there is nothing in a gas-works that should justly cause dissatisfaction among the employees. Indeed, the reverse should be the case, as the same men are employed year after year, and in time have many privileges granted them, which are not accorded to ordinary workmen in other manufactories.

The hours are reduced and the wages increased?—Yes; and the heavy work in and about gas-works is done now by machinery, which makes the work much less arduous.

Is there anything dangerous or unhealthy about it?—Nothing at all. Are there any vital statistics obtainable?—I do not know of any.

What is the general conduct and character of gas workers. In your experience, are they more temperate, for instance?—Yes. Thirty years ago it was sometimes painful to go into large retort-houses. At that time we employed a special class of men for lifting the very heavy scoops; and they were always full of beer. They took a large quantity of beer every chance they had; and we had a certain amount of trouble with them from time to time. Now we have reading-rooms on the works, where tea and coffee are supplied, and the men can have any amount of oatmeal they like to mix with water for the purpose of allaying their thirst. In all the works under my charge, we do not allow any drinking on the works; but we give ten minutes' interval in the morning, during which a man may smoke and do what he pleases—go into the lobby and make himself some tea or coffee—and the same in the afternoon. Since we have done this, we have found that the men are improving daily.

At about what age do they become incapacitated for work?—A man can work at stoking very well till he is about fifty years of age; and after that age, it has always been the custom at our works to provide other places for such men, so as to give them lighter work.

Have you any views on the matter of pensions or superannuations which you would wish to bring before us?—In my view, the question of old-age pensions can be more easily undertaken by gas companies than by any other manufacturing bodies. If gas companies and corporations were to combine and form a Central Association or fund, into which all employers contributed a fair and equal percentage of the amount received by the employed, no great difficulty would be found in providing pensions for old age for gas-works employees. I think profit-sharing, so far from preventing disputes, might lead to them.

Do you think it would be within the province of the Legislature to stipulate that all persons employed in gas-works, and all kindred works under statutory powers, should be provided with superannuation allowances?—No; I do not go so far as that. But I think some large central fund might be formed for the purpose. If it is only carried on in individual works, when a man left he would have to sever himself from the fund; whilst if there were a central fund, that would be impossible. At the present time the weak part of bonus or other systems is that they are confined to individual works—generally large ones. But if the principle was universally accepted or made compulsory in gas-works large and small, then the removal of a man from one works to another would not interfere with the amount of claim he would eventually have upon the general fund, which would from time to time receive a fixed percentage of the wages earned by the workman or officer as the case might be, together with an equal amount paid by the gas company or corporation. This would entitle a workman or officer, on attaining a given age, to receive a certain pension for the rest of his life, calculated according to the amount received for premiums. But whilst a person, on arriving at a certain age, might be legally entitled to this pension, it should by no means follow that he must retire on reaching this specified age.

Has it ever occurred to you that you might form a Joint Committee of Conciliation of employers and employed?—Yes, it has; and I think it a very desirable thing to be done. There is nothing in the world to prevent it.

Mr. LIVESEY: Your Institute does not now represent a single London Gas Company, and you have not had returns from them.

Witness: We left them out purposely, because we knew that you and Mr. Trewby were going to give evidence.

And you have left out Glasgow?—We had no return from Glasgow, or from Birmingham, or Liverpool, or Leicester.

Of the 110 gas-works from which you have had returns, the greater number work on Sundays the same as on ordinary days. Was it not your impression that Sunday work was stopped?—It was.

By your system, it costs nothing whatever to give the relief, does it?—I really do not find that it costs any more. We gain a little by not stopping the work.

But the other system, stopping on Sundays, does cost more?—Yes; there is a certain amount of waste fuel, and so on, which makes its cost more as between seven days' working and stopping, and seven days' working and not stopping.

You have said that the ordinary system in London is no relief to the night man. Would not the night man go on at 6 o'clock on Sunday morning?—He only gets relief alternately with the day man.

But the day man gets relieved?—A portion of the day-men obtain relief undoubtedly; but a large proportion of the engine drivers, firemen, and so on, do not.

Surely the drivers get off?—Only if you stop the engines.

Practically they get half their Sundays in the year. I myself find that the men are better and stronger; and I am sure they would not go back to the old system on any account. You do not seem to approve of profit-sharing?—I do not think I should like to put it in that way. I approve of profit-sharing; but I do not think it is the best way, and I think perhaps a better may be found. But I approve of it most distinctly as being a move in the right direction.

In giving a man wages, however high, you only buy his time; you do not purchase his interest in the concern, and it does not matter to him whether it is prosperous or not?—At the same time, if you give him a share in the profits, you are simply giving him a bonus in another form.

Is not profit-sharing something beyond wages? Does it not give a man an interest in the business which no mere wages would give him?—If he had some control of the way in which the profits were shared.

Supposing that a committee formed of representatives of both workmen and employers met in conference from time to time, to settle what should be the basis of profit, do you think that would be wages?—Yes, undoubtedly, because in that case you would import into the domain a question which had nothing to do with it.

Mr. AUSTIN: Did you engage one-seventh more men for the purpose of giving each man one day's rest in seven?

Witness: Yes.

Mr. BOLTON: Do you find the workmen unanimous in disputes as to hours of labour and wages?

Witness: No; I have found that that is not so.

In the case of Boards of Conciliation, would it be the majority that should rule the minority?—Yes, by all means.

Then how would the majority on the Board of Conciliation compel the minority?—They could not do that. They would be at liberty, of course, after the decision of the Board, to turn round and say, "We won't accept it."

Then what becomes of your compulsory powers?—In the first instance, you would start with a Board which is accepted by the men and the masters; and before the Board can get to work, they must agree to take the decision of the Board. If they did not do so, it would be a breach of faith.

Mr. MUNDELLA: You would rarely find that employers and employed did break away from the decision of the Board; and anyone who was recalcitrant would have public opinion against him, and would find it very difficult to maintain his position?

Witness: Quite so.

Mr. Thomas Duxbury, Engineer and Manager to the Darwen Corporation Gas-Works for the past 15 years, said the number of men employed at the works, in the depth of winter, was somewhere about 150. The number of tons of coals carbonized in the works last year

was 14,000; and the sum paid in wages amounted to £5500. From 1882 to 1887, when the works were pretty stationary, the average wages amounted to 2s. 9½d. per ton, leaving out 1889, when they were in a transition state—changing the hours of labour from twelve to eight, &c.—and coming to the three years ending March, 1890, 1891, and 1892, the average cost per ton for retort-house work was 3s. 6½d. The yardmen and labourers obtained from 20s. to 22s. per week, which he did not consider excessive. The stokers had 5s. 5d. a day, working eight-hour shifts, for carbonizing 3 tons of coal. They did not get as much work done in the eight-hour shifts as they used to do in twelve-hour shifts. Under the latter system, the cost of carbonizing a ton of coal used to be 2s. 0½d.; whereas it was now 2s. 4½d.—an increase of about one-sixth. The stokers, when working on Sundays, made £2 0s. 6d. per week; and this was more than the average wages paid in the neighbourhood. There was a strike in 1890; and the Corporation engaged new men, who for a time had to be kept under protection inside the works. This rendered the men on strike powerless; and they did not get the sympathy of the public or the support of the Union. The Union allowed them pay at the rate of 8s. per week for one week only. They afterwards applied to be taken back; but the Gas Committee refused to take them in a body, or to discharge any of the new men. Eventually, however, they consented to take them back as vacancies occurred, on the understanding that they would work side by side with the new hands, and not neglect work or interfere with them in any way. The men did not keep to their promise in this respect; and he had to take severe measures. One of the old hands, whom he had to discharge for interfering with the new men, told him he had instructions to do it from the Union officials. Witness thereupon decided that, when another case of the kind arose, he would discharge not only the immediate offender, but also the Secretary of the Union. Another case did occur within a few hours; and he then carried out his determination. This had the desired result; and he never had occasion to discharge another man. The state of affairs was such that he had to put his foot down in a manner that might have seemed harsh; but it was effectual. The grounds upon which the men struck in 1890 were, in his opinion, unreasonable. Having regard to their work and hours of labour, the Corporation men were far better paid than men employed in somewhat similar capacities in the surrounding factories. He objected to the demand of the Union that all men, without regard to their qualifications for work, should be paid at the same rate. The minimum standard fixed by a Trades Union ought to be for competent men, and incompetent men ought not to be entitled to the same rate.

The CHAIRMAN: But you are not bound to employ incompetent men?

Witness admitted that that was so; but he contended that it was hard on comparatively incompetent men that they should be debarred from getting employment for what they were worth. He was in favour of the establishment of Boards of Arbitration or Conciliation, to which either the men or the masters might appeal for the settlement of disputes. He thought such a Board might consist of a person nominated by the masters, another by the men, and a third by the Board of Trade. He considered that on public grounds strikes in gas-works should be prohibited during the four winter months; and, of course, there should be no reduction of wages or increase of hours during the same period. He would also like to see prohibition of picketing as carried out in his neighbourhood, where it often included a blow on the head.

The CHAIRMAN: But that is punishable very seriously.

Witness: I know it is; but they are not all punished.

That is not the fault of the law.—Perhaps not, if the law was strictly carried out; but I do not think it is.

By Mr. LIVESEY: The strike at Darwen took place because, after the hours had been reduced from twelve to eight, the men demanded increased wages. When they had been granted all they asked for in September, 1889, three months afterwards they presented fresh demands, which were refused. They did not then strike; but they did so in November, 1890.

Mr. TAIT: Do you wish to take away the legitimate right of picketing at present possessed by workmen?

Witness: I do not want to take away the legitimate power of picketing—only the intimidation and violence.

Mr. TAIT: I think you will find that the Trades Unions are with you in that, and as anxious as yourself to put down intimidation and violence.

Mr. H. E. Jones, Engineer and General Manager of the Commercial Gas Company, said they had never had any serious trouble with the men in their works; but they had had with the coal porters, who belong to a different Union. They had had a good many costly struggles over extremely unreasonable demands, which were not vindicated in any way by the men themselves or their Union leaders when discussing the matter afterwards. In two or three cases, the Union did not sustain the action of the men. In 1889, the coal porters stopped work simply in sympathy with the dockers; and, after being out for three weeks, would not resume work without extra money. They struck altogether, and without giving any notice. There was no arrangement with the coal porters that they should work exclusively for the Company, or that they should give a week's or a fortnight's notice before ceasing to work; but he thought some such notice might be reasonably expected from men who were working for a Gas Company almost regularly and continuously.

The CHAIRMAN: When you discharge them, do you give them any notice?

Witness: We do not discharge them. When they finish a ship, their job is at an end.

They are not considered as among the workmen employed as gas workers. Do you then require notice?—Yes; a week's notice.

Why do you confine it to a week?—It is the custom; and we pay them weekly.

We understood the notice was a fortnight in some cases?—Yes. There was a notice introduced at the time of the alteration to the eight hours, when there was a good deal of trouble; but I disliked it so much that I did not carry it out.

If you are anxious to prevent the risk of your district being left in darkness, why not have longer notice—say, a fortnight or a month?—

We pay the men weekly; and we think the law would require the notice to be the same.

You have to consider the exigencies of the public, as well as of the Company. Now there is a law specially made for you, which says, when a person employed by any gas or water contractors maliciously breaks his agreement, knowing that the probable effect will be to deprive the district of gas or water, he shall be liable, on conviction, to pay a penalty of £20, or three months' imprisonment. Surely that law was made expressly to prevent the public from suffering such consequences as the last witness indicated; and why do you not make your contracts with your workmen so as to give ample time, in case of dispute, for getting fresh hands?—Practically, we could get a fresh supply of men in seven days.

Then there is no such danger to the public as the last witness feared?—That is so, provided the men respect their notices; but I have known them throw down their tools, and refuse work for an hour or two, though it is true they have come back on being firmly treated.

Those have been cases of ebullition of temper, I suppose; but no serious breaking of notice?—No.

Therefore you can proceed in the ordinary way?—If they respect the law.

If they do not, there is three months' hard labour for them, is there not?—Yes; but it is very difficult to get three months' hard labour for 500 men. You might do it for five.

However, you think that practically the seven days' notice is sufficient?—Yes.

And you get no notice whatever from the coal porters; and when they struck in 1889, it was in sympathy with the dockers?—That is so?

What happened? Did you get them back?—Yes; and in coming back, they obtained extra rates of wages.

Witness proceeded to say, in answer to further questions, that the coal porters employed by the Company at the Regent's Canal were practically employed all the week through, as ships were constantly arriving. The men employed at Wapping averaged about three days a week; and when not employed there, they were generally at barge work for the Company at Stepney. There were gangs of them who worked at both places. Between the barge work at Stepney and the ship work at Wapping, they were engaged about 250 days in the year. At the conference which took place at the Mansion House, Mr. Michael Henry, for the coal porters, demanded that they should be paid the same for barge work as for shipping. Witness demurred to this, on the ground that the barge work was lighter, and less troublesome, being always done in the day time. But, at the urgent request of Sir John Lubbock, Cardinal Manning, and others, witness agreed to look into the matter if the gentlemen named would consent to act as arbitrators. Michael Henry then said: "But in the meantime we must have the extra money." The Company objected, but ultimately consented to pay the extra money pending the arbitration. Afterwards the men put difficulties in the way of arbitration, and nothing came of it; and it appeared that the arbitrators had not bound the men in any way to bring forward their case in a reasonable time. Sir John Lubbock wrote: "As the men were not prepared to submit their claims to arbitration, we have to regard the provisional reference to us as entirely at an end." The Company, however, had been paying the extra rate ever since. Witness himself was led into a kind of tangle over the matter. It appeared that the men employed knew nothing of the proceedings at the Mansion House; and, having once obtained the extra penny per ton, they said they intended to stick to it. In reference to the coal porters, he might add that the Company had had one or two cases of exceptional hardship to submit to, considering all they had done. In February, 1891, the men declined to unload a ship on the ground that the crew were not members of the Sailors' Union. Witness tried to reason with them, but failed to get them to act; and the Company had to pay £340 demurrage in consequence. In another case, they refused to unload because the ships were at a wharf where the regular men were on strike, and non-Unionists were employed. The Company had to remove the ships, and were put to expense. On Sept. 29, 1890, the men stopped in the middle of unloading a ship, and ordered the Company's weighers to withdraw. The foreman took the men away; and witness then stopped the unloading of the ship. They asked him why he did so; and he told them it was because they were not unloading it properly. They then said they would not, and demanded to be paid for what they had done. Witness refused to pay them. Ultimately they resumed work; and he sent the weighers back. He mentioned this and other instances to show the reckless way in which the Company were put to expense.

The CHAIRMAN: Have you ever tried to bring about a better understanding with the leaders of the Union?

Witness: I have been on what I may call good terms with the leaders all the way through; I have never taken up a line of hostility to the Union.

Have the leaders approved the kind of capricious action you have described on the part of the men?—Yes. The Secretary told me he was very sorry; but it was inevitable, and must be put up with.

Then it amounts to this, that the coal porters have refused to unload ships which have been manned by seamen who were not members of the Seamen's Union?—Yes, in two cases those are the kind of disputes that cost us most money.

And the coal porters have been put in motion by the leaders of the Seamen's Union?—I suppose so.

Are the relations better now?—The events I referred to are quite recent. The work of the coal porters has rather increased lately. As to the stokers, I have nothing important to speak of. The chief difficulty we have had has been caused by the men throwing down their tools, chiefly at night time, because of the employment of gangs of free labourers. This has occurred four or five times. In every case they were told that, if they would strike, they must—that they would be allowed to go, and that their places would be filled up. After some delay—three or four hours—they in each case went back. Our works are surrounded by the docks. The dock dispute came on after we had conceded the eight hours to our men. There was a certain amount of excitement when we reduced the hours. When the hours were altered, we did not lower the wages; but in some cases rather improved them. The

reduction of hours put us to great expense. In regard to wages, we ourselves felt that, as it was some years since they had had any great advance, some improvement in their position was desirable. They agreed to work at an increase of 28 per cent.; but the cost ultimately proved to be 48 per cent.

Have you increased the price of gas?—Yes, recently. This month we have been charging a small extra rate (2d. per 1000 cubic feet) in consequence of difficulties as to coals; the present price being 2s. 6d.

How is it there is such a great disparity in the prices charged for gas by different Companies in London?—That depends a good deal upon financial circumstances. The Companies are differently situated in regard to the amount of capital they have employed. Some of the older Companies have capital representing antiquated and costly plant, which has been replaced by much cheaper things. The younger Companies have had the advantage of smaller capital, and can consequently produce gas cheaper than the older Companies.

What percentage do you bring your shareholders?—An average of 6 per cent.

Ought not each Company to be able to produce gas as cheaply as the others?—No. They are not all equally well placed; some being on the river, and some on land. There is a difference, for instance, between our small works at Wapping on the river, and our large ones at Stepney.

Have you any suggestions to make as to any method that can be devised which will put an end to the friction between the Company and some of their workmen?—There has never been much friction, except when they obtained the eight hours, which they did very easily—much too easily. I am really opposed to it, although I am prepared to loyally abide by it now.

Do we understand that your cost of production is more than 40 per cent. higher than formerly?—Yes; the labour.

You do not mean that the men earn 40 per cent. more?—No; certainly not. The men work so much less. They get the same money for eight hours that they formerly had for eleven.

Has it ever occurred to you that the large Gas Companies of London might arrange a system of arbitration and conciliation between themselves and their workmen, and have a uniform rate of wages and hours of labour?—We do practically have a uniform rate of wages. As to a Board of Arbitration, unless it is very peculiarly constituted I have not much faith in it; and you must have the co-operation of the men.

But has it ever been submitted to the men that the employers are willing to enter into the establishment of a Board of Arbitration, at which all disputes might be discussed?—Yes. When we met at the Cannon Street Hotel, after the demands of the men had been conceded, I said to their delegates: "Would it not be better for us to meet in this way, and settle disputes?" and they agreed that it would. But I do not see what any Board of Conciliation can do, if one side or the other is determined to have every inch.

You have conceded the eight hours; and the other demands of the men?—Yes.

Examination continued: We work on Sundays to avoid injury to the retorts. But we try to suspend work for a clear twelve hours; and we pay double time for certain shifts. In regard to strikes, I am afraid you will never get rid of them. Of course, in an industry like ours, where the police safety of an important district depends on the light, we go into these disputes and negotiations with painful anxiety, knowing that any failure on our part involves great risk.

The CHAIRMAN: Do you think it would be wiser instead of having so short a notice as seven days that you should require and give fourteen days?

Witness: There might be some advantage in that, although I do not think seven days' notice is too short, if the men would respect it; and if you could really use the law of conspiracy. It is difficult to apply it to 3000 men.

You do not complain of the law not being severe enough?—No; but you have a practical difficulty, when you are dealing with thousands of men.

Your difficulty is that the men may break their contracts in masses?—Yes; that is the only difficulty. Apart from that, the seven days' notice would be sufficient. Of course, I should like fourteen days; but if we were to propose it, there would be fresh demands for terms.

You think men should be restrained from striking out of sympathy with another Union?—I think it ought to be provided against and punished. It puts me, for instance, who have no voice or power in the matter, in the position of having to suffer for the wrongful action of either masters or men in some other district altogether.

How can you prevent the collateral suffering to which you refer? Take the case of the Durham strike at the present time, numbers are suffering from the consequences who are not in the least responsible?—That, of course, is inevitable, when a strike goes to the fountain-head of the raw material. But it ought not to be inevitable that, because certain men are on a ship the miners should refuse to get coal, or other men refuse to unload.

But you know that you have a remedy in your own hands as gas-works proprietors if you employ your own coal porters, subject to notice?—I do not think that is quite a certain remedy, because you are assuming that, if a man is under agreement with you to work for a given time, he will never raise any of these questions. It is very difficult to prove malice.

By Mr. LIVESLEY: The Mansion House conference was with the barge porters. Our barge porters are in our employ, and in regular work. The old rate gave them something like 12s.; and the new rate, 15s. They based their demand on the contention that the barge porters ought to have the same as ship porters. I was present when Michael Henry said: "I will accept arbitration for the other Companies, but not for the South Metropolitan; and unless it is agreed to, all the coaling shall be stopped to-morrow." It was under this threat that the Companies agreed. I received a telegram from you offering to unload for us; and I replied declining with thanks, because I was afraid of complications. I was afraid that, if we got the coals unloaded, our stokers would strike. I remember two strikes in London among the stokers—one in 1864, and another in 1872; and in both cases, the Companies procured men, and things were settled all right. When a

workmen's Union goes beyond its functions, and assumes to govern one's works, it is better, however unpleasant it may be, to have a strike, and have it out, than to go on for a long time in suspense and uncertainty.

By Mr. AUSTIN: I would always prefer arbitration if I had confidence in the arbitrator, and was assured the men would abide by his decision.

(To be continued.)

THE METROPOLITAN WATER SUPPLY COMMISSION.

Monday, May 30.

(Lord BALFOUR OF BURLEIGH, Chairman; Sir G. B. BRUCE, Sir A. GEIKIE, F.R.S., Professor DEWAR, F.R.S., Mr. G. H. HILL, M.Inst.C.E., Mr. J. MANSERGH, M.Inst.C.E., and Dr. W. OGLE, Commissioners.)

At the commencement of the proceedings this morning,

The CHAIRMAN announced that the Commissioners had decided to sit on Mondays and Tuesdays in each week throughout June, omitting Whit Monday and Tuesday.

Mr. Corble, Clerk to the Lea Conservancy Board, examined by the CHAIRMAN, said he had occupied his present position during the past 22 years, and was well acquainted with the district of the Conservators, five of whom represented riparian owners, one local authorities, two the New River Company, two the East London Water Company, one the Corporation of London, and one the London County Council. None of the landowners represented on the Board were officially connected with the Water Companies. The correspondence which took place in 1891 between the Board and the two Water Companies with regard to the navigation water arose in consequence of that having been a very short water time, and that traders were complaining to the Board of the want of water. The Conservancy then considered their rights, under the Act of 1855, as to passing more water down the river to fill up the lower reaches. The letters explained that water passed down the river would go out into the Thames, and be practically wasted. The other remedy was by dredging.

The CHAIRMAN: What quantity of water was being passed down the river prior to March 17, 1891?

Witness: The Engineer will be able to give the exact figures; but, taking it all round, except on one occasion, we never took much more than 1,500,000 gallons daily, though we are authorized to take 5,400,000 gallons, for navigation purposes.

For how long a time has your statutory quantity not been passed down?—For many years. A rough calculation shows that, if we took our full supply, it would be equal to 35 days' supply of the two Water Companies.

Do you mean you could not get it?—We could not get it without the two Companies losing that amount.

Have the 5,400,000 gallons a day been passed down since April 4 last year?—Only once during the summer—in June. We have never carried out our resolution strictly at any other time. The water in the lower reaches was then exceptionally low; and our Engineer acted on the resolution which gave him a free hand in any emergency.

One of the witnesses for the East London Water Company gave us to understand that, even if you did take this water, it would not make any material difference, because the reaches below were so wide that 5,400,000 gallons would not appreciably deepen the water over so large an area?—That is correct; but provision is made in the Act of 1855 for taking sufficient to fill up. If we did so, however, the Companies might make deductions from the water-rents.

You do not think that a very desirable consummation?—The Companies pay 3d. per 1000 gallons; and, worked out at that rate, they ought to pay us £250,000 a year.

Do you think that power will ever be put in force?—No. The Companies work very fairly with the Conservancy. Under the Lea Conservancy Act of 1868, they have to pay the Board £1000 per annum to be applied in preventing the pollution of the water—one-third being paid by the New River Company, and two-thirds by the East London Company.

That has very seldom been paid; and in one year it was only £96?—That was just after the Act was passed. In addition to this £1000, £3500 a year is paid for water-rents.

Examination continued: For the offence of turning sewage into the river, the Act imposed a penalty of £100 for the first day, and £50 for each day following; but the Conservancy had never been able to get a conviction under it. The magistrates naturally leaned a little in the circumstances, as the Board had to take the case to the town which was in question. In cases where manure was placed on the banks, they generally obtained convictions. They had had trouble from manure, lime, &c., carried on the river in barges; but there was no great amount of pollution from that source. In 1881, the trade in manure on the river was 46,913 tons; but last year it was only 28,972. More artificial manure was now carried by rail, though large quantities of gas lime were now conveyed along the river. He did not think the trade would increase. The main trouble was from the men pumping out the barges at night; but there was not a great deal of pollution from this, though, of course, it did tend to make the water in the river less pure than it otherwise would be.

By Sir A. GEIKIE: As to the steps taken to prevent this, the Board prosecuted the offenders when they caught them. With regard to the statement made by Mr. Bryan in his evidence, that the compensation reservoir formerly afforded an excellent means of flushing, but that the Conservancy's dredging operations had filled it up, he might say that the reservoir had no effect upon the lower reaches. All the water from it went to supply certain mills, and then passed out into the Thames. The mill rights were now abolished.

Major Lamorock Flower, Sanitary Engineer to the Lea Conservancy Board, examined by the CHAIRMAN, stated that he had filled his present position for 21 years. As to the question of pollution there was practically none above Hertford. They had had to take legal proceedings against the local authority of that town in reference to pollution; but they were not successful. There was undoubtedly a local pollution; and he did not think it ought to be allowed to continue. This

was 15 miles above the East London Company's intake; but he had seen the effluent lately, and it was black and offensive. The treatment of the sewage at Ware, near Rye House, was thoroughly efficient; and no pollution occurred there. The other sanitary authorities above the intake—Stanstead, Hoddesden, and Broxbourne—were satisfactorily disposing of their sewage by irrigation of the land; and the sewage of Waltham Abbey was now also well disposed of.

By Sir G. BRUCE: A considerable population existed above Broxbourne, which was not included in any sewage arrangements.

By Mr. HILL: Inspections along the river took place every few months; and sometimes at shorter intervals. No exact system was followed. The chemical witnesses would speak to the character and analyses of the effluents. The population above the East London intake was between 120,000 and 130,000, of which 80,000 would be in towns and villages.

By Dr. OGLE: None of the towns or villages passed their sewage into the stream, without previous treatment. In Luton millions of gallons of water were used daily in straw-bleaching by oxalic acid; but none of the water was passed back into the river. Possible sources of pollution to the number of 87 were shown on the plans above the East London intake. In his judgment, the character of the Lea water was not deteriorating year by year. At one time it was; but it was now improving. Whatever pollutions existed were gradually diminishing in character and effect. As far as manure was concerned, it was much less; and if an Act were passed to compel owners to make their barges sound, instead of allowing them to be leaky as they were now, it would be still further decreased. The quality of the water was good and wholesome; and the papers put in on behalf of the County Council did not fairly represent the condition of the water supply of the Lea Valley.

Mr. J. Child, Engineer to the Lea Conservancy Board, examined by the CHAIRMAN, confirmed his statement before the Rivers Pollution Committee, when dealing with this subject, that the smallest flow over Field's Weir had occurred in August, 1885, when it was only about 21,500,000 gallons a day. He also stated at that time that the East London Water Company were drawing from the Lea and reservoirs 23,171,190 gallons a day; and the New River and East London Companies together were taking the whole of the water in the river, except the quantity required for navigation. The smallest flow over the weir for six months of which there was any record was in the period from June to December, 1874; the average daily flow being only 15,300,000 gallons a day. It was pointed out to witness that it had been stated that the quoted gaugings were erroneously taken, and none given in the other witnesses' tables were so low; and he replied that the difference arose from the fact that the gaugings during the last nine years were taken on mistaken instructions. Those made before the year 1884 were correct.

By Mr. MANSERGH: They took 2,500,000 gallons a day; and an extra quantity beyond that for flushing purposes.

By the CHAIRMAN: The later gaugings in the tables showed no increase in the minimum flow in the dry months.

Mr. W. C. Young, Consulting Chemist to the Lea Conservancy Board, examined by the CHAIRMAN, said he had inspected the Lea annually, since his appointment nine years ago, throughout its course as far as Hertford, and twice up to its source. Those were official inspections or surveys made for the Conservators about July. His analyses did not indicate any serious pollution from sewage contamination. Traces of sewage appeared in the river, caused by the discharge of the effluent from the Hertford Sewage Works. The object of making the analyses was to contrast the condition of the water 100 yards above, and the same distance below, the point of discharge for the effluent. He found below that point an increased amount of albuminoid ammonia, free ammonia, and chlorine in the water. As a chemist, he did not think there was a process known by which soluble organic matter could be removed; and it was that which promoted the growth of fungus. At the source of the Lea, the quantity of organic pollution was half a grain per gallon. The analyses did not indicate any serious pollution by sewage matter in any part of the river, which was in a remarkably pure condition.

The CHAIRMAN: What do you say with regard to the water at the East London intake being fit for conversion into a fluid suitable for consumption?

Witness: It is very excellent water indeed, especially this year. In April last, the Lea water contained less than four-tenths of a grain of organic matter per gallon.

Was that after filtration, as supplied?—No, it was just after it was drawn in at the intake.

By Professor DEWAR: He introduced some figures to the notice of the Chemical Society in November, 1891, as to the organic matter in solution. Asked how his figures compared with Dr. Frankland's on the one hand and the Companies' officials on the other, witness said, if it were assumed that the organic matter in solution contained 23 per cent. of carbon, the same result would be obtained as given by Dr. Frankland. The figures submitted by the Water Companies, if multiplied by 4, should represent those given by Dr. Frankland, Dr. Tidy, and the other analysts. The percentage of nitrogen in the organic matter varied a good deal—from 21 to 28 per cent. He had only had a sample of one of the effluent waters submitted to him for analysis; and it was then very satisfactory. He should expect to find sewage fungus in all sewage-contaminated water; and this would become a further source of pollution if not removed. Dr. Brooks's and Dr. Odling's analyses showed the pollution to be more of an animal character than Dr. Frankland's.

Sir W. H. Wyatt, examined by the CHAIRMAN, said he had been Chairman of the West Middlesex Water Company for eight years, and a Director for fourteen years past; and he was also Governor of the Chelsea Water Company. The printed statement they had sent in to the Commission, gave a brief history of the Company down to the present time. By an agreement with the Thames Conservancy—to pay them £1000 per annum—they were allowed to draw 4,500,000 gallons of water daily from the river, in addition to the 20,000,000 gallons taken under the agreement with the City Corporation. The great point with regard to the Chelsea Company was that their district was very much built over—they were hedged in by the river itself, and by the other Water Companies; and they did not expect a

large increase of population. There were only 528 acres of land which could be built upon in the district; and they calculated twelve houses to the acre. Assuming a certain quantity of water only was to be taken from the Thames, they were advised that there would be a surplus when the demands of all the Companies 15, 20, or 25 years hence were satisfied. There would be no difficulty in obtaining any quantity of water; and, in addition, there were wells and gravel beds, from which a considerable supply could be procured. Their present supply had had no effect upon the river. The water was kept at the required level by the lock below Hampton. The number of houses in the Company's district on March 31 last was 75,186, of which about 37,000 were under constant supply. The constant service was difficult to maintain in severe drought or frost; and enormous waste was caused by people tying up their fittings, and letting the water run so as to prevent freezing. Notwithstanding this, the Board thought it a wise policy to grant a constant supply as against an intermittent one; and the waste might be checked by more thorough inspection, to see that the fittings were kept in repair. In the older parts of the district, where the fittings were bad, they might exercise their power of cutting off the supply; but they did not care to do it. The proportion supplied for trade as against domestic purposes by the West Middlesex Company was 14 per cent.

By Mr. HILL: Their present consumption per head was 28 or 29 gallons a day, and was pretty steady—rather decreasing than increasing. A larger quantity of water would be required for a constant supply at first; but after a few years it might be different. He thought 28 gallons per head was an excessive quantity to allow.

By the CHAIRMAN: They would like to have a little more subsiding reservoir capacity; and they would have had it long ago, but were waiting to see what the turn of events would be before laying out money. He hoped the results of this Commission would afford them some light.

Mr. M. W. Hervey, the Engineer to the West Middlesex Company, examined by the CHAIRMAN, said their largest average pumping was in the week ending June 19, 1891, when it was 132,776,496 gallons, or a daily average of 18,968,071 gallons. They obtained these figures by taking the capacity of each pump, and the number of strokes made by the engines; 5 per cent. being sufficient allowance for errors from variations of stroke. His other figures were corrected from the census and quinquennial assessments. The inhabitants per house were $7\frac{7}{9}$ — $7\frac{3}{4}$ would be a fair basis to take. Having promised to send in a statement as to the annual supply by meter, witness proceeded to state that his Company could store $7\frac{1}{2}$ days' supply of unfiltered water; and they could easily pass through their filters in a day, one day's supply—16 million gallons—and a good deal more.

The CHAIRMAN: If your storage reservoirs were depleted, and your subsidence reservoirs empty, and a long flood occurred, during which you would keep your intake shut, so as not to draw in flood water, how long would it be before you could hope to get the water you take in from the Thames in a fit state to be supplied for consumption?

Witness: We could pass it on to our filter-beds direct, and filter it at once. They would hold sufficient for the day's supply, at all events.

I understand you do not anticipate nearly so rapid a proportional increase in the next 40 years as you have had in the same past period.—No, we do not. In that time our number of supplies has nearly trebled. In 1873, there were 326 constant supplies; and in 1891, 32,342. In better class houses defective fittings were quickly repaired; but in such places as Lisson Grove, it was more difficult to get them done, notwithstanding constant inspection.

By Sir G. BRUCE: With regard to the engine power at Hampton, they had one compound Worthington engine at work, and two engines in reserve. Another triple-expansion engine was going to start work the next day. They could draw off the water in the filter-beds to within about 3 feet. It might be drawn right down; but they preferred not to do so, and, as a rule, they only drew it off to within about 6 feet from the bottom. A large quantity of water could be obtained during a great part of the year without taking any flood water at all.

By Mr. HILL: During actual flood time, they took as little water as possible. As to the arrangements for cleaning the reservoirs, they had cleared out one or two in his time; but they had gone many years before requiring it. He thought the last one went for 20 years. It had not been cleaned before. Then, taking the average of depth throughout the reservoir, he believed there were 15 inches of water in some places—near the intake it was deeper, and it gradually tailed off towards the end. With regard to future consumption, he thought it would be reduced per head.

By Mr. MANSERGH: The Company were now pumping at Hampton exclusively with the Worthington engine. The Cornish engine was ready for use, but they did not use it—it was a stand-by. They worked the Cornish engine at Hammersmith. He considered that 5 per cent. allowance was enough to cover short stroke and spill. As to their filling power, they had an area of 15 acres capable of dealing with $2\frac{1}{2}$ gallons per square foot per hour. They were only pumping about 17,000,000 gallons; so that there was a large margin of filtering area. They never filled at the rate of $2\frac{1}{2}$ gallons; but much slower. One filter-bed was generally out of use; and there might be another ready for cleaning. About five years ago, they removed, washed, and repaired the whole of the material in the first three filter-beds constructed for the Company in 1852. The total minimum thickness of filtering material was 3 ft. 6 in.; the sand being 2 ft. 6 in. With regard to the waste of water, he believed it was very largely due to defective fittings.

By Dr. OGLE: So far from there being any apparent waste from introducing the constant supply, the average daily supply per head had gone down almost coincident with that introduction. The constant supply began in 1873; and the supply per head was then larger than it had ever been before. The increase in the supply last year was due to the frost.

By Professor DEWAR: If the filters were not working properly, the analysis of the Company's chemist would indicate it. He did not think the filter-beds were cleaned because they absolutely required it; and he did not know that they afterwards filtered the water any better than before. The water unquestionably had improved by, he believed, something like 30 per cent. between 1868 and 1890.

By Mr. MANSERGH: He always shut off a bed for cleaning when it was filtering only at the rate of 2 inches per hour.

By the CHAIRMAN: If the level of the water at the Company's intake was reduced, it need not necessarily be so by the quantity of water abstracted by the Companies; but it might be due to manipulation at the weir.

Mr. F. H. Wybroo, the Secretary of the West Middlesex Company, examined by the CHAIRMAN, said there had been a very large increase in the number of supplies from 1880 to 1884. That was when the building speculation was at its height throughout London. Since then the increases had diminished in number very much every year, and were lower last year than at any time since 1876. It was thought that the increase in the future would not be so great as it had been during the last 40 years. The town district was almost entirely built upon; and only the country district, containing 5800 acres, remained to be built upon to the extent of about one-half during the next 40 years. This would only give an increase of 34,900 houses. Of course, this was only an estimate. The average population per house in the town district was 7.79; but in the country district, it was only 6.91. Therefore $7\frac{3}{4}$ for the whole future supply was rather an over-estimate.

Mr. W. Willis, Assoc.Inst.C.E., the Superintendent of Supplies of the West Middlesex Company, examined by the CHAIRMAN, said he had been 24 years in their service. In 1871 they were so anxious about the constant supply being introduced, that they took special steps through the turncocks to ascertain the amount of waste per day or week. In Lisson Grove they found waste occurring in perhaps every third or fourth house, and another similar place was Kensal Green New Town. On the other hand, in Hampstead Road or Stanley Gardens, they only found waste in every sixth house. They had lately increased their staff of inspectors; and by this means they would be able to reduce the daily quantity per head. Every gallon saved per head represented 500,000 gallons of water. Previous years they had got down to 25 gallons, in places where they made special efforts.

By Sir G. BRUCE: The Company's inspectors did not take leathers and washers with them for defective taps. They had thought over the matter; but did not know whether they would be able to work it.

Mr. MANSERGH: It is done sometimes in the country districts.

Witness: They find it saves something; but we find there are some fittings which are constantly out of repair. The defects as a rule are in the poorer class of houses.

Sir W. H. Wyatt, recalled, and examined by the CHAIRMAN, said the daily average supply of the Company was not quite so large in 1887 as in 1885. They attributed this to the exceptional circumstances in that year. In 1887, being Jubilee Year, the West-end of London was very full, and the weather was hot; but, of course, that would not account for 1885. In 1872 they delivered 301 gallons of water per supply; and the figures for 1891 brought out 279 gallons. This was due to greater activity in discovering waste. If the cisterns were not in order, they were not so soon emptied. They had made an allowance for empty houses in their calculations of gallons per head. They had treated them as if they did not exist. The number of houses cut off could be ascertained. If there was a considerable proportion of uninhabited houses, it might make a difference; but probably it would not be very large. In part of the district, the height of the houses had been much increased, and was still increasing. In Fulham, on the contrary, there was a large proportion of small houses. There were in the Company's district a great many houses let out in flats. The District Engineer would be able to give information on that point; but they were not bound to supply water beyond the height which their reservoir at Wimbledon would reach. The Chelsea Company thoroughly believed that under no circumstances could they ever be called upon to supply more than 15,000,000 gallons of water a day; and they were quite capable of doing that.

Tuesday, May 31.

Evidence on behalf of the Chelsea Water Company was continued to-day.

Mr. Richard Hack, the Engineer to the Company for the last six years, said that in 1872 the quantity of water they supplied worked out to 301 gallons per supply; and in 1891 to 279 gallons. The difference he attributed, in a measure, to waste through the condition of the engines. There was now a great improvement in the pumping, and not so much waste. The average daily supply was arrived at by taking as a basis his returns of the pumping. He estimated from the capacity of the pumps entirely; allowing no percentage for loss, because there was very little—5 per cent. would no doubt cover it.

The CHAIRMAN: One Company estimates 10 per cent. of waste?

Witness: It would be too much for my pumping.

Being requested to tell the Commission the considerations which applied to the estimate of the Company's future supply, witness said he must refer the Commissioners to the District Engineer for that. Being then questioned as to the subsiding reservoirs of the Company, he stated that they had four of these; and that they were all at use at one time. The water passed through all four. He next mentioned that on one occasion the Company had abstained for ten successive days from taking water from the Thames, on account of the discoloration of the water during flood. That was the longest period during which they had so abstained since he entered the service of the Company; but they had abstained for shorter periods—such as six and seven days. At present they had power to take 20,000,000 gallons out of the Thames every 24 hours. They now took less than half that quantity; but they were contemplating taking 15,000,000 gallons. They had spare land to extend their reservoirs and filter-beds.

Mr. HILL inquired if the Company at any time took flood water into their reservoirs.

Witness replied that he had never taken coloured water in; but he took it that there was very little harm in flood water coloured by suspended matter, such as clay. In the subsiding reservoirs, the water became clear; and they rarely had a filter blocked through a deposit. The depth of the reservoirs was 18 feet; and three years ago they were all four cleaned out. As a rule, they cleaned one each year—he was cleaning one this year.

What is the depth of the deposit at times?—Four inches. Five inches is the most I have found.

By Mr. MANSERGH: When we abstained from taking water from the Thames for ten days, we reduced the level of the water in the reservoirs by 10 feet.

By Professor DEWAR: We always filter at a constant rate. Irrespective of the quality of the water supplied to the filters, we filter at the same rate. But at all times the rate of filtration is very slow.

Replying to further questions, witness affirmed that his Company's water was of good and superior quality from one end of the year to the other; and this he thought was due to their storage capacity and their extensive filtration area. He had had no complaints during the last few years as to the quality of the water supplied—with regard to suspended matter or discoloration. For the future, they were experimenting to have infiltration water—that was underground water—the same as the Southwark and Vauxhall and Grand Junction Companies had had for some time past. The experiments were being conducted on the Company's land at Moulsey, 100 feet from the margin of the river, and above its level. There was pure spring water there; and he did not anticipate any difficulties in procuring it. He did not anticipate having to go through an extensive operation of puddling to keep out sewage. Pollution from sewage could scarcely take place.

The CHAIRMAN: You are, as I understand it, limited in water to 22,000,000 gallons a-day—that is, 20,000,000 gallons by the old agreement with the Corporation of the City of London and 2,000,000 gallons by the new agreement which you concluded with the Thames Conservancy Board. Do you contemplate counting the water taken from the gravel bed as in the 22,000,000 gallons, or in excess of it?

Witness: In excess of it.

It is practically water which would go into the Thames if you did not take it?—Some of it would; I cannot say the whole of it. I am proposing to take this to enable me to prolong the time of the intakes being closed. I am going to take that water during such periods as the ten days I spoke of. During that I shall collect 3,000,000 gallons a-day, and add it to the reservoirs of clear water.

Supposing your intakes are closed for a period—you have said the maximum has been ten days—supposing they are closed for five days, that would mean (their being closed) that you would lose the chance of taking five days' supply from the river. Do you count that as lost to you for ever, or do you make up the supply when you get the chance?—Well, I have done; I have certainly taken more than the requirements of the Company after a flood, on different days when the water is clear. In view of another flood following up, I have filled up quickly; and then at such times, I take more water.

The point I want to get at is, do you consider that in the course of the year you are allowed to take 365 times 22,000,000 gallons, or is your agreement—your statutory power—that each day, from twelve to twelve, must stand or fall by itself?—Yes, each day of 24 hours we are limited to 22,000,000 gallons.

You see the bearing of this is that, if your intakes were closed and you were drawing water from the gravel (not taking it in from the river), you might have said, if you chose, that the 3,000,000 gallons were really counted in the 22,000,000 gallons that you are entitled to take?—Well, looking at it in that way, it might.

But if such a thing were to happen, and you were to hand over, as suggested, a portion of your unused limit of 22,000,000 gallons, you do not consider that you would be precluded from helping yourselves to this underground water by the fact of using in any particular way the whole supply that you are entitled to take from the Thames?—That is my contention.

Mr. HILL: What is the extent of this gravel area?

Witness: I do not know the extent of it. The depth of it is between 6 and 8 feet, all overlaying the bed of clay down the Thames Valley.

Is any large portion of this gravel area covered with population?—No very large area.

As to this particular area at Mousley, what becomes of the drainage from the population of that area? Does it go into cesspools, or is it carried away by a drainage system?—Carried away by a system of drainage.

Do you know that of your own knowledge?—I understand it is so.

The CHAIRMAN inquired concerning the distance of the Company's intake from Chertsey.

Witness stated that it was about 8 or 10 miles.

Is that from the district of the Chertsey Rural Sanitary Authority?—I believe from any part of Chertsey there would be a distance of 7 miles.

The CHAIRMAN explained that the reason he inquired was because the Chertsey Rural Sanitary Authority had sent a letter in which, after stating what they were doing to carry out their duties under the Public Health Act, they said that, until the populous places of their district were provided with sewers, it was impracticable to prevent a certain amount of pollution, from the overflow of cesspools or slop water from cottages, finding its way into the Thames; and that there were also wasting cesspools, some of them sending down to the water-beds from which London Water Companies drew part of their supplies. He wished to know if there was anything in these statements which suggested to the witness a danger to the gravel-bed of which he had been speaking.

Witness thought what the Chertsey Sanitary Authority spoke of was too far distant from his Company's gravel-bed to affect it. He should think there was nothing from Chertsey which could affect them at Moulsey.

(To be Continued.)

The Continental Union Gas Company, Limited, state that an interim dividend of 5 per cent. for the past half year on the ordinary and $3\frac{1}{2}$ per cent. on the preference stocks will be payable on July 4, tax free.

The Proposed Purchase of the Taunton Electric Light Works by the Corporation.—The Taunton Electric Light Company last Thursday agreed to accept the offer of a Committee of the Town Council to purchase their works, subject to the approval of the Local Government Board and the Board of Trade, at the price of £9300.

THE ANNUAL REPORT OF THE CHIEF INSPECTOR UNDER THE ALKALI ACT.

The annual report to the Local Government Board of the Chief Inspector under the Alkali, &c., Works Regulation Act (Mr. A. E. Fletcher) was issued last week as a parliamentary paper; and, as in previous years, we extract therefrom the portions which have reference to matters with which our readers are most concerned.

The number of works registered under the Act does not vary much year by year; but last year it appears that it was less by 7 than in 1890. The alkali works proper are still in a decreasing minority as compared with other works which have been more recently brought under the Act. Of these there are 798, while of the former there are only 113. Counting with these the similar works in Scotland, brings up the total to 1048, of which 129 are alkali, and the remaining 919 other works. The treatment of ammoniacal liquor is carried on in the same number of works as in the preceding year—viz., 30; but there has been an increase of ten in the number of works carrying on the manufacture of sulphate and muriate of ammonia, the figures being 348 as against 338. During the year the Chief Inspector and his assistants paid 4793 visits to works, and made 4863 tests or partial analyses of the effluent gases. The Chief Inspector includes in his report a brief sketch of the prominent duties of Inspectors under the Act, and then he gives a table showing the average amount of acid gases escaping for each district. Referring to the column showing the acidity of chimneys (given as SO_3), which records an average of 0.700 grain per cubic foot, he says that the increase shown in the general acidity is doubtless in part due to the working of the Claus process in obtaining sulphur from sulphuretted hydrogen. In passing this gas, mixed with a limited quantity of air, through a layer of heated oxide of iron, the principal reaction which takes place is the oxidation of the hydrogen and the deposition of the sulphur. A secondary action, however, takes place simultaneously with this, reversing the primary action, whereby sulphur vapour with vapour of water forms sulphuretted hydrogen and sulphurous acid. The result is that a considerable quantity of these two gases passes away at the exit from the sulphur depositing chambers; and no efforts have yet been successful in completely effecting their mutual decomposition. Mr. Fletcher referred to this difficulty in his last annual report, and described some of the efforts that had been made to prevent the escape of these noxious gases into the air. As no decided success attended these efforts, he felt it his duty to insist that in any case the discharge into the atmosphere of sulphuretted hydrogen could not be permitted, even if recourse must be had to the unsatisfactory step of burning it. In so doing, an amount of sulphurous acid is generated, equivalent to the sulphuretted hydrogen burnt, and the result is the exchange of one most noxious gas for another less noxious—a process that can only be recommended as a makeshift until a better one is proposed. This method of dealing with these gases is at present in operation in all but two of the works; and the extra acid thus generated may account for the increased general acidity of the chimney gases. The problem of how economically to deal with the exit gases of the Claus sulphur kilns is, therefore, still unsolved; and the amount of sulphur lost is very large, reaching probably not less than 4000 tons a year.

The section of the report dealing with the manufacture of sulphate of ammonia opens with the following table, showing the amount produced in the United Kingdom during the past three years:—

	1891. Tons.	1890. Tons.	1889. Tons.
Gas-works	107,950	102,138	100,711
Iron-works	6,290	5,064	6,145
Shale-works	26,600	24,730	23,953
Coke and carbonizing works .	2,766	2,325	2,795
Total	143,606	134,257	133,604

Considerable interest, Mr. Fletcher remarks, attaches to the gradual advance in these figures, as they show an increase of skill and care applied to many manufacturing processes. Almost the whole of the ammonia is collected during the distillation of coal; a small quantity being obtained during the distillation of bones and other animal matter. The "ammonia water" of gas-works, once considered as an entirely waste product—material that would not burn, and that was too offensive to be thrown away—now yields the principal supply. The distillation of shale for the production of paraffin oil ranks next; and this is followed by the blast-furnace gases of iron-works. The waste gases from these used not long ago to flare like beacons, lighting up the "black country" of Staffordshire and other districts devoted to the smelting of iron from its ores. Now these gases are brought down and burnt under the steam-boilers which supply power to drive the blast-engines of the works, also to heat the air being driven through the tuyeres into the smelting-furnaces. In so doing great inconvenience was experienced from the tar and liquor, which tended to clog the pipes, so that a system of definite condensing and collection of these matters had to be arranged. It was then found that this tar and ammonia had considerable value, and warranted the erection of large plant to collect them more completely. Great expense was incurred to this end. In one of the Scotch iron-works as much as 18 miles of 3-inch iron condensing-pipes are in use, together with mechanical scrubbers for separating the tar and ammonia from the gas before it is burnt. In some of the more extensive iron-works as large a capital as £70,000 has been expended in the erection of apparatus for the collection and manipulation of the tar and ammonia. To such an extent has this been found profitable, that there are cases where more of the capital invested in an iron-smelting works is devoted to the collection and treatment of the tar and ammonia than to the production of the iron itself, and more profit is yielded by the former than by the latter; so that it may be said that a strange inversion has taken place, and that in some cases iron has become the bye-product of an iron-smelting works, yielding the place of main product to the ammonia, &c. The following figures which Mr. Fletcher gives bear out this statement: Taking Scotland first. The number of blast-furnaces at present at

work is 77. Of these, 57 are provided with condensing, scrubbing, and distilling apparatus for collecting the tar, ammonia, &c. He is informed that a blast-furnace of medium size costs, with its plant of blowing engines and the like, about £7800, and that the expenditure on the ammonia plant is in excess of this; so that in Scotland at present the apparatus for collecting the ammonia, tar, &c., from the gases of the iron blast-furnaces has cost over £444,600. A goodly sum, for collecting that which was formerly thrown away! And this must be on the increase, for if the outlay has proved remunerative when applied to 57 out of the 77 furnaces, one may expect the application to be still further extended. In England, the tar and ammonia are saved in only one of the iron-smelting works. It is there applied to the gas coming from three furnaces, at a cost of £12,000 per furnace, which is an expenditure greater than that incurred in Scotland. The resulting profit has fully justified the outlay. The sulphate of ammonia produced is probably quite sufficient to pay for interest on the capital expended, while the naphtha, oils, and pitch obtained from the tar bring up the profit account to a satisfactory figure. This process cannot be carried out with the blast-furnaces of the North-Eastern District of England, as in them coke is used. The tar and ammonia is driven off from the coal in the coke ovens, and must be collected from them if at all. In concluding this portion of the report, the Chief Inspector remarks: "It may be objected that, if the collection of ammonia were to be carried out much more extensively than at present, the price would decline, and the process become unprofitable. This fear will, however, vanish when it is remembered that the chief use for ammonia is agricultural. There is an unlimited demand for it as manure. In a previous report, I pointed to the fact that our farmers have as yet hardly realized its value to them in this respect, and that most of the sulphate of ammonia produced here is exported, much of it going to Germany. Regarded in this light, it will be seen that the demand for ammonia may gradually be very widely expanded, and any fall in price be at once checked by increased consumption."

In dealing with the tank waste of alkali works, Mr. Fletcher recalls to mind the description he gave in his report of 1888 of the Chance-Claus process then proposed as a practical method of dealing with this material, by which the sulphur was to be extracted and the residue left in a condition no longer liable to cause nuisance from the discharge of sulphuretted hydrogen into the air. It has now, he says, been largely applied, and has attained great commercial success with unusual rapidity. To say that the process is not perfect would be true, but ungenerous. It is the best hitherto proposed, and has already proved a great boon alike to the manufacturers and the public. Already 80,000 tons of sulphur have been extracted from the tank waste at a cost which leaves a profit to the manufacturer. The present rate of production is about 900 tons a week, and is fast increasing; the sulphur made being of the purest. This large production, he believes, has not brought down the price of sulphur—on the contrary, the price during the past year has been more than maintained; but the amount sent from Sicily has diminished. The recovered sulphur finds a ready market at home, and large quantities of it are exported to the United States and elsewhere. Mr. Fletcher also makes reference to the great combination formed in 1890 among nearly all the proprietors of alkali works, and says the anticipation that this consolidation would be fraught with benefit, from the point of view of an Inspector, has been fully borne out. Many of the smaller and less ably-managed works have been closed, the best managers have been promoted to the superintendence of a district, and the details of working, found beneficial in one place, have been carried out in others.

Passing over the reports upon other works which come under the cognizance of the Chief Inspector and his assistants, we notice that during the year there have been three cases in which a prosecution was instituted under the Act. Two of these were brought under section 11, on the ground of manufacturing operations having been carried on in works not previously registered as provided. In each case a penalty of £5 and costs was imposed. The remaining case was that of the Northwich Gas Company, for contravention of the provisions of section 9, in that sulphuretted hydrogen was allowed to escape into the air from the oxide purifier. A penalty of £10 and costs was imposed.

As the employees at some of the chemical works which come under the observation of the inspectors appeared to be protected from attacks of the influenza epidemic, Mr. Fletcher has collected a few statistics on the subject, as it appeared that useful information might in this way be afforded. It seems that very few of the cases recorded terminated fatally. Drawing a comparison between the men employed specially in connection with chemical work and those who were outside labourers or artisans, also those attending steam-boilers, he finds that the average proportion of cases among these latter classes is 16.35, while the average among the chemical workers is 9.08 per cent. The figures certainly show that chemical works are not centres of disease; but rather that they afford some protection from it to those employed there. This belief has for long been prevalent among the managers of chemical works. The manager of one gas-works writes: "I am sorry I cannot state the total number of men we have had down with the influenza, as no account has been kept. Neither of the men engaged at the sulphate of ammonia works has had it. Nearly every one of our outdoor men have been attacked; but the stokers in the retort-house have been singularly free, only one or two of them have had it. It seems to be most prevalent among those engaged out-of-doors in the fresh air." In a tabular statement which follows, it is shown that in gas-works employing collectively 3016 men, the total number of cases of influenza was 264; being at the rate of 8.75 per cent. Out of 590 men employed in sulphate of ammonia work, there were only 38 cases, or 6.44 per cent.; and of 1076 engaged in tar-works, only 56 were affected, or 5.20 per cent. The report concludes with these remarks: "The comparative immunity from attacks of influenza on the part of men employed in the manufacture of sulphate of ammonia has been noticed by many. In several works there was complete immunity. The average, as shown in the table, has been, however, brought up by one or two returns which tend to contradict this. In this manufacture there is liable to be a slight smell of sulphuretted hydrogen, and a peculiar odour arising from a substance present in the gas liquor. It would be interesting to know if this is the protecting agent. The

information here collected, as far as it goes, seems to show that men engaged in chemical manufactures are to some extent protected from attacks of influenza. Of these the men employed in alkali works, tar, gas, and sulphate of ammonia works appear to escape best. The inquiry is interesting, and might perhaps with advantage be extended to other branches of manufacture."

In an appendix to the report are given extracts from the reports furnished by District Inspectors. Some notice of these will be taken in a future issue.

MONTE VIDEO GAS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Tuesday, at the Cannon Street Hotel, E.C.—Mr. A. K. MACKINNON in the chair.

The SECRETARY (Mr. A. G. Hounsham) read the notice convening the meeting; and the report of the Directors and the statement of accounts (which were referred to in the JOURNAL last week) were taken as read.

The CHAIRMAN said that, when he had the honour of addressing the shareholders last year, and gave them a favourable report as to the position and prospects of the Company, coupled with the hope that the worst of the financial crisis in Uruguay had been seen, they little dreamt that in less than a couple of months after they would receive a severe awakening to disabuse their minds. It was not necessary to dwell at length on the subsequent events that took place, as they were familiar to the shareholders and others in this country. The facts that came to their knowledge would have prepared them to learn that the crisis in Uruguay was of a very acute character. As a consequence, strict retrenchment and economy became the order of the day, from the Government down to the poorest inhabitant—affecting materially the revenues of all companies and industries established there, their own Company suffering with the rest; and thus they were, unfortunately, unable to declare a higher dividend than 5 per cent. for the year. The shareholders had at previous meetings complained, and quite naturally so, at the smallness of a 6 per cent. dividend; and they might be disposed to ask why they should not now be paid an additional 1 per cent. (which, in fact, had been very nearly earned) out of the balance of £8027, which would be carried forward. To this he would reply that the Board, composed of prudent men, thought it desirable to have this balance in hand to deal with in case of contingencies; and he believed the shareholders would agree that in this matter the Directors had judged for the best in their interests. The number of public lamps now lit with gas exhibited an increase of 6.36 per cent. on 1890. This, while a hopeful sign, was coupled with a serious leakage of gas in the remainder of the lamps; for, at the request of the Municipality, they had to keep the connections intact. The Board trusted that this matter would have a favourable solution ere long. He might mention that, from data just to hand, they found, for the month of March of this year, the decrease in the consumption of gas, public and private, had been reduced to 8.44 per cent., which was an improvement. While on this topic, he could not resist uttering the hope that they might see their way, at no distant period, to make a reduction in the price of gas, to encourage a greater consumption, and meet the heavy competition of kerosene. At present, however, they were unable to foreshadow any proximate reduction, as they were handicapped by the heavy losses through non-payment by many consumers of their bills. Bearing on this subject, it was, he said, very gratifying to him to state that the Municipality for the past few years had been punctual with their payments. The Government departments had also for some time included the gas bill in their estimates; so that the Company obtained their payments with very fair regularity. Dealing with other interesting points, the Chairman said that up to the end of 1890, the Company had 85 miles of mains; and in 1891, they had been increased to close on 87 miles. The extensions had since been continued, as they would be in the future, so as to give the outlying districts the advantages of gas. Although the number of public lamps supplied with gas had increased during the present half year by 31, still they had only a total of 568 lamps. He was credibly informed that the public would be glad to see a return to the lighting of the remainder of the lamps by gas, for at present they were condemned to the light of incandescent glow lamps, which gave a light "small by degrees, and beautifully less;" whereas the illuminating power of the gas supplied averaged more than 17½-candle power. The matter of coal supply had been an anxious one. Thanks, however, to good management, last year there was a decrease in cost of 7s. 6d. per ton carbonized; and he believed this year they might look forward to doing as well. The value of the stock of coal at December, 1891 was £3085 less than in 1890. The reserve fund remained at £70,000; and the insurance fund, at £11,500. They had £30,000 invested in first-class securities (in India, Metropolitan, and Nottingham Corporation 3 per cents., in equal proportions); and the balance was used as floating capital. The Chairman next made a lengthy explanation regarding the item of Government bonds, in the accounts; and, continuing, mentioned that the stock of gas-fittings for 1891 showed a decrease over the previous year of £234; of materials for use, £3866; and of materials for repairs to ships, £507. The decrease in the dock revenue of £1865 was not satisfactory. They had had few vessels in the dock for repairs; but the great depression in trade in Monte Video had operated against them. They could have taken larger ships had the dock admitted them; and although the Directors had been advised to enlarge it, they hesitated at the present moment to incur a considerable expense for an uncertain return. As he stated at the previous meeting, since their Manager (Mr. Lane) had been at Monte Video, the expenses had been reduced. As to the works, he was happy to say that the new plant and buildings were all but completed. Besides the new gasholder (making four in all at the works, and capable of storing close upon 500,000 cubic feet), these consisted of a number of coal-stores roofed, new condensers, engine and house, two boilers, double exhausters, station-meter and house, water-tank, pump-room, and two large purifiers. They would have to spend some additional capital on new

works; but this outlay would be kept down until such time as the Directors saw a good prospect of an increase in the revenue to warrant it. Their Engineer (Mr. Anderson) had made changes in the retort-house, which would enable them to postpone the construction of a new one until such time as the increase of consumption would warrant the expenditure. With this return of prosperity, which he (the Chairman) trusted was not far distant, the shareholders might look forward to brighter prospects. He concluded by moving the adoption of the report and accounts.

Mr. MULVAM expressed the opinion that the report was not a satisfactory one. A dividend of only 5 per cent. was proposed; and the value of the shares had gone down 25 per cent. during the year. This, he thought, was not altogether owing to the financial crisis in Monte Video.

Mr. BARBER inquired whether anything had been done since the last meeting in the way of getting a deposit from the consumers, so as to prevent them running away without paying their gas accounts. The Company's great competitor appeared to be petroleum; and he was sure the consumers could not get three months' credit for that. They called themselves the Monte Video Gas Company; but it seemed to him they were also a dry dock company and a stock jobbing company. He believed they would find it far more to the interest of the undertaking if the Board curtailed some of these outside operations, and concentrated their attention on the original business of the Company; and then, instead of having a dividend of only 5 per cent., it would be nearer 8 or 10 per cent.

Mr. YOUNG remarked that he was not satisfied with the Directors' report, nor their recommendation that a dividend of 5 per cent. should be paid. He had been in the habit of regularly attending their meetings; but last year he did not do so, as the Chairman had, at the previous meeting, given the shareholders great hopes of better things. With a reserve fund of £70,000, and with stocks in hand representing altogether over £100,000, they were not earning what they ought to do. If they looked at other gas companies, they found they were paying respectable dividends. [Mr. R. MORTON: Those working on the River Plate, Sir?] He could not say that. But he held that reserve funds were for the purpose of equalizing dividends; and if they earned 6 per cent., especially in a time like the present, it certainly ought to go into the pockets of the shareholders. He should move as an amendment, that the report be received, and that the dividend for the year be at the rate of 6 per cent.

Mr. BYFIELD also expressed his dissatisfaction with the report and the dividend.

Mr. HUGHES asked if the Company were likely to get a renewal of the public lighting contract, and whether they would be opposed by the electric light.

Mr. MATTHEWS, in order to test the feeling of the shareholders, seconded the amendment. With their large reserve fund and investments, he could not see the object of only declaring a dividend of 5 per cent.; and he certainly thought the shareholders were entitled to the additional 1 per cent. Possibly, he added, the Company were in a better position to-day than ten years ago; but still the Chairman had stated in his remarks that, although the Municipality had not renewed the contract for public lighting, yet they compelled the Company to keep the mains charged with gas for the purpose, and this occasioned them great loss. What, he asked, could they expect in the future from a Municipality who treated them in this way?

The CHAIRMAN said, as had been truly remarked, the Board naturally knew more about the concern than the shareholders; and it was impossible for them to communicate every minute detail regarding the position of the Company. Their Company being a South American one, they had to deal with a condition of things which was wholly distinct to what ruled in England. Nearly the whole of his speech was intended for the other side. He wanted the Government to see that the Company were suffering from a wrong, in the hope that they would meet them, and remove it. As had been observed, they had really earned the extra 1 per cent.; and if it had not been for circumstances connected with the works, and that it was desirable to have an amount sufficient to meet their completion, without trenching on the reserve fund, the Directors would have paid the additional 1 per cent. dividend. One shareholder had expressed his opinion that they ought not to devote themselves to any other business but that of gas making. The reason they acquired the dock was that they might unload their coal expeditiously and economically; and, as it was considered a pity they could not utilize it in some other way, the shareholders agreed with the Directors to devote a small amount of capital to the purchase of machinery and for repairs, and this had since been earning very fair interest. The Company did not dabble in stocks. But "necessity has no law;" and as the Government owed them money, and were unable to pay, unless they took the bonds referred to, they would have fared very badly. However, he believed that in time the Company would not only get what they cost them, but something besides. As to the question of bad debts, they had succeeded in obtaining a deposit from some of the consumers; but they could not insist upon it in all cases.

Mr. ROBERT MORTON remarked that if the business had continued increasing in the way it was doing two-and-a-half years ago, the dividend, instead of being 5 per cent. on this occasion, would probably have been 10 per cent. But it had diminished to a large extent; and although they had curtailed the expenditure very considerably during the last two years, there were still some heavy expenses which must be maintained. While he did not find fault with the shareholders for wishing to get a higher dividend, and testing the feeling of the meeting as proposed, still he believed they would look at the matter in a fair way.

Mr. TATHAM said he thought it would be better if the question asked by Mr. Hughes in regard to the contract was put to the Chairman privately. Respecting the dividend, he pointed out that, although the Directors were proposing to carry £8027 to the current year's revenue account, they brought forward at the commencement of the past year £4034; and if they paid the suggested extra 1 per cent., they would only carry forward about £2000. Knowing the state of things in Monte Video, it was decidedly better to be prudent, and to make the dividend as secure as possible by keeping this £8027 in hand.

Mr. BARBER, after this explanation, appealed to Mr. Young to withdraw his amendment.

Mr. MATTHEWS, the seconder, said he should now withhold his support, as he had no doubt the collective wisdom of the Board was the best for the shareholders; and he should rely upon it.

Mr. YOUNG, after some further discussion, consented to withdraw the amendment; and the motion was then carried.

On the motion of the CHAIRMAN, seconded by Mr. SIMPSON ROSTRON, a dividend at the rate of 5 per cent. was declared.

The retiring Directors (Messrs. W. O. Dodgson and R. Morton) and the Auditors were next re-elected.

On the proposition of Mr. YOUNG, the usual complimentary vote was passed to the Chairman and Directors; and the proceedings then terminated.

GERMAN CONTINENTAL GAS COMPANY.

The Report and Accounts for 1891.

The following is an abstract translation of the report of the Directors of the above Company for the past year:—

The increase in the quantity of gas consumed from the thirteen stations of the Company amounted in 1891 to 1,850,092 cubic metres, or 5.53 per cent., as compared with 4.62 per cent. in the preceding year. As regards magnitude, this has only been surpassed in two years—1883 and 1884—when, on account of the cessation of certain contracts, an important lowering of the price of gas followed, and, as a result, there was an extraordinary augmentation in the consumption of gas. But in spite of this substantial increase, and although the lighting industry of the Company did not show any reason why the financial result should be less satisfactory than in the previous year, yet as regards the year just closed it can only be characterized as indifferent. In 1890, however, the low prices for coal ruling before the miners' strike continued until the middle of the year, and therefore the higher prices were only experienced during the second half; whereas throughout the whole of 1891 the Company's cost of production was burdened with excessively high rates for coal. A corresponding rise in the value of residual products could not be sustained, and even the preceding year's prices were not to be obtained; therefore a greater outlay for coal was confronted with smaller receipts for coke and tar. Moreover, the rouble exchange sank from an average of 235.5 in 1890 to 218 in 1891, which resulted in a considerable loss in the Warsaw undertakings of the Company. In addition to this, the repairs account at many large installations has been very heavy. On the other hand, neither the commercial aspect of the year 1891, which was generally bad, nor the continued extension of electric lighting in districts illuminated by the Company, has restrained the augmentation of the consumption of gas; and this is best demonstrated by the considerable increase in the number of new lights supplied during the last four years, amounting to an average of about 16,200 per annum. The Company have endeavoured, as far as possible, to meet this demand for fresh supplies of gas. *Inter alia*, the Directors have followed the example of the Paris Gas Company, and have laid on at the Company's expense service-pipes rising to the uppermost flats in both old and new houses, in order to supply sufficient gas for larger heating and cooking appliances and more extensive illumination, if required by their customers; the customers themselves having to pay the expenses incurred in making the connections from the rising pipe to their rooms. In Paris, this system has proved so successful in augmenting the consumption of gas and increasing the profits, that, up to Dec. 31, 1890, 30,230 of such conduits, gratuitously laid down, had been utilized by 110,496 paying consumers—a number which represents nearly half of the entire gas consumers of Paris. Moreover, the Directors instituted during the past year what are called "town inspectors," whose duty it is to look after the medium and smaller concerns of the Company; to test and improve the gas appliances (which are in many cases old-fashioned) in private dwellings; to introduce new burners and larger heating and cooking appliances; and to make known to the public the great progress of the gas industry during recent years. In order to assist the town inspectors in their duties, the Directors have had a small pamphlet prepared for their customers by one of the Engineers at the central office. In this is set forth in a popular manner the description of new apparatus, and the advantages of using gas for heating and cooking; supplying at the same time numerical examples derived from actual practice. This little pamphlet is distributed to the public.

In a previous report (March, 1890), the Directors drew attention to the progress made in the better utilization of gas, by the introduction of the regenerative lamps of Siemens and others, with which it was possible to obtain in large lamps double the illuminating power with the same quantity of gas previously required for the inferior illumination. After two years, they are now able to record a very important modification in the incandescent gas-burner of Dr. Auer von Welsbach, by which ordinary lights are improved to such an extent that, by using the newest refractory material, not only is the light effect of an ordinary flame increased fivefold without any greater consumption of gas, but also—a matter which is scarcely of less importance—with the newest burners the heat radiated is small. With gas at an average price of 16 pfennige, a light of 16 candles is obtained, with the latest type of Welsbach burner, at a cost of ½ pfennige (1-200th of a shilling) per jet per hour. In spite of this rapid progress in gas illumination, the Directors will also endeavour to supply the demand for electric light in the Company's districts by the erection of central stations in conjunction with their gas-works, but only when such demand appears likely to be permanent. The new gas-engines of 120-horse power installed at the Dessau central station last October, have proved a success.* The gas industry, therefore, is in a position, on the one hand, by operating conjointly with electricity, to permit of the latter being rationally supplied with the smallest expenditure for establishment and management; or, on the other hand, to successfully continue its competition with other modes of lighting, as is evident from the recent improvements.

* A full account of this installation was published in the JOURNAL on Jan. 5 and 12 last (pp. 21, 67).

The business records of the Company for 1891 show that the total production of gas—amounting to 35,298,364 cubic metres, with 337,586 lights—was distributed among their several stations in the manner indicated in the following table:—

Station.	Production in Cubic Metres.	Production compared with 1890.	Number of Lights.	Number of Lights compared with 1890.
Frankfort-on-the-Oder	1,936,220	+ 129,580	19,315	+ 334
Potsdam-Neuendorf	2,802,710	+ 325,978	28,598	+ 2,118
Dessau	1,744,810	+ 171,800	21,191	+ 1,579
Luckenwalde	773,216	+ 12,601	9,017	+ 414
M. Gladbach-Rheydt-Odenkirchen .	4,829,690	+ 158,330	62,512	+ 2,765
Hagen-Herdecke-Haspe	863,640	— 165,670	9,258	— 319
Warschau-Praga	14,638,600	+ 749,080	111,760	+ 4,364
Erfurt	3,151,040	+ 369,586	25,926	+ 1,443
Nordhausen	1,018,982	+ 68,635	13,470	+ 700
Lemberg	1,231,910	+ 130,530	12,713	+ 1,757
Gotha	1,152,586	+ 107,892	15,326	+ 1,488
Ruhrort	936,680	— 213,220	7,991	+ 327
Herbesthal	218,280	+ 4,970	599	—
Total	35,298,364	+ 1,850,092	337,586	+ 16,970

The total gas consumption is accounted for in the following table:—

Purpose.	Cubic Metres.	Compared with 1890.	Percentage of Total Production.
Street lighting	6,217,679	+ 280,455	17.62
Public buildings	2,675,675	+ 178,924	7.58
Private consumption	12,972,383	+ 810,668	36.75
Consumed in factories	7,385,762	— 462,315	20.92
For heating	1,653,745	+ 292,400	4.69
For power	2,091,012	+ 250,629	5.92
Consumed by the Company	337,575	+ 27,647	1.01
Loss	1,944,593	+ 471,684	5.51
Total	35,298,364	+ 1,850,092	100.00

The length of mains amounted to 672,070 metres, as compared with 644,142 metres in the previous year. The average consumption of gas per burner for the past year was: For private lights, 85 cubic metres; for street lights, 455.3 cubic metres—average for all lights, 100.4 cubic metres. The numbers for 1890 were, respectively, 86, 448.6, and 101.4 cubic metres. The consumption for motive power of 2,091,012 cubic metres of gas was distributed among 527 engines, with 2179½-horse power. During the past year, the calculations and tests for the internal working of the Company were made by weight; and consequently the following numbers relate to kilogrammes only, and not, as heretofore, to hectolitres as well as kilogrammes. The average price of gas coal (Westphalian, English, Silesian, &c.) was 2.11 marks per 100 kilos., as compared with 2.06 marks during the preceding year. The yield of gas was 28.9 cubic metres per 100 kilos. The firing of the retorts consumed, on an average, 16.21 kilos. of coke and tar per 100 kilos. of coal carbonized. This is somewhat higher than the figures (15.39 kilos.) for the previous year, and is due to the use of new factors for the conversion of mass into weight, and the introduction of duplicate weighings—one in the store, and the other in the retort-house. Hence the difference arises from more careful supervision. The price of coke fell from an average of 2.33 to 2.23 marks per 100 kilos.; that of tar, from an average of 5.46 to 5.01 marks per 100 kilos. The price of ammonia continued to weaken, on account of the competition alluded to in the previous report; nevertheless, during the past year there was a slightly higher yield than in the previous year, owing to improvements introduced in the methods of working.

Turning to the statistics relating to the different stations of the Company, there was an increase in the quantity of gas produced, varying from 749,080 to 12,601 cubic metres, and in the number of lights, of from 4364 to 334, in all the stations except Herbesthal, Ruhrort, and Hagen-Herdecke-Haspe. At the last station there was a falling off of 165,670 cubic metres, or 16.09 per cent., in the production, and of 319, or 3.34 per cent., in the number of lights, due to the authorities of the Hagen Railway Station adopting electric lighting, and to their transferring to the municipal gas-works what gas business they still retained. The acquisition of new consumers at this station continued during the year; and it promises the best prospects in the near future. The retrogression at Ruhrort amounts to 213,220 cubic metres, or 18.54 per cent., in production; but there is an increase of 327, or 4.27 per cent., in the number of lights. The diminution is attributable to the Phoenix Smelting Works, the Company's largest consumer, introducing electric lighting. A prolongation of the arrangement with the town to December, 1914, gives a more certain prospect of recouping some of the deficit, by increasing the quantity of gas distributed to small consumers. At Herbesthal the production increased by 4970 cubic metres, or 2.33 per cent.; but the number of lights remained stationary at 599—a result to be anticipated, after the great increase in the previous year. At Frankfort-on-the-Oder the reconstruction of the entire system of purification taxed the capacity of the old plant to the greatest possible extent, and entailed an expenditure of 5700 marks from the renewal fund. The Potsdam-Neuendorf stations showed the greatest increase in gas consumption—325,978 cubic metres—that has been registered since its erection. In fact, the chief station in Potsdam has been completely overhauled and equipped up to the maximum capacity of the land. In order to gain space in a works situated at one extremity of the town, to facilitate the management, and more especially to aid the supervision and furnishing of installations, and to render intercourse with the Company's clients more convenient, the offices, installations, works, and the Manager's house are to be removed to a newly-purchased piece of land in the best part of the town. New contracts and prolongations of contracts lasting until 1920 were concluded in the outlying districts, Glienicke, Neuendorf, and Nowawes, which ensure for the future an extensive and developing market in the immediate vicinity of the two stations in Potsdam and Neuendorf. At Warschau-Praga, in spite of continued agricultural depression, an increase of 749,080 cubic metres in the gas consumption has been recorded, owing to the great activity of the management, and more especially to the

newly-organized town inspectorships at Dessau, the business continued to prosper. The electrical central station, as already remarked, had undergone reconstruction, and further economies had resulted from continued improvements, so that in the past year an average of 730 litres of gas was consumed per horse power, as compared with 750 litres in the previous year; consequently, although the electrical supply had increased by 482 ampère-hours, the quantity of gas burnt in the engines diminished by upwards of 8½ per cent. To run a glow lamp of 16 candles, including all accessories, required only a consumption of 91·38 litres of gas per hour by the engine, as compared with 100·52 litres in the preceding year. The working results for the year showed an increase of 482 ampère-hours in the production, 93 additional glow lamps, and an increment of 132 in the total lights reduced to 16-candle power. The number of arc lights remained unaltered at 59. The financial result was about the same as in the previous year; therefore debts and interest were covered. A better result can only be hoped for when the private consumption increases so as to equalize, to a certain extent, the exceptionally short periods during which the chief consumers (the Ducal Palace, the Court Theatre, and the Hereditary Prince's Palace) employ the light. Whatever the present result, the future advantage to be derived by the Company from this installation is regarded as good, inasmuch as by it they have shown the practicability of establishing electric light stations in medium-sized towns, under circumstances quite different from those obtaining in the numerous other systems of electric lighting. The central workshops will, in the Directors' opinion, develop into a big undertaking. The sale of apparatus continues to extend; and last year a large number of new and improved appliances were announced in a new catalogue, which can at once be turned to good account, not only in the Company's own stations, but also throughout the gas world. The building account of all the stations (gas-works, electrical central stations, and central workshops) was increased last year by 1,109,504·42 marks.

The profit and loss account of the Company for the past year shows a gross profit of 2,359,037·54 marks, or 197,544·88 marks less than in the previous year. A result of this character having been anticipated, a "compensation fund" of 200,000 marks was established in 1890, in order to allow for extreme variations in the prices of coal and residual products, more especially as higher rates for coal and losses on exchange might obtain simultaneously. This, in fact, happened during last year. The increase in the expenditure for coal, solely on account of higher prices, was 36,676·21 marks, while the reduction in the receipts for residual products amounted to 22,087·61 marks; and a loss is recorded through the fall in the rouble exchange, which brings the receipts 73,591·42 marks below the amount of the preceding year. In spite of this, the Directors, under the present circumstances, do not intend to draw on the "compensation fund," but to leave it at its present amount of 200,000 marks. They moreover intend to add 10 per cent. to the special reserve fund, but to reduce the renewal fund from 75,000 to 60,000 marks, as so much reconstruction and building has been done that it is not expected any beyond what the present reserve can cover will be carried out for some time. On this basis there would be carried over to the reserves: Special reserve fund, 184,279·14 marks; renewal fund, 60,000 marks—total, 244,279·14 marks. The total reserves (exclusive of the Lemberg sinking fund of 660,238·10 marks) would be: Reserve fund account, 1,500,000 marks; special reserve fund account, 900,879·35 marks; renewal account, 316,439·05 marks; compensation fund account, 200,000 marks; insurance account, 160,316·73 marks—total, 3,077,635·13 marks. Deducting the amounts stated from the net profit, the Directors proposed paying a dividend of 10 per cent. out of the balance, and carrying over 7056·57 marks to the new account.

The increase in the gas production during the month of January of the current year, as compared with the same month last year, amounts to 2·65 per cent., against 4·05 per cent. in 1890. The increase in the number of lamps, however, is 1387, against 631 in January, 1890.

In concluding their report, the Directors point out the need of more capital to carry on the ever-extending business of the Company, and to render possible the undertaking of any necessary enlargements, as well as the development of electric lighting. A resolution was therefore submitted to the general meeting, to the effect that the Directors should be empowered to issue bonds to the amount of 5,000,000 marks, and to arrange the terms and nature of the security, interest, and redemption thereof.

The Finances of the Stoke-upon-Trent Gas Department.—In the JOURNAL last week, we briefly recorded a further discussion in the Stoke-upon-Trent Town Council on the question of the accounts of the Gas Department. It will be remembered that Messrs. Alfred Lass, Wood, and Co., made a report on the subject, the accuracy of which was impugned by Mr. Sant, who stated the points on which he disagreed with it—one of them relating to the sinking fund. Since the meeting referred to, Messrs. Lass, Wood, and Co., have written a letter (which, we understand, was submitted at a meeting of the Council last Thursday) in which they say that the figures in their report with reference to the sinking fund are perfectly correct. They are based upon the figures settled by the Board of Trade in the Stoke Provisional Order, 1888; and, as fully explained when they had the pleasure of meeting the Committee, the Town Clerk, and the Engineer (Mr. H. Taplay), they could not go behind that Order. The figures in Mr. Sant's table differ from those in the Provisional Order to the extent of £1600, which constitutes the whole difference between Mr. Sant's figures and Messrs. Lass and Co.'s. It will also be observed, they remark, that credit was given by them to the sinking fund for the full amount of the repayments shown in the published accounts of the Committee for the year ended March 31, 1891—viz., £4217 13s. 6d. They had not the books to refer to at the time of writing; but, as far as their memory served them, they believed it would be found that the £1600 was paid off very shortly after it had been borrowed; and the Board of Trade no doubt took this into consideration when they settled the figure given in the Provisional Order as £41,900, instead of Mr. Sant's figure of £43,500. If it is desired that the £41,900 mentioned in the Provisional Order of 1888 should be altered for the purpose of making it agree with Mr. Sant's table, it appears to Messrs. Lass and Co. that application will have to be made for another Order.

THE KIRKLEATHAM WATER-MAINS ARBITRATION.

The brief paragraph, with the above heading, in our issue of the 24th ult., p. 982, is likely to be misunderstood, it has been pointed out to us, unless an explanation of the matter is given. The Arbitrator (Mr. Henry Law) has certainly restated his award, and given the method he adopted in framing it; stating that, in his view, his basis was "the correct one," "having regard to the whole scheme of the Act of 1876." He, however, gives an "alternative" award to be used if the Court should be of opinion that he was wrong in his original method.

To make the matter absolutely clear, we quote the re-statement of Mr. Law's award, which was in the following words: At the hearing of the reference, two rival contentions were put before me as to the principle upon which the price of the "mains, pipes, and fittings" under the Act ought to be ascertained. It was contended, on behalf of the Kirkleatham Local Board, that the basis of calculation should be merely the value of the mains, pipes, and fittings regarded as plant *in situ* capable of earning a profit; and this value they arrived at by taking the cost of the mains, pipes, and fittings, of laying them down and making good the ground, and deducting a sum for depreciation. They further contended that I had no jurisdiction to take into consideration at all the present or prospective earnings of the mains, pipes, or fittings. On the other hand, it was contended, on behalf of the Joint Board, that the price must be ascertained by reference to the value of that which was parted with; but that that value must be taken as the value to the seller, and not the value to the buyer, and that as the sale of the mains, pipes, and fittings in question was coupled with an obligation on the part of the Joint Board to cease to supply water within the Kirkleatham district, what the Joint Board were really parting with was their power of earning revenue by the supply of water through the mains, pipes, and fittings in question in the Kirkleatham district, and that at all events, the value to them of the mains, pipes, and fittings in question was to be measured, not by the cost of providing them and laying them down or by their mere value as plant *in situ*, but by the revenue which the Joint Board was enabled to earn by their means. Having regard to the whole scheme of the Act of 1876, it seemed to me that the contention of the Joint Board was the correct one; and I, therefore, adopted the following basis in arriving at my award: I capitalized the average net revenue earned by the Joint Board in the Kirkleatham district for the seven years ending the 13th of August, 1891, made all proper deductions for working expenses, maintenance, rates, &c., and further deducted the Kirkleatham district's proportion of the revenue earning part of the Stockton and Middlesbrough water undertaking in 1891, less certain deductions; and the result was the figure which I previously awarded—viz., £25,424. In arriving at this sum, I did not take into consideration, nor does such sum include, any amount in respect of any prospective increase in the revenue earned by the Joint Board in the Kirkleatham District. If the Court should be of opinion that I was wrong in adopting the basis of calculation aforesaid, and that the basis contended for by the Kirkleatham Local Board should have been adopted, then I award, in the alternative, that the price of the mains, pipes, and fittings, calculated upon such basis, is the price or sum of £8006.

As reported in our "Legal Intelligence" to-day, the Queen's Bench Divisional Court has held that Mr. Law's original award was wrong, and adopts his latter amount of £8006 as the value to be paid by Kirkleatham.

THE REGULATION OF WATER COMPANIES' POWERS.

In our "Parliamentary Intelligence" to-day, we report further proceedings on the above-named Bill, which has been somewhat modified since its introduction. In its original shape, it consisted of a preamble and 14 clauses, whereas now there are 17 clauses. The following is an epitome of the Bill as finally amended:—

The preamble sets forth that it is expedient to amend the Water-Works Clauses Act, 1847. By clause 1, the title of the amending Act is to be The Water Companies (Regulation of Powers) Act, 1892; and clause 2 specifies that it is not to apply to Scotland or Ireland. Clause 3 gives a definition of a water company. Clause 4 provides that companies are to serve on consumers a demand-note for water-rate, giving particulars in regard to their claim. It is to set forth the rental, annual value, or other basis at or upon which the premises in respect whereof the claim is made are assessed, as well as the scale, percentage, or prescribed sum claimed; and the company are not, until the service of the note, to enforce payment of the water-rate. Clause 5 specifies that every demand-note, except when the water is supplied solely under agreement or by meter, is to have printed upon it a statement informing the person liable to the payment of the water-rate that unless he shall give to the company, within 14 days from the day of service, notice objecting to the amount claimed, he will be held to have admitted his liability to pay it. According to clause 6, the times at which the demand-note shall contain or be accompanied by the statement of particulars already referred to shall be as follows: (1) Where the annual sum on which the premises supplied are chargeable for the purposes of water-rate exceeds £20, quarterly when payment of the rate is claimed quarterly, and half yearly when it is claimed half yearly. (2) Where the annual sum does not exceed £20, once within three months after the commencement of the Act, when the person liable to the payment of the rate shall first become entitled to a supply, and when any alteration shall be made in the last previously given statement of particulars. (3) Where the rate is for water supplied under agreement or by meter, at any time after the company shall be entitled to require payment thereof. By clause 7, where the annual sum on which the premises served are chargeable for water-rate does not exceed £20, every demand-note which shall not contain or be accompanied by particulars, shall have printed on the face of it the following words: "The particulars of the amount hereby required to be paid will be again furnished on application in writing being made at the office of

the company by or on behalf of the person liable to pay the same." By clauses 8 and 9 notice is to be given to the company if fresh particulars are required on any change of person liable; and objections to the demand-note are to be made within 14 days. The notice is to specify the items and particulars in question, and the grounds on which they are objected to. Where no notice of objection has been given, the amount claimed shall, for the purposes of the Act, be deemed to be admitted. Clause 10 specifies that no occupier indebted to a water company in any amount due shall, until he has paid it, be entitled to demand from the company a supply of water for any other premises. According to clause 11, where the occupier is liable to the payment of the water-rate in respect of any premises, no water company shall cut off the supply for non-payment of any amount in dispute until it has been settled by a Court of Summary Jurisdiction in the district in which the premises are situated, nor for non-payment of any rate until the expiration of 14 days after notice in writing has been given by the company to the occupier of their intention to cut off the supply. No notice is to be given by them until the expiration of 14 days from the service of the demand-note for the non-payment whereof the supply is to be cut off. When any notice has been given, the occupier may, before the expiration of 14 days after service, apply to a Court of Summary Jurisdiction; and the Court may require the company to postpone the cutting off of the supply for such time and on such terms and conditions as may seem fit. It is provided, however, that the application shall not be based on an objection taken to, or to the payment of any admitted amount, or any amount decided to be due. If, within 14 days from the service of the notice, the amount shall not have been paid, and if such application for delay shall not have been made by the occupier, or if made shall have been refused, the company may cut off the supply in any case in which the occupier is liable to the payment of the water-rate. Clause 12 gives a water company power of entry in certain cases; and clause 13 specifies that they are to be liable to a penalty not exceeding £5 per day on cutting off a supply in contravention of the Act. By clause 14, notice is to be given to the Sanitary Authority of the supply being cut off; and any company failing in this respect are to be liable to a fine not exceeding £10; and the Sanitary Authority are to take proceedings. By clause 15, the powers of the Court of Summary Jurisdiction are defined. Clause 16 specifies that the Act is not (except as regards certain of its clauses) to apply where water is used solely for trade, business, or manufacture, or for ornamental purposes, nor where it is supplied partly for trade, business, or manufacture, or for ornamental purposes, and partly for domestic purposes, if the amount of the water-rate stated in the demand-note in respect of the supply for domestic uses is less than that of the water-rate so stated for the other purposes, or any of them. The date for the commencement of the Act is fixed by clause 17 at Dec. 25, 1892.

A Town thrown into Darkness.—About 9 p.m. on Saturday, the 28th ult., the gasholder at the works of the Market Rasen New Lighting Company failed to act, and without any warning all the shops were thrown into darkness. In most instances the tradesmen were compelled to resort to the use of candles. The supply was resumed early the following morning.

The Extensions at the Leeds Gas-Works.—In moving the confirmation of the proceedings of the Gas Committee at the meeting of the Leeds County Council last Wednesday, Alderman Gilston pointed out that they had accepted a tender from Messrs. W. Nicholson and Son for the erection of an exhaustor and boiler house and chimney at the Meadow Lane works, for £1715; and also a tender from Messrs. Clayton, Son, and Co., for the erection of a gasholder near the works, with a capacity of 5,250,000 cubic feet, for £34,790. The highest tender, he added, was £61,000. The minutes were approved.

Horton's Estate, Limited, is the title of a Company registered with a capital of £500,000 in £100 shares, to adopt an agreement come to between members of the Horton family of Birmingham, Finbury, and Malden. The objects of the Company are very various. Among others, to deal in house, land, or other property, and in freehold and leasehold ground rents; to make advances thereon; to act as builders and contractors; to establish and maintain water-works, gas-works, hotels, and places of amusement; to trade as brick makers, timber merchants, carriers, &c., also as stock and share dealers, company promoters, and carry on the general business of a financial agency.

Staffordshire Potteries Water-Works Company.—The annual meeting of this Company was held at Hanley last Wednesday week. The Directors reported an increased rental of £503. The balance for the year, with the addition of £2264 brought forward from the previous accounts, made a total of £19,029, from which, after deducting the interim dividend of 3 per cent. paid in December, there remained a balance of £10,629. Out of this, they recommended a dividend of 3 per cent. for the half year ended March 25 last, free of income-tax; making, with the interim dividend, 6 per cent. for the year, and leaving a balance of £2229 to be carried forward to next year's account. The new works at Hatton were approaching completion, and the permanent engine was now delivering water into the Hanchurch reservoir for distribution to the district; and the supply obtained from that source, together with that from the existing works, would enable the Company to meet all demands for some considerable time. In moving the adoption of the report, the Chairman (Mr. J. F. Wileman) congratulated the shareholders upon possessing a sound and prosperous undertaking. This year, he said, they were paying £329 in interest on debentures and £2100 on new stock more than was paid three years ago; and they were doing this without materially reducing the credit balance. Their revenue advanced steadily; last year's increase being £503. It was true they would have to provide more dividends on the new stock which they lately sold so satisfactorily at a premium of 53 per cent.; but they did not anticipate any great difficulty in meeting this increased demand. With this last issue of new stock, the Directors hoped and believed that they had touched the bottom with regard to expenditure upon new works. The motion was carried; and it was also resolved that the remuneration of the twelve Directors be increased from £500 to £750 a year.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

A meeting of the Edinburgh and Leith Gas Commission was held on Monday last, at which the business was not of surpassing interest. The Engineers presented reports, which showed that by the agreements which have been effected with the Railway Companies, concerning the rates to be charged for the carriage of goods to and from the works, a saving of £3721 a year has been effected, as compared with the maximum charges which were proposed by the Companies. As the Railway Companies have not, however, been in the habit of charging maximum rates, and it is improbable they will do so in future, the saving will be greater than is represented by the above-named sum. The principal item of business before the Commissioners was the report upon the gas supply by the Edinburgh Merchants' Association, which was submitted by the Secretary of the Association in a courteous letter, backed up, however, with a rather forcibly expressed hope that the Commissioners would be able to adopt the suggestions made. The Lord Provost welcomed the report, as showing that an influential body of citizens were interesting themselves in their doings; and he expressed his belief that the illuminating power of the gas they supplied was ridiculously high. It was not suitable for use as a motive power. If they were to make a change now, they would feel that they had support in the community; but before doing so, they would require investigation as to how they would be situated with respect to their works, their pipes, and the burners in use. He thought they should ask their men of skill to report to them upon these matters. Mr. Kinloch Anderson, in moving that the report be sent to the Works Committee, expressed the opinion that if they reduced the illuminating power of the gas, they might have the consumption increased by 50 per cent.; and he doubted whether the consumers' bills would be any lower. Bailie Archibald pointed out, with reference to the complaint in the report that coal-owners made too large a profit upon the coal they supplied to the Commissioners under yearly contracts, that the Commissioners in the first year of their existence, realized a profit of from £15,000 to £20,000 by coal being cheap, and said that they must naturally take the bad years with the good in that matter. He suggested that they might make an experiment in the autumn with a lower quality of gas, to see how the public would take to it. Several other speakers approved of the proposal to lower the illuminating power of the gas. Mr. Wells recalled the fact that two years ago he proposed a reduction in the illuminating power; but that he was then opposed by gentlemen who were now in favour of it. The Lord Provost, who spoke very sensibly on the whole subject, deprecated any change being made without the public getting due warning, so that consumers might provide themselves with suitable burners, or any experiments being made which would put the public to expense. The report was sent to the Works Committee, who are to report upon it.

During the past year there has been a decreased output of gas from the works of the Edinburgh and Leith Corporation Gas Commissioners of 16,206,000 cubic feet. The Edinburgh works produced 997,803,000 cubic feet, an increase of 23,366,000 cubic feet as compared with the previous year; and the Leith works produced 369,915,000 cubic feet, a decrease of 39,572,000 cubic feet. The total was 1,367,718,000 cubic feet, as compared with 1,383,924,000 cubic feet in the previous year. That there is an increase in the one case and a decrease in the other is explained, not by any falling off in the consumption in any particular district, but by alterations in the areas attached to the different works, the full districting arrangements not having yet come into force. The figures are not strictly accurate, in respect that they are those for the year from May 1 to April 30 inclusive, whereas the financial year of the Commission is from May 15 to May 15; but the Commissioners themselves publish no other record of their output than the monthly returns of the Engineers, and therefore, taking the same period for each year, the figures given approach as near to accuracy as any that can be obtained. The decreased output of the past year is accounted for on two grounds. In the year previous, the gas was for a long time of lower illuminating power, and more of it was used; and last year the price of it was advanced by 9d. per 1000 cubic feet. But even with the decrease of 16 millions, the position of the Commission compares very favourably with what it was two years ago; because a year ago it was reported that there had been an increase in the output of 144 million cubic feet, and consequently the output for the year just closed was better by 128 million cubic feet than that of the year before last. These figures only deal with the output. The quantity of gas sold is another matter. The unaccounted-for gas reported a year ago amounted to 155 million cubic feet; and the revenue from gas was £229,807. If the past year were to work out the same way, the revenue from gas should be £234,000. But there is no use anticipating, as the correct sum realized will be published soon; and the balance will depend more upon the expenditure than upon the revenue.

The Corporation of Glasgow, in the development of their electric lighting installation, have sanctioned contracts for electrical insulators, electrical storage batteries, copper strip for electrical conductors, and insulated cables, at a cost estimated at between £11,000 and £12,000. They have also agreed to pay £9103 for a plot of ground at the corner of Waterloo and Main Streets, as a site for their projected electric lighting station. This is not a particularly suitable site, there being few public buildings in the immediate neighbourhood; but I presume it was the best the Corporation could do unless they were prepared to go much further in price. They can scarcely look for doing much business within 500 or 600 yards of the station; and even the thoroughfares they propose to light do not, at any point, come much nearer to it than that. The Corporation have taken over the private adventure of a firm of electric lighting purveyors in the city, at considerable cost; but they do not seem to be going to have the supply all in their own hands. A Kelvin-side Electric Lighting Company has sprung into existence, which must be proposing to do business within the Corporation area. The Electric Lighting Committee of the Corporation had before them the other day a letter from the Board of Trade, asking if they had any observations to offer with regard to the financial position of the Company; and the Town Council on Thursday authorized the

Committee to reply that they had no observations to make. The Company is probably started with the intention of squeezing the Corporation into a purchase; but the tenor of their reply would seem to indicate that the Corporation consider they have been sufficiently squeezed already, and that, so long as they hold their own in the centre of the city, they are regardless as to who may prospect the outlying districts. Being an electric lighting venture, there is probably wisdom in this resolution, because the suburbs cannot be expected to make electric lighting a profitable speculation; but it shows one of the weaknesses of a system of lighting, which is not able to cover its whole area, but is obliged to allow others to obtain a footing in it.

The Dundee Gas Commissioners may be said to have this week launched their electric lighting adventure. They met yesterday to consider the offers by contractors to do the work in connection with the installation; and they accepted tenders to the amount of £3112 for the erection of the buildings of the station, and to the amount of £17,330 for the lighting plant. The original estimate of the Committee was from £15,000 to £20,000; so that it has not been very much exceeded. The Commissioners agreed that each department of the work should be given to a different firm. Surely this was an unwise resolution; because, if they had had only one contractor, they could then have held him responsible if any cause for dissatisfaction had arisen. Except for the erection of the buildings, none of the contractors are local firms.

An action against the Dundee Gas Commissioners has been originated in the Court of Session this week, to recover £180, as compensation for damage inflicted upon property by the gas explosion in the Lochee district in January last. The owner of the property says the explosion was caused by one of the Commissioners' workmen, who had been searching for the source of a leakage of gas, entering a dwelling-house with a lamp, and that the leakage was from the Commissioners' main in the thoroughfare, and arose from the fracture of an old and worn-out pipe. The Commissioners' reply is that their workman carried a safety-lamp, and that the explosion was caused by an inmate of the house raking out a fire; and also that they took every means to keep their mains in order, and that if a fracture had occurred, it was owing to the frost.

The hiring-out of gas-cooking appliances by the Corporation, is a flourishing business in Glasgow. In summer there are whole streets where there is scarcely a house in which gas is not used for cooking, in preference to coal. In April, 93 gas-stoves and 141 kitchen-range fittings for burning gas were sent out to consumers by the Gas Department; and at the end of the month between 10,000 and 11,000 such appliances, all the property of the Corporation, were in use. Besides these there are many owned by the occupiers of houses.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, June 4.

Sulphate of Ammonia.—The market keeps quiet, but may, on the whole, be said to be a shade steadier. This may be due to the reduced quantities offering, and to less pressure to sell, no doubt in consequence of the approaching holidays and the closing of many works during Whit week. While the influence of nitrate is constantly being put forward, as affecting the sulphate market, it is interesting to note the relative figures at the end of May during the past ten years:—

	1883.	1884.	1885.	1886.	1887.
Sulphate	£17 10 0	£14 2 6	£11 7 6	£11 0 0	£11 10 0
Nitrate	11 0 0	9 7 6	9 10 0	9 0 0	10 0 0
	1888.	1889.	1890.	1891.	1892.
Sulphate	£11 15 0	£12 0 0	£11 3 9	£11 0 0	£9 17 6
Nitrate	9 7 6	8 7 6	8 0 0	8 12 6	8 0 0

The quotations for sulphate are about the same as last week. Nitrate is a little easier again—viz., 7s. 10½d. per cwt.

LONDON, June 4.

Tar Products.—Buyers of benzol are still shy of the higher prices asked by distillers, though business to a small extent has been done at 1s. 8½d.; but 1s. 10d. is being asked by large makers. Fifties do not participate in the advance, and are distinctly neglected; no more than 1s. 4½d. being obtained. Curiously, solvent naphtha is in good demand, and worth nearly as much as 50's benzol. The manufacture of saccharine from toluol has not improved the value of the latter, as, by itself, it is quiet at a less price than solvent naphtha. Anthracene is still somewhat difficult of sale, although it is reported that a stock of "A" quality has realized 10½d. For "B" makes, there seem to be no buyers at the moment. There is more inquiry for naphthalene; and carbolic products are in distinctly better form. Business has been done at: Tar, 10s. to 12s. Pitch, 27s. to 29s. Benzol, 90's, 1s. 8½d.; 50's, 1s. 4½d. Toluol, 1s. 2½d. Solvent naphtha, 1s. 3d. Crude benzol naphtha, 30 per cent., 8d. Creosote, 1d. Naphthalene salts, 20s.; pressed, 45s. Carbolic acid, crude, 60's, 1s. 1d.; 70's, 1s. 4d.; crystals, 5d. Cresol, 8d. Anthracene, 30 per cent., "A" quality, 10½d.; "B" quality, 7½d.

Sulphate of Ammonia.—Business has fallen off during the past week; and the little spurt, from which it was hoped better prices would begin, has disappeared, leaving the market distinctly quiet. Sales have been reported at prices varying from £9 15s. to £9 16s. 9d., less 3½ per cent.; but the former figure is the outside value to-day. Gas liquor (10-oz.) is quoted at 5s. to 6s. 6d.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Although the month has opened without any actually announced reduction in list rates, the demand for all descriptions of round coal is extremely slow, and the tendency of prices decidedly in favour of buyers. Except in the Manchester district, where the pits are working five days, which is practically full time, it is exceptional where collieries are running more than about nine days to the fortnight; and although this restricted output

checks any large accumulations of stocks on the pit banks, considerable quantities accumulate under load in waggons, and to clear these sales are frequently pushed at very moderate figures. The better qualities of round coal, suitable for house-fire purposes, are for the most part fairly well maintaining their price; and still average 12s. for best Wigan Arley, 10s. to 10s. 6d. for Pemberton four feet and second qualities of Arley, and 8s. 6d. to 9s. for common house-fire coals. Common round coals are, however, becoming more and more difficult to move; and both for inland requirements and for shipment, are in exceedingly poor demand. Supplies are plentiful, and to move away quantities special quotations are made; whilst to meet competition for business, concessions upon list rates have frequently to be made, to keep customers together. On inland sales for steam and forge coals, prices do not now average more than 7s. 9d. to 8s. 3d. per ton at the pit mouth; whilst for shipment, there is plenty of steam coal offering at 9s. 3d. per ton—9s. 6d. being only obtained for the very good qualities. Seconds house coal can be bought readily at about 10s. 6d. per ton; and the best qualities at 12s. 6d. per ton, delivered at the ports on the River Mersey. The chief feature of interest in the market just now is the tendency of prices with regard to the supplies of gas coal for the ensuing season, tenders for which are now being sent in. As reported last week, a strong effort is being made to hold on to the prices obtained last year; but the joint meeting of Lancashire and Yorkshire coal owners held at Sheffield last week did not result in any definite agreement in this respect being come to. The Yorkshire coal-owners, on their part, stated that they were strongly determined to hold on to the prices of last year; and the absence of any prospect of a reduction in miners' wages this year was put forward as a reason for thus holding to the prices. If Yorkshire makes no move in the way of reducing miners' wages, Lancashire will have to follow a similar course; but the Lancashire colliery-owners did not seem disposed to bind themselves down to any agreement as to the prices they should quote on tenders, evidently preferring that they should be allowed to have a free hand in this matter. As yet no very large quantity of gas coal has actually been placed. But one or two important contracts have been settled; and it is reported that, in one instance at least, the price was cut down about 6d. per ton upon that realized last year, whilst it is evident that in several other instances there has been some giving way in prices. Generally, however, the tenders that are being sent in are based upon the average prices obtained last year; and where the concessions above referred to have been made, it seems probable that it has been under some special pressure. With regard to engine classes of fuel, the demand is just now fairly good; and prices in most cases are being steadily maintained at late rates. Burgundy averages 6s. 3d. to 6s. 9d.; the better qualities of slack, 4s. 9d. to 5s. 3d.; and common sorts, about 3s. 3d. to 3s. 9d. per ton at the pit's mouth.

Scotch Coal Trade.—There is still a good demand for all sorts of coal; and prices have been quite maintained. The miners are reported to be working a little better; but, notwithstanding, stocks do not accumulate. It is not anticipated that there will be any serious trouble with the men this season; the recent reductions having been acquiesced in, and the masters, on their part, being hopeful that prices will be maintained. While shipping orders are still on the increase, a greater demand for home consumption is also reported—coal merchants being evidently anxious to, if possible, lay in stocks. Gas coal is not commanding the prices which it did a year ago. The prices quoted are: Main, 7s. 9d.; ell, 8s. 6d. to 8s. 9d.; splint, 8s. 3d. to 8s. 9d.; and steam, 10s. to 10s. 3d. per ton. The exports again show a very large increase. For the week, the total export was 180,843 tons, an increase over the corresponding week last year of 43,983 tons; and for the year to date 2,842,990 tons, an increase over this period of last year of 403,784 tons.

The Costs of the Hunter Prosecution.—In the minutes presented by the General Purposes Committee at the meeting of the Salford Borough Council last Wednesday, it was stated that, at the last meeting of the Committee, the Town Clerk read the following resolution from the Consultative Committee: "That this Committee, having met, desires that the General Purposes Committee will instruct the Town Clerk as to whether any and what steps should be taken with reference to the bill of costs delivered to Samuel Hunter by the Town Clerk, in pursuance of the agreement of Aug. 7, 1889." The General Purposes Committee thereupon resolved—"That the Town Clerk be instructed not to take any action with respect to the costs delivered by him to Samuel Hunter, in pursuance of the agreement of Aug. 7, 1889, and that the amount be written off." Mr. Mandley announced that, as no satisfactory reason had been given why the bill of costs should not be paid, he should strenuously object to the adoption of the minutes in their present form. In consequence of this, the matter will come up again at the next meeting of the Council.

Extensions at the Sutton-in-Ashfield Gas-Works.—Last Tuesday Major-General H. D. Crosier, R.E., one of the Local Government Board Inspectors, held an inquiry at Sutton-in-Ashfield, in reference to the application of the Local Board for sanction to borrow £6000 for gas-works purposes. The Clerk (Mr. Hibbert) explained the borrowing powers of the Board under their Gas Act of 1878. They had, he said, reached the extent of those powers, having raised £30,313; and the Local Government Board had already sanctioned the borrowing of a further £1000. In answer to the Inspector, it was stated that the quantity of gas made in 1876 was 11,581,000 cubic feet; in 1887, 25,903,000 feet; and in 1891, 26,009,200 feet. The storage capacity of the works was 48,000 feet; there being three holders. The average daily production was about 70,000 feet; and in the winter months they frequently made 120,000 cubic feet. Mr. C. E. Jones, the Consulting Engineer, proceeded to show how the sum applied for would be expended in the extension of the works; the items including £1250 each for a new holder and tank, £1000 for purifiers, £960 for contingencies, further sums for the extension of mains, which at the present time the Board were unable to carry out owing to want of capital, considering that such work should not be included in current expenditure, and also for the purchase of 1410 yards of land adjoining the present works.

Extensions at the Newport (Mon.) Gas-Works.—A new tank and gasholder are about to be constructed at the Crindan Station of this Company's works to the designs of Mr. Thomas Canning, Assoc. M.Inst.C.E. The first two lifts will be capable of containing a million cubic feet of gas, and additional lifts may, if thought necessary hereafter, be added to double this capacity, or nearly so. The contractor for the tank is Mr. Linton, a well-known local builder.

The Alterations at the Aberdeen Corporation Gas-Works.—Messrs. Henry Balfour and Co., of Leven, have secured from the Aberdeen Corporation the contract to remove an existing gasholder of 80 feet diameter, and to re-erect it in a new tank some distance from the works. It is to be fitted with a system of water-balance, to allow of the pressure being varied from $3\frac{1}{2}$ to $1\frac{1}{2}$ inches as required; the water being lifted by a centrifugal pump, driven by a gas-engine.

The Sittingbourne Local Board and the Water-Works.—The Milton Town Improvement Commissioners have received an offer from the Sittingbourne Local Board of £2000 for the purchase of their share in the present water agreement; this being part of a scheme for acquiring the water-works for the public. The Commissioners are inclined to be bought out at the price named; and the matter has been submitted to the Local Government Board.

The Prevention of Waste of Water at Plymouth.—Since the present Water Engineer of Plymouth (Mr. Sandeman) took over the duties of his office, the consumption of water has been reduced from 5 million gallons to $3\frac{1}{2}$ millions. It appears that he has 19 of Deacon's and 27 of Siemens's meters in use; and these control the supply to 76,000 of the inhabitants. By an inspection of the water-fittings in the town, some prevention of waste has been effected; and another means to circumvent this that has been resorted to, has been the cutting off of the water supply from 8 p.m. until 6 a.m. next morning.

Tampering with a Water-Meter.—At the Widnes Police Court recently, Edmund Gandy was summoned by the Widnes Local Board for unlawfully making certain alterations in his water-meter. The meter was supposed to have burst during the severe frost last winter; and defendant, instead of notifying the Local Board, repaired it himself, by screwing an iron plate on the bottom. He would have had to pay for it being repaired; but the result was there was a considerable waste of water. It was not denied by the witnesses that the meter registered all the water; and therefore no loss had occurred to the Board. The Bench imposed a nominal fine of 5s., with costs.

The National Union of Gas-Workers and General Labourers of Great Britain and Ireland are now holding their third annual conference at Plymouth. The proceedings commenced on Sunday with an outdoor demonstration. A procession was formed on the Hoe at two o'clock, and marched through the principal streets of the town, led by bands of music. Thousands of people accompanied the procession; and much enthusiasm was displayed. An open-air meeting was afterwards held on the North Quay; speeches being delivered from four platforms. In the evening, a crowded meeting at St. James's Hall was addressed by Mr. Cuninghame Graham, M.P., Mr. W. Thorne, Dr. Aveling, Mrs. Aveling, and others. Another meeting was to be held at St. James's Hall last evening. The conference will close to-morrow (Wednesday).

Proposed Purchase of the Fleetwood Gas-Works by the Commissioners.—At the monthly meeting of the Fleetwood Commissioners on the 25th ult., the question of the charges made by the Fleetwood Gas Company was further considered. The matter had been discussed on several previous occasions; and latterly an effort to secure a reduction in price was unsuccessful. Mr. Armour, in dealing with the subject, said that if the town obtained the gas-works from the Company the undertaking would pay for itself in a few years. He was sure that twice the quantity of gas would be used if the price were brought within reach. He pointed out that at Blackpool, where the gas-works are owned by the Corporation, gas is supplied at 2s. 6d. per 1000 cubic feet. He argued that the present was the time for the Commissioners to purchase the undertaking, because in a few years they would probably have to pay double the price. He moved that the Lighting Committee be authorized to confer with the Directors of the Fleetwood Gas Company upon the question of charges for gas, and also to ascertain upon what terms the works could be acquired by the Commissioners. The motion was adopted.

Buenos Ayres (New) Gas Company.—At the annual meeting of this Company to be held to-morrow, the Directors will submit their report on the working of the concern during the year ending Dec. 31 last. They open it by remarking that the result, as shown by the figures in the accounts, is due to the unprecedented depreciation in the value of the currency in which payment for gas is made. The conversion of this currency into sterling has also destroyed the benefits that would otherwise have been derived from the increase in the charge for public and private lighting, which the Directors were able to effect during the year. Notwithstanding that the business of most industrial undertakings trading in the Republic has been very adversely affected by the political and commercial crisis through which the country is passing, the Directors have the satisfaction of reporting that, in the case of this Company, the gross income in currency advanced from \$2,067,992 in 1890 to \$2,218,493 in 1891—the largest amount in dollars which has been earned in any one year since the formation of the Company, while the private meters fixed have increased from 9557 to 10,151; thereby showing that the business continues steadily to improve. In addition to an increase of 50 per cent. in the charge for public lighting, the Directors have been successful in their efforts to procure the assent of the Municipality to a reduction of the number of public lamps in use—a desirable economy for them to adopt during the present financial pressure. By these arrangements, no material increase has been made in the municipal debt during the year. In order to meet the provisions of a local Act recently passed, imposing a tax on the profits of companies trading in the Argentine Republic, the form of keeping the local accounts as heretofore in a fluctuating currency has been changed, and has now been put on a gold basis. They are now incorporated in the London books at their value in gold, in conformity with the system adopted by other English companies doing business in the Argentine Republic.

The Dewsbury and Heckmondwike Water Board and the Water Supply of Hemsworth.—A letter was read at the meeting of the Dewsbury and Heckmondwike Water Board last Thursday, from the Hemsworth Local Authority, stating that they were not now willing to proceed further with the scheme for receiving a supply of water from the Board, and that a resolution had been passed by them rescinding all previous resolutions on the subject. It was decided not to proceed with the Bill to empower the Board to supply Hemsworth.

Liability for the Bursting of a Water-Pipe.—At the Sheffield County Court last Thursday, his Honour Judge Ellison gave his decision in a case in which Mr. J. A. Bain, a bookseller, of 13, Iligh Street, Sheffield, sued Messrs. Staniforth, Ball, and Co., stockbrokers, of the same premises for £50 damages to his stock-in-trade and other property by reason of their negligence, whereby a water-pipe burst on their part of the premises. Plaintiff's shop is on the ground floor; and defendants occupy the rest of the building, and have a water-closet on the second floor. Last Christmas, a pipe connected with the closet burst; and the water poured into plaintiff's shop. The window of the closet was found open; and this was the ground of negligence alleged. But Mr. Eaton, the Corporation Water Engineer, gave evidence proving that the pipe was completely covered by woodwork casing, and that no portion was freely exposed to the atmosphere. He also stated that the open window would have no material effect in freezing the pipe, and that no artificial heat would have much effect, as the closet was open to the current of the staircase. His Honour said that supposing the defendants knew there was going to be the intense frost on the night of Christmas Day that did occur, it might have been questionable whether there was not some negligence in leaving the window open. But a person could not be held guilty of negligence in a matter as to which he was completely in ignorance. There was no evidence at all as to when the window was opened, or how long it was open. No doubt at the time defendants might have contemplated a frost. Still, he (the Judge) could not see any evidence of negligence, and gave a verdict for defendants. He added, however, that it would be a right thing for them, seeing the damage plaintiff had sustained, not to ask for costs.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

For Stock Market Intelligence, see ante, p. 1054.)

Issue.	Share	When ex-Dividend.	Dividend or Div. Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon invest. ment.
£			p. c.					£ s. d.
GAS COMPANIES.								
590,000	10	13 Apr.	10½	Alliance & Dublin 10 p. c.	10	16½—17½	..	6 0 0
100,000	10	"	7½	Do. 7 p. c.	10	11—12	..	6 5 0
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105—107	..	4 13 5
100,000	20	27 May	8	Bahia, Limited	20	10—12½	..	13 6 8
200,000	5	12 May	7½	Bombay, Limited	5	6¼—6½	..	5 11 1
40,000	5	"	7½	Do. New	4	4½—5	..	6 0 0
380,000	Stock.	26 Feb.	12½	Brentford Consolidated . . .	100	212—217	..	5 12 11
150,000	"	"	9½	Do. New	100	162—167	..	5 10 9
220,000	20	11 Mar.	11½	Brighton & Hove Original . .	20	40—42	..	5 9 6
888,500	Stock.	11 Mar.	5	Bristol	100	95—100	..	5 0 0
320,000	20	13 Apr.	11½	British	20	42—44	..	5 2 3
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	10	19—20	..	5 15 0
51,510	10	"	8½	Do. 7 p. c.	10	15—16	..	5 6 3
328,750	10	"	—	Buenos Ayres (New) Limited	10	6½—7½	—½	—
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	94—97	..	6 3 9
150,000	20	26 Feb.	8	Cagliari, Limited	20	25—27	..	5 18 6
550,000	Stock.	13 Apr.	13	Commercial, Old Stock . . .	100	229—234	..	5 11 1
165,000	"	"	10	Do. New do.	100	180—190	..	5 5 3
130,000	"	30 Dec.	4½	Do. 4½ p. c. Deb. do.	100	118—123	..	3 13 2
800,000	Stock.	30 Dec.	13	Continental Union, Limited . .	100	220—225	..	5 15 6
200,000	"	"	10	Do. 7 p. c. Pref.	100	190—195	..	5 2 7
75,000	Stock.	30 Mar.	10	Crystal Palace District . . .	100	185—195	..	5 2 7
486,090	10	29 Jan.	10	European, Limited	10	19—20	..	5 0 0
354,060	10	"	10	Do. Partly paid	7½	13½—14½	..	5 3 11
5,470,820	Stock.	12 Feb.	12	Gaslight & Coke, A, Ordinary	100	207—211	..	5 13 9
100,000	"	"	4	Do. B, 4 p. c. max.	100	94—98	..	4 1 7
665,000	"	"	10	Do. C, D, & E, 10 p. c. Pf.	100	250—255	+2	3 18 5
30,000	"	"	5	Do. F, 5 p. c. Pf.	100	118—123	+2	4 1 3
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	169—174	..	4 6 2
1,300,000	"	"	7	Do. H, 7 p. c. max.	100	154—158	..	4 8 7
463,000	"	"	10	Do. J, 10 p. c. Pf.	100	247—252	+2	3 19 5
476,000	"	"	—	Do. K, 6 p. c. Pf.	100	148—153	+2½	3 18 5
1,061,150	"	11 Dec.	4	Do. 4 p. c. Deb. Stk.	100	114—117	..	3 8 5
294,850	"	"	4½	Do. 4½ p. c. do.	100	118—123	..	3 13 2
908,000	"	"	6	Do. 6 p. c. do.	100	165—169	..	3 11 0
3,800,000	Stock.	12 May	12	Imperial Continental	100	212—216	-3	5 11 1
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4—4½	..	6 13 4
560,000	100	1 Apr.	5	Met. of Melbourne, 5 p. c. Deb.	100	108—110	..	4 10 11
541,920	20	27 Nov.	5½	Monte Video, Limited	20	14½—15½	..	6 9 0
150,000	5	27 May	10	Oriental, Limited	5	7½—8½	..	6 1 2
60,000	5	30 Mar.	7	Ottoman, Limited	5	4—5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited	10	2—3	..	—
420,000	100	3 May	6	People's Gas of Chicago—				
500,000	100	1 June	6	1st Mtg. Bds.	100	104—107	..	5 12 1
150,000	10	15 Oct.	10	2nd Do.	100	100—103½	..	5 16 7
500,000	Stock.	26 Feb.	15½	San Paulo, Limited	10	8—9	..	—
1,350,000	"	"	12	South Metropolitan, A Stock	100	270—275	..	5 12 9
200,000	"	"	13	Do. B do.	100	217—221	-1	5 8 7
725,000	"	30 Dec.	5	Do. C do.	100	250—240	-2½	5 8 4
60,000	Stock.	11 Mar.	11½	Do. 5 p. c. Deb. Stk.	100	142—146	..	3 8 6
WATER COMPANIES.								
729,331	Stock.	30 Dec.	10	Chelsea, Ordinary	100	252—257	..	3 17 9
1,720,252	Stock.	13 Apr.	8	East London, Ordinary . . .	100	197—202	..	3 19 2
544,440	"	30 Dec.	4	Do. 4½ p. c. Deb. Stk. . . .	100	138—142	+2	3 3 4
700,000	50	11 Dec.	8½	Grand Junction	50	99—103	+1	3 2 6
708,000	Stock.	12 Feb.	10½	Kent	100	260—265	..	3 19 3
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max. . . .	100	220—225	..	4 4 5
406,200	100	"	7½	Do. 7½ p. c. max.	100	187—192	..	3 18 1
279,706	Stock.	30 Mar.	4	Do. 4 p. c. Deb. Stk.	100	121—124	+1	3 4 6
500,000	100	12 Feb.	12½	New River, New Shares . . .	100	325—335	..	3 2 4
1,000,000	Stock.	29 Jan.	4	Do. 4 p. c. Deb. Stk.	100	126—129	..	3 2 0
902,300	Stock.	30 Dec.	6½	S'hwk & V'xhall, 10 p. c. max.	100	148—153	..	4 4 11
126,500	100	"	6½	Do. D 7½ p. c. do.	100	133—138	..	4 14 3
1,155,066	Stock.	11 Dec.	10	West Middlesex	100	242—246	..	4 1 3

† Next dividend will be at this rate.

Additions to the Preston Water-Works.—The Preston Town Council, at their last meeting, approved of a report by the Borough Engineer on the water supply of the borough, and also of the recommendation of the Water Committee that the following works should be executed: A 36-inch new iron main from Acragate Lane to the Grimsargh reservoirs, with new straining chambers, &c.; a 36-inch new iron main from the Grimsargh to the Alton reservoir, with new straining chambers, &c.; the construction of a new reservoir of 275 million gallons capacity, and of straining tanks, and the diversion of a portion of the Loud and of the Spade Mill conduits for carrying the water to the reservoirs, at an estimated cost of £95,500; and further that the Council memorialize the Local Government Board for power to borrow this sum.

Exhibitions of Gas Appliances.—An exhibition of the gas-stoves manufactured by Messrs. C. Wilson and Sons, of Leeds, was opened in the crypt of the Middlesbrough Town Hall last Wednesday week. In connection with the exhibition, a series of cookery lectures was given by Miss R. M. Watts, of the Yorkshire School of Cookery; whilst each day fifty loaves of bread were handed over to the Chief Constable for distribution among those who are in distress in consequence of the present dispute in the coal trade. Messrs. R. and A. Main, of Glasgow, held an exhibition of their enamelled steel gas cookers and other appliances, in the Primitive Methodist Church Schools, at Nottingham, from Tuesday to Friday last week. Attractive lectures on cookery were delivered each day by Miss Thompson, of the Nottingham and District School of Cookery. A series of free demonstrations in cookery was given by Miss E. E. Golding, of South Kensington, during the past week at the Albert Hall, Landport—each afternoon being devoted to high-class cookery and the evening to every-day cookery. In connection with the lectures, there was an exhibition of the various gas appliances manufactured by Messrs. Richmond and Co., of London and Warrington. This firm have also recently exhibited at Macclesfield and Ramsgate.

Portsmouth Water Company.—At the half-yearly meeting of this Company last Thursday week, the report submitted by the Directors stated that there was an available balance of £14,681, from which it was recommended that the full statutory dividends should be declared. The Chairman, in proposing the adoption of the report, referred to the proposed purchase of the works by the Corporation. The Directors had, he said, been asked what they would consider to be a fair purchase price. This they had stated; but they had not yet received any further information—the negotiations having been suspended, probably owing to the death of one of the members of the Committee having the matter in hand. If again approached, the Directors would give the matter careful consideration; and the shareholders would be called together for consultation on so important a question. The report was adopted.

Yorkshire and Lancashire Water Gas Company.—In the Chancery Division of the High Court of Justice, Mr. Justice Stirling had before him on the 14th ult., a petition by the Company that the Court would confirm a scheme for an extension of the area of the Yorkshire Water Gas Company and an alteration in the name of the Company. Mr. W. B. Lindley, who appeared for the Company, said it was incorporated on April 30, 1889, with a capital of £151,000, for the purpose of acquiring all rights in certain water-gas patents, with powers to grant licences, for the county of York. It was now desired to extend the Company's operations to Lancashire; and the Company had, therefore, passed resolutions to this effect, which had in due course been confirmed by a later meeting, in terms of the Act. They now came, by their petition, for the sanction of the Court to an alteration in the Memorandum of Association, authorizing the Company to acquire similar rights for Lancashire to those they already had for Yorkshire; and also to sanction the alteration of the name to the Yorkshire and Lancashire Water Gas Company, Limited. The learned Counsel said the assent of the Company's creditors had been obtained. There was no opposition; and his Lordship, therefore, made the required order.

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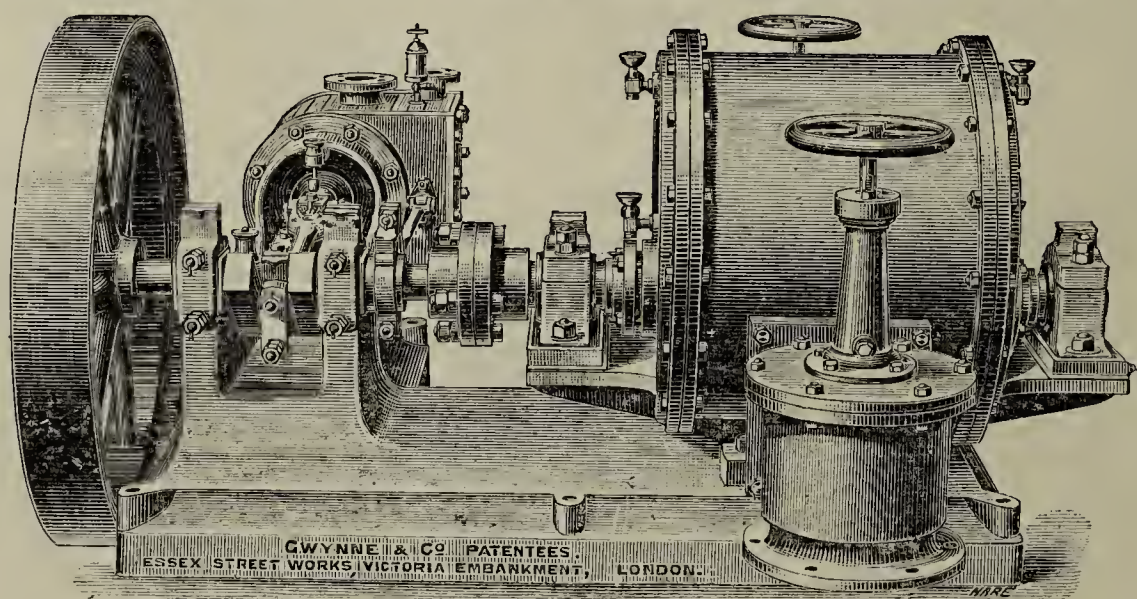
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TO CORRESPONDENTS.

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THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JUNE 14, 1892.

The Gas Industry before the Labour Commission.

IN another part of the present issue will be found the remainder of the evidence relating to the conditions of labour in the gas industry given before the Labour Commission by Mr. G. Livesey, Mr. G. C. Trewby, and others. Our comment upon this evidence last week left off with Mr. W. A. Valon's testimony; but we also reported the evidence of Mr. T. Duxbury, of the Darwen Corporation Gas-Works, and Mr. H. E. Jones, of the Commercial Gas Company. Mr. Duxbury's story was not long; but it was brilliantly illustrative of the practical reliance upon lawlessness and violence of the New Unionists. Mr. Jones's statement was full of strong interest, albeit not of the kind which the witness would probably have preferred. He had to tell how the coal porters did what they pleased with the Commercial Gas Company, from the period of

Sir John Lubbock's farcical "arbitration" on the claims put forward by Michael Henry downwards. It does not appear from Mr. Jones's story that the policy of giving way in everything, presumably for the sake of a quiet life, has served the Commercial Company very well, since their Union coalies seem very ready to strike, so to speak, "at large," or whenever the humour suits them. The extravagant wages they receive probably accounts for this skittishness. Like many another man, the average coalie "cannot carry corn." To Mr. George Livesey the witness had to confess that he "was afraid" to do a variety of things which might have upset the unionist stokers. It is always pleasantest to suppose, when one see things going on differently in different gas-works, that every manager knows his own business best. There was doubtless a plausible case to be made out at the time for the abandonment of the South Metropolitan interests at the Mansion House conference, at the bidding of the now notorious Michael Henry, and for trusting in the "sweet reasonableness" of the Trade Union leaders, who confess that they are frequently powerless to control their men, and are as often mistaken in their counsels; but the result of taking this course, in the experience of the Commercial Gas Company, does not make a very attractive picture as it was unfolded before the Commission.

Next came Mr. G. C. Trewby, who made a brave showing of the size and condition of the industrial army in the pay of The Gaslight and Coke Company. He soon had to tell the Commission of the occurrence of labour troubles at Beckton, however, even after the Company had freely conceded the eight-hour shift desired by the Union, at a cost to the undertaking of £70,000 per annum. The first serious affair of the kind was over the introduction of labour-saving stoking machinery, when 61 men in the employ of the contractors had to be protected by a body of 34 police against the violence of the other men. Mr. Trewby drew a marked distinction between the working of the older Trade Unions with which he has had to deal (such as the Engineers and Boiler Makers) and the Gas Workers' Union, which set up to be nothing else than a "fighting body." With much quiet force, the witness remarked that this particular Union is more endurable now, because many of the members have left it. It is necessary, in connection with a portion of Mr. Trewby's evidence, and certain passages between him and the Chairman of the Section, to lay some stress upon the point of the much-debated question as to whether the law is strong enough to meet the eventuality of gas stokers breaking their legal notices *en masse*. Mr. Mundella seems to think that the terms of the Conspiracy Act are sufficient in this regard; but Mr. Thorne has not hesitated to express his conviction that gas stokers should set the Act at defiance, when there are enough of them in the same boat, upon the ground that it would be practically impossible to imprison from 2000 to 5000 men at once. We hold that, having regard to human nature, which does not grow stiffer in the backbone with advancing years, Mr. Thorne's view of the matter is shrewder than Mr. Mundella's. London gas managers declare, moreover, that the Act is, to all intents and purposes, a dead letter as regards the very men against whom it would be first set in motion, because such men have no permanent address, and the police could never catch them. But when the police have caught them, what then? It is idle to pretend that what can be done with five men can be done equally well with five thousand. Logically or not, the public mind is swayed by the idea of numbers. If a single holiday-maker at this last Whitsuntide had fallen overboard from an excursion steamer, there would have been an end of him. The community would not have shivered over his fate, nor have provided a penny for his family, supposing these to exist and to have been left destitute. But multiply that imaginary sufferer by five hundred, and what would have been the result? There would be a Mansion House Fund, and all the rest of it; although the need of the individual victims would be no more severe than if there had been no such multiplication. It is the same even with cases of admitted law-breaking. The solitary murderous poacher, when caught, gets his punishment, and nobody sympathizes with his fate; but let there be half-a-dozen of him, and straightway our emotionalists begin to cry out about the iniquitous wholesale sacrifice of men to the "cult of the sacred birds." So it would be with the gas stokers. Knowing, as we say, the times we live in, it is inconceivable

that any Magistrate would sentence 2000 or 5000 men in a batch to three months' imprisonment, with or without hard labour, or that such a sentence would be enforced.

Mr. Livesey's evidence was very full, as was to have been expected. He gave the first taste of his quality by demolishing the claim of the Socialists and Trade Unionists to the invention of the eight-hour shift; and he then proceeded to show, from the books of the South Metropolitan Gas Company, how the wages paid to workmen have risen during the last fifty years. He told the Commission how the conditions of employment under that Company altered from time to time; and then, on the special invitation of the Chairman to "tell them all about '1889," Mr. Livesey gave the history of that eventful period, when the South Metropolitan Company stemmed the flowing tide of the New Unionism. He also cleared up many matters that have hitherto remained in obscurity. Among other details, he explained the origin of the historical threat, ascribed to him by labour agitators ever since, of "smashing the Union," and narrated, in simple, graphic language, how it came to be a question of who was to manage the Company's works, and how the Directors and their officers contrived to retain the control of their own business. The practical working of the "Federation of Labour" was illustrated by Mr. Livesey's statements of how the coal porters abandoned the Company's wharves, how the lightermen left the contractors' barges, and how the Seamen and Firemen's Union boycotted the Company's vessels. The works were "picketed"—to give it the legal term—by thousands of the Company's enemies; and before the Directors saw the end of the conflict, they had paid £100,000 for the defence of their position. "Was the result worth the cost and trouble?" Mr. Livesey was asked. His reply was, "Unquestionably." The whole of his answer to this inquiry deserves to be given. "It checked, from that day to this, for all the gas undertakings in the kingdom, the further aggressions of the Gas Workers' Union, one of which would have been the additional shilling a day, or another 20 per cent. on wages, equal in our own case alone to some £20,000 a year. But this was the smallest part of the gain—it broke down a system of tyranny over employers and employed that had become intolerable. Even that is not the greatest advantage—it gave, in place of hostility and antagonism, peace and goodwill; in place of doubt and mistrust, confidence; and in place of sullen and discontented workmen, a body of cheerful, willing, and capable workers, with whom it is a pleasure to be associated." Mr. Livesey's evidence, reinforced as it was by the facts and figures which the Chairman of the South Metropolitan Company has ever at his fingers' ends, made an evident impression upon the Commission. He was not cross-examined, even by the Labour members; and no attempt was made to shake the main edifice of his testimony—nobody being able to defend the principles and practices of the Social Democratic bodies whose growing power for evil was wrecked upon the South Metropolitan Company's splendid combative organization.

Last Week's Doings.

ONCE more it has happened that, while the Labour Commission was collecting materials for a history of the agitated times from 1888 to 1890, history was being made out of doors by acting representatives of employers and employed. Several things were going on last week which observers of labour matters could hardly fail to find very interesting. There was the International Miners' Conference in London, the Co-operative Union Congress at Rochdale, and the meeting of the delegates of the Amalgamated Engineers in Leeds; to say nothing of the annual performance of the Gas Workers, at Plymouth. Of greater practical importance than any of these gatherings, moreover, was the conference between the masters and men engaged in the London building trade, which resulted in an amicable settlement of differences that might easily have issued in a most serious strike. This incident of contemporary history is of peculiar interest by reason of the light it throws upon the talk about Boards of Arbitration or Conciliation, which is now-a-days so much indulged in by all sorts of people. Mr. Joseph Chamberlain, in the course of his speech at Smethwick, said something about this device for the prevention of strikes. Like everybody else, Mr. Chamberlain is shocked at the occurrence of such reproaches to civilization and common sense as the

Durham strike; and he expresses the confident belief that if there were Arbitration Boards duly constituted for taking cognizance of labour disputes, and pronouncing judgment upon the rights of every disagreement of the kind that had such deplorable results in Durham, the decisions of these tribunals would so influence public opinion as to ensure their own validity, even without means for imposing a distasteful judgment upon the defeated party. This might, and probably would, be so in cases where the dispute was a *bonâ fide* one, as between men of business anxious to come to such terms as would enable work to be properly carried on. But where men's passions had been roused, or their minds had been played upon by professional agitators with interests of their own for prolonging a strike, there are only too many examples, like those of the Durham miners and the Tyneside fitters, to show that public opinion can be defied by strikers quite long enough to enable infinite mischief to be done. This consideration, however, leads to the reflection that where, as in the case of the London building trades' dispute, there is real anxiety for a settlement, and where agitators are kept out, and none but practical men have a hand in the affair, there is no need for any tribunal, other than such as the existing organizations of masters and men can create at will, to formulate an authoritative decision. The most important point in the new settlement for the building trades is the establishment of a week of 50 hours as full time for summer; for, as in regard to the Saturday half holiday, what is law for the builders now will probably soon extend to other trades. This peaceful conclusion of a dispute involving the length of the working week will do more to knock the "Legal Eight-Hour Day" nonsense on the head than any amount of argument. For, seeing that the building trades have arrived by consent at a working week of 50 hours, it is absurd to pretend that an Act of Parliament is needed to get the two hours which differentiate this period from the magic figure beloved of Socialist agitators.

It must be growing apparent to the Burns and Mann clique that the workers for whom they have posed as leaders and spokesmen are "going to do without them," as a song, also once popular, has it. They were not asked to place their exceptional talents at the service of the builders' men; and the Amalgamated Engineers, not content with passing over Tom Mann for the coveted berth of General Secretary of the Society, did not even send either him or Burns to Leeds to help in the serious work of revising the rules. Indeed, the President of the delegates' meeting (Mr. A. B. Childerson) is one of those old-fashioned trade unionists at whom the self-appointed leaders of the New Unionism used to laugh a year or so ago. He "does not believe in street processions, or bands and banners. Likes the old methods best. Is of a pacific disposition. Does not look upon an employer as a natural enemy, but as a man to be dealt with on equal terms." We are also informed that this reactionary leader is opposed to flaunting Trade Unionism in the streets, and has great faith in the moral force of a big balance at the Society's bankers when the men come to argue with their employers. All this—especially the "big balance"—is so utterly foreign to the spirit of the New Unionism, that if the policy represented at Leeds by Mr. Childerson is to prevail with the Amalgamated Engineers, it is clear that New Unionists must betake themselves to more congenial company, such as the Seamen and Firemen, or the Dockers.

The International Miners did little at their meeting besides squabble in three languages over the curious point as to whether the Legal Eight-Hour Day should apply only to the underground men or should embrace the surface workers also. The English members of the congress saw practical difficulties in applying the rule to all workers in and about mines; but this regard for facts was little to the taste of the philosophical Germans and logical Frenchmen, who would not hear of any invidious distinction being drawn between the rights of the different orders of mine workers. Seeing that there is a long way to go yet before anybody will have his working time cut down by law to eight hours, this polyglot dispute strikes an observer as being another example of "much ado about nothing." The same remark, by the way, applies with equal force to the Plymouth performance of the (nominal) Gas Workers, represented upon this occasion chiefly by the queer Aveling family.

A Daring Questioner.

ONCE upon a time, an enthusiastic gentleman who felt constrained by Destiny to assume charge of the policy of the London County Council, took the trouble to compile a book to which he gave the name of "The London Programme." In this modest work he set forth a scheme of municipal aggression which could only have a logical end in the local authority undertaking to "do for" the rate-payers, out of the rates, in respect of everything that humanity has need for, from the cradle to the grave. The progressive Londoner was to look to Glasgow, Manchester, Birmingham, and even, as we seem to remember, to Paris, for examples of what the spirit of municipalization can do when permitted a "free hand;" and he was to insist upon doing likewise in London—only more so. It has always struck us as a remarkable circumstance, that when our uncompromising worshippers of what they call the "Spirit of Democracy" wish to impress the British people with a full sense of the all-sufficiency of various democratic nostrums for removing all the ills that afflict towns-people living under our admittedly imperfect social and political systems, they shun all reference to the land which, one would think, need only to be cited to prove their case. We mean, of course, the United States of America. Here there is, and has been for years, manhood suffrage, with one vote per man, a very elaborate Federal constitution, and all sorts of modern conveniences of the same character; but, somehow, our Progressists do not care to talk about the condition of the cities of the States. Why is this? Well, an explanation, if but a partial one, may perhaps be found in a curious paper contributed by Mr. William Nelson Black to the April number of the *American Engineering Magazine*. To the ardent believer in Municipalism for its own sake, this plain-spoken statement must come as a severe shock. For in it he will find the author asking whether it is "expedient to put any kind of productive work in the hands of municipalities," and answering the question with a decided negative. Of course, the ingenious American writer puts the municipality, as an institution, among those bad things which the free American people inherited from the Old World. The remarkable thing is that Mr. Black paints the municipality *per se* in the colour after which he is himself named. He goes on to show, much to his own satisfaction, that the Municipalities of the United States, and particularly that of New York, have shamefully mismanaged the public business, and he wishes to do away with everything of the kind, and put not only gas and water supply, but also drainage, paving, town and river-side improvement, bridge-building, and in short every local requirement down to school provision and management, into the hands of companies, who might be depended upon to do their work under economic conditions. His thesis is simply this: "The municipality is unnecessary; it is, moreover, industrially inefficient and politically corrupt; and there is no reason for its continued existence." One can easily imagine the hair of the author of the "London Programme" rising in horror at this denunciation of the idea of Municipalism arising from the midst of the most democratic community in Christendom. But what is to be said about it? We have been so habituated of late years to the ravings of self-styled reformers who have told us that local authorities "ought" to supply their districts with gas, water, electric lighting, tramways, and many other services which were once thought to fall within the scope of private enterprise, that some of us have begun to tacitly accept the assertion as indisputable. But here is a bold man who, having seen how things work, asks: "Why should a ring of gerry-mandering politicians be permitted to take a shilling 'out of the pockets of the people, in the name of the 'Municipality,' for doing something that any commercial firm would do better for sixpence?" The query is an awkward one, to say no more.

Masonic.—We have much pleasure in announcing that Earl Amherst has appointed W. Bro. W. A. Valon to the Junior Wardenship of the Provincial Grand Lodge of Kent; and he will be installed in this office at Ramsgate on the 24th inst.

The Judgment in the Gasholder Guiding Patents Case.—We learn that Messrs. Gadd and Mason have given instructions for notice to be filed of appeal against the judgment of Mr. Justice Kekewich in the action brought by them against the Manchester Corporation—see JOURNAL for the 31st ult. (p. 1017).

THE INCORPORATED GAS INSTITUTE.**PROCEEDINGS AT THE TWENTY-NINTH ANNUAL GENERAL MEETING,**

HELD AT THE

INSTITUTION OF CIVIL ENGINEERS, JUNE 14, 15, & 16, 1892.

Mr. W. A. VALON, Assoc.M.Inst.C.E., President.

INAUGURAL ADDRESS.

GENTLEMEN,—In approaching the at once pleasurable but anxious task of selecting a few thoughts for your acceptance, it was early apparent that it was necessary to move an enormous mass of raw material, to make an insignificant collection. The mountain, viewed from a distance, conveyed no true conception of its magnitude; but when well under its shadow, the true proportions were clearly discernible. Thus it was slowly realized what needed to be penetrated before success could be hoped for, in the endeavour to extract something worthy of critical eyes, however indulgent.

The report of the Council need only be enlarged upon to notice rather more at length the untimely removal from our midst of more than one familiar face—among them, Josiah Deakes, of Worcester; also Mr. W. H. Bennett, of London, who until 1888 held the post of Secretary to this Institute. Those who, like myself, had the advantage of his friendship for many years, will recognize the gap that is left by his death. Mr. George Shepard Page, of New York, was also very suddenly removed. Only a day or two before the public announcement of his demise, a letter came to me from him which bore no trace of the coming event. His kindly manner, with a distinct personality, will be long remembered by all the members of this Institute; and his personal friends on this side will continue to bear in mind a genial man of a warm and attractive temperament. We have also the misfortune to record on the death-roll the name of a Past-President of this Institute, Mr. Robert Harris. In 1884, he sat in the chair now occupied by me; and by his decease, I lose a friend. He was a member of the Institution of Civil Engineers; and at the time of his being finally laid aside by illness, he was a Vice-President of the Society of Engineers. We may conscientiously refer to him as a gentleman of unassuming demeanour, ever ready to do a kindly action, lend a helping hand, or impart information which he himself must have acquired at considerable sacrifice. He was a good man of sterling value; and we can now only rise in our places as a tribute of respect to the man and the office he once held.

The great exhibition to be held at Chicago in the coming year, **The World's Fair in America in 1893.** serves mention as an event which will probably have a tendency to bring the claim of gas to its proper position as a lighting and heating agent in competition with other systems—notably electricity. Opposition through prejudice could scarcely have reached further than was shown by the authorities who had the granting of space in and about the building for exhibition purposes. For a considerable time, it was doubtful if gas exhibits would obtain any place in the great show. Nothing daunted, however, by obstacles, a syndicate of gentlemen was formed, with Mr. Alex. C. Humphreys as Secretary and Chairman of the Finance Committee, who rendered it certain by their energy and perseverance that the great American Gas Industry should be suitably represented in a building erected independently for that purpose.

It is intended that foreign exhibitors shall have as favourable positions as possible assigned to them; and it is hoped that any of our Members who can, will apply for space for apparatus, so that the British exhibits may not be the least interesting in the building. The Gas Industry Council of America intend to provide and maintain exhibits covering all points which cannot be looked for from individual exhibitors—such as historical exhibits, showing the development of the industry; advanced forms of construction,

* The principal matters dealt with in the report are noticed on p. 1112.

including combination of lighting and ventilating, application of gas-engines for pumping, the working of elevators, and other engineering requirements, special installations of high candle power lighting; and demonstrations of the value of gas as a light of luxury and convenience as well as the light of the million. Opportunity will thus be afforded to all professional visitors to become acquainted with the progress made in the industry up to date, covering work done in all the countries of the world, which means that gas engineers visiting the exhibition will obtain information, in as many directions as they would otherwise obtain by months of travel among gas companies and manufacturing firms. I hope to meet a goodly representation from this Institute in Chicago next year; and in the name of the genial and clever Secretary of the Gas Industry Council of America, I promise you a warm welcome.

At times, some of us have stated that the manufacture of gas has improved but little since its early days; and as a result, this has been persistently repeated by outsiders.

This fallacy was easily and ably refuted by our immediate Past-President, in some of the remarks contained in his address delivered last year at Carlisle. True progress is rarely progress by events. The so-called great discoveries are apt to reckon very little in the sum of our experiences; it is the aggregate of small events which are alone truly formative in the contribution to the total of our general knowledge. Countless small improvements have by degrees led up to a state of perfection in our manufacturing processes, seen but dimly, if at all, by the original discoverers and founders of our great industry. The strides which we have made must be judged by a survey of the progress of a period. The true test of that progress is the feeling that from time to time advancement has been surely made, rather than by the evidence of any great innovation that will bear enumeration and measurement. Therefore, it happens that, while running our eyes over the events of the past year, we see nothing that stands out prominently as the immediate product of the time intervening since our last meeting; yet there remains in the mind a feeling of satisfaction, that steady advancement has been made.

In the manufacture of gas, advancement seems to have shown itself principally: First, in the more general adoption of some method of drawing and charging retorts by machinery; and, secondly, in efforts to improve the method of purification. In distribution, the advance has been made in endeavours to improve the method of consuming gas.

Much has been said and written on the subject of machinery during the past year; but, having due regard to the importance of the matter, certainly not too much. This subject divides itself under three heads: (1) Machinery for horizontal retorts; (2) machinery for sloping retorts; and (3) labour-saving machinery, as applied to every part of a gas-works.

For a considerable time past, machinery for horizontal retorts, sloping retorts, and labour-saving machinery as applied to all parts of a works, has occupied the serious attention of some members of the gas profession, and has been as persistently treated with indifference by others. The moment has, however, arrived when all must give the question careful study in one form or another. Many forms of machines have from time to time been under our consideration. They are all well known by the names of the makers, and need not be mentioned in greater detail. Many of those introduced had some excellences; some, many defects. The machines now existing and competing for favour are limited; but it naturally follows that they are more efficient. By this, it is not meant to imply that perfection has been reached. There is much room for improvement; and it is not certain that better machines than have yet been seen, do not remain to be devised. They have, however, now reached such a stage of development that there is no reason why one form or another should not be freely introduced into every works; and one cannot help thinking that, in the light of present experience, the engineer who neglects the introduction of appropriate machinery into the retort-house, and every other department of his works where it can be economically used, is casting upon himself a heavy responsibility, that neither need, nor should be borne. The machines, to be useful, should

be simple in construction; easy to work and maintain; all working parts should be in duplicate; and, while possessing the maximum of efficiency, the machines should only require the minimum of ordinary labour, and be as little dependent as possible on skilled workmen for their repair, maintenance, and manipulation.

The retort-house of to-day may have the outside and inside appearance of half a century ago; but, in reality, it bears the unmistakeable stamp of accumulated experience, gained in a great degree through the knowledge made available by the mutual interchange of thought and description of methods imparted to the members through the agency of this Institute. Turn for a moment to the Proceedings of 1872, when Mr. Livesey read his paper on "Hydraulic Mains," and note the remarks of the various speakers, some of them representative men. The current knowledge of the day may be fairly gauged. Now, the division of the tar and liquor, on which so much depends, is clearly understood, and well disposed of. The anti-dip, as an extreme measure, struck the light by which we saw the happy medium of a reduced liquor seal. Self-sealing lids, screened foul mains, and last, but not least, gaseous firing, have all contributed their quota to the general advancement. "Authority," which dogmatically asserted a balance of good by the use of an exhauster so long as the exhaust maintained in the hydraulic main equalled the pressure thrown on the retorts by the seal of the dip in use, is now a thing of the past.

A few words on gaseous firing may be useful, although most of you are probably acquainted with past work in this direction. Gaseous firing, thanks greatly to the independent line taken up by our leading technical journal, is better understood now by the profession than it would otherwise have been for a generation or more to come. Many papers have been read and discussed at intervals, since my experience was laid before the Institute in 1882 and 1884. The principle sought and fought for in those papers has prevailed. Practice has confirmed the lessons then taught, and clearly established the lines on which we can work with advantage. Many interesting contributions from men of observation have been added to our Transactions since the date named. All, however, tend to greater simplicity; the last, but not the least important, word having been spoken on the subject by our friend Mr. W. R. Chester, of Nottingham, at the Manchester District Institution last year.

The following may be suggested as an accompaniment to a good arrangement for economical heating: (1) Sufficient depth of furnace; the failure to obtain which from any cause, either structural or financial, is a mistake. (2) The greatest possible simplicity in construction. (3) Controlled air supply, both primary and secondary; no more being admitted than is absolutely required for perfect combustion. (4) Only sufficient heating surface to raise the temperature of the secondary air supply to as nearly as may be the temperature of the combustible gases at the point of ignition. (5) Let the heat generated be distributed equally throughout the setting. This does not mean dividing the initial flame into small jets—indeed, that is a mistake, and should, as far as practicable, be avoided. (6) Use steam as well as water for producing the moisture necessary for preserving the brickwork and fire-bars where these are used. (7) Let each setting have its own furnace, controlled by its own chimney. An outside producer, or a furnace arranged to supply more than one setting, is less economical in fuel, and more expensive structurally, if maintenance be taken into consideration.

At the present moment, one is hardly prepared to class sloping retorts as an improvement on the present mode of setting them horizontally; nor at the same time need a final judgment be given with regard to them, as it is impossible to tell what may be reserved for the future, although the results hitherto obtained have been disappointing. In a degree, this may be accounted for by the extravagant promises made by those introducing the system; the great expectations raised not having yet been realized. Nothing appeals more to the desires of a gas manager than a self-discharging and, if possible, a self-charging retort. Any arrangement promising this longed-for improvement will be sure to secure immediate attention. Hunger is not dainty, and takes all food until the

craving is satisfied. From observation, we are forced to the conclusion that we have expected too much from inclined retorts. The gain, either in labour, machinery, or comfort, is at present doubtful; while the increase of cost for construction and maintenance is certain.

As purification begins in the hydraulic main, the gas from this point until it leaves the washer needs as much care, knowledge, and attention as at any period during its progress to the gasholder. A condenser has the twofold duty to perform of removing the tar and reducing the temperature. The first should be done as quickly as possible; the second, as gradually. Now, as the tar is mechanically suspended in more or less minute globules in the crude gas, it is necessary that these globules should be brought into contact with each other, or some hard substance with a velocity sufficient to cause their collapse. This process should be concluded as speedily as possible, while the gas is still hot; and the initial temperature can be maintained as high as is necessary by jacketing the pipes with non-conducting material. But close observation has shown that, to maintain the temperature by the use of steam introduced in any manner, no matter how carefully it may be handled, will not result in good—indeed, it must be so, as a second distillation on a totally different basis is naturally set up, and the two processes cannot go on harmoniously together. No doubt, if practicable, cooling the gas should not commence until all the tar has been deposited; but as this is at present unattainable, let us get as near perfection as we can. The question of condensation was in 1882 made a special subject of inquiry by the Institute, and greater uniformity of condensing arrangements might reasonably have been expected to commence from that date; but nothing strikes an observer more than the diversity in pattern of the apparatus employed to prepare the gas for the removal of the ammonia.

The succeeding operation of washing is not likely to fail for want of efficiency.

Washing. The apparatus now employed takes many different forms. Some may be more economical than others from a structural point of view or in after manipulation; but all do their work well—indeed, in most cases too well. More damage is done than is generally supposed by over-washing. Care should therefore be taken to guard against this extreme, so that the illuminating power may not suffer, as well as to avoid its after-influence during the process of removing sulphur. Some time since, experiments were made by Mr. C. F. Goodno, of Dedham, Mass., on the effect of condensation and washing on the illuminating power of gas. These were undertaken from the knowledge that a very minute variation in the percentage of absorbable hydrocarbons by volume is sufficient to materially influence the illuminating power. In view of the general opinion that lime in the purifiers absorbed hydrocarbons from the gas, a number of trials were made by passing gas through a layer of oxide or a layer of lime, each about 12 inches thick; an examination of the gas being made for hydrocarbons, by means of "Hempel's" apparatus, before and after treatment. The result of nine separate experiments was to show that the percentage of absorbable hydrocarbons was not reduced by passing through lime or oxide. The gas was next examined in a similar manner as to the effect of the passage through a pipe condenser and a washer, consisting of a rectangular iron box with alternate shelves, supplied with 4 to 5 gallons of fresh water per 1000 cubic feet of gas passed. The average of five experiments gave a loss of hydrocarbons to the extent of 0.36 per cent. These results were so striking that, for satisfaction, the experiments were retried at my own works, the effects being fully borne out. While trying these experiments, an important light was thrown on the influence in after-purification of over-washing the gas; and continued trials and many observations enabled me to fix what in my mind should be the end of the duty of the washer and scrubber. It is not wise to push washing and scrubbing to the point of perfectly clean water, or to eliminate the last traces of free ammonia from the gas before passing it on to the lime boxes, or lime and oxide boxes, as the case may be; for it may be presumed that we have all, without exception, advanced to the position that purification dependent upon oxide without a due proportion of lime, is indefensible, as being incomplete and extravagant. A series of experiments,

made with a controllable scrubber, showed that the illuminating power of the gas suffered by the removal of the whole of the free ammonia in such a manner as to reserve a last chamber of clean water at the outlet of the scrubber. A second chamber of clean water accentuated the evil; the reduction of illuminating power being measured as ranging between 3.3 and 7 per cent. Continued trials further demonstrated that clean water freely applied reduced the lighting power to an alarming extent; and so it became important to determine in practice the point to which washing should be carried. This point is reached when the gas leaving the scrubbers contains from 4 to 6 grains of free ammonia in 100 cubic feet. The value of this ammonia, if extracted, is insignificant. It is not my intention to enter into or notice what should now be regarded as old methods of purification; they should be considered obsolete, and observed from an historical point of view only.

The two systems holding the field are the Claus ammonia process, and the oxygen process—the so-called "air arrangement" being an offshoot of pure oxygen.

When in Belfast, attending the meeting of the North of Ireland Gas Managers' Association, an opportunity was afforded me of examining the Claus process, although not in use at the time, the pumps having been stopped for repair owing to the great difficulty of keeping the rods and stuffing-boxes sound, due to the natural action of ammonia on metal. From this cause, the loss of ammonia was so large as to reduce the available quantity below that required for complete purification. The pump difficulty, in conjunction with the waste of ammonia, which rapidly reduces the quantity below what is required for continued purification, has hitherto been the great drawback to a very fascinating system—one from which, it must be confessed, we all had great expectations. But as difficulties are seldom insurmountable when seriously grappled with, we may hope to hear more of this truly scientific process in the future.

Personal experience of pure oxygen enables me to speak well of it. On more than one occasion, the result of my experience has been laid before the Institute; and from time to time additional facts, the results of further experience, have been communicated to the technical press, in order that it might be known if the data then relied upon had been established. In working this system, practical experience has ripened without in any way altering the facts as already stated.

The conflicting accounts given by users of air with lime or lime and oxide, render it extremely difficult to arrive at any definite conclusion with regard to its use. Since 1888, air seems to have behaved itself better than it did in days gone by; nor does it now, according to some experimentalists, depreciate the lighting power of hydrocarbon gas by admixture, as it used to do. In 1888, we hear of 2 per cent. of air being introduced into oxide of iron purifiers, without depreciating the illuminating power. In 1890, the percentage that could be safely used with lime was reported as increased to 4 per cent.; this quantity having practically no effect on the illuminating power, or at most, equal to 1-10th to 2-10ths of a candle. And it was stated that 3 per cent. improved the luminosity. In 1891, it was found, by a more careful observer, that 1 per cent. of air reduced the illuminating power 0.25 of a candle only; but as this result, even if correctly recorded, was gathered from experiments which were not on all-fours with those reported as applying to oxygen, they are of little or no value as a comparison. The trials referred to were made with an Argand chimney full of flame, without any regard to the arbitrary 5-foot burner, fixed by the Statute, and apart from the question of the most equitable test for lighting value.

It is but little comfort to the gas consumer, who, as a rule, burns his gas in small quantities, to be reminded that if he burns it in larger bulk, under certain conditions—whether he wants the extra light or not—he will obtain better results, as far as light for quantity is concerned. But according to the experiments of Dr. Schilling, made recently, and referred to later on, this hypothesis is also untenable. The point selected for the intake for air is sought to be made responsible for the divergence from well-ascertained data, with regard to the effect of nitrogen on the illuminating power. Be not deceived. It has been clearly proved that

nitrogen, mechanically introduced to coal gas at any point of the apparatus, during the ordinary process of distillation, cannot be made a carrier of hydrocarbons as far as the gasholder.

Dr. Schilling, in his paper read before the German Association of Gas Engineers (referred to in the JOURNAL OF GAS LIGHTING for Jan. 12, 1892, p. 65), gave the effect of air on illuminating power as follows:—

Per Cent.		With a Slit Burner. Depreciation.		With a Regenerative Burner. Depreciation.
2	..	14.5	..	16.7
4	..	26.8	..	25.8
6	..	37.6	..	35.3
8	..	48.2	..	47.8

Reduced to unit percentages, the slit burner gave a depreciation of from 6.02 to 7.25 per cent. per unit of air. The regenerative burner gave 5.88 to 8.35 per cent. The depreciation of illuminating power therefore ranged from 7 per cent. per unit for 2 per cent. of air, to 6 per cent. per unit for 8 per cent. of air. These experiments agree closely with my own made and published in 1888. But it is interesting to notice further, that the results recorded by Dr. Schilling are practically the same with the flat-flame burner as when consumed in bulk with the regenerative burner; but are in direct conflict with the statements made during the reading of the paper on "Purification" at the Institution of Gas Engineers in May, 1891, and prove the use of air to be unjustifiable and extravagant.

Here let me say it is my desire not on any account to be misunderstood. No accusation is made that gentlemen do not record what they regard as honest conclusions; but they may be either insufficiently informed, have founded their opinion on insufficient data, or may be liable to prejudices which may bias their judgment. Purification is no doubt better understood to-day than at any previous period of our history; nevertheless, much remains yet to be learned and applied. If all would do as they should to contribute their quota of experience to the general fund of information, with the single desire of arriving at the truth of certain principles, and would approach the subject with an endeavour to obtain complete, clear, and solid knowledge on which we may rely for the future, we should accomplish much, and succeed in dismissing error, which may be founded on insufficient data, and passes current principally on the very shifty ground of "Authority."

Care should be taken never to obtain knowledge in a slipshod way. There is great danger of obtaining information, and deciding important questions right away, on what is called "Authority," without giving the necessary time for patient and impartial examination; hence, those who do this are either liable to be led astray by erroneous statements, or, by refusing to examine what is brought before them, are compelled to an opinion which they hope will find expression in some other quarter for which they will not be responsible but may safely quote. It is hard to most men to be rid of intuitional feeling, dangerous though it be. While there can be no royal road to knowledge, one may admit that many learned and scientific men, much to their annoyance, after years of thought, discussion, and research, have arrived at a conclusion which has already been in practice from sheer force of intuition. Still, even on that account, we should not advocate the doctrine of intuition. It is a dangerous one. Knowledge and judgment should alone be relied upon to guide; but, dangerous as this trust in intuition undoubtedly is, and disastrous as its record may be, it is not one whit worse than that of its rival "Authority." The man who is educated, is more likely to be wise than he who is not; but education and judgment by no means go together.

Let me conclude my remarks on purification by relating the experience which occurred while testing for illuminating power during the washing process already referred to. It may prove useful and will perhaps be of interest. It may be mentioned that it has been a habit for many years, while experimenting, to watch the effect of the experiments in other departments of the manufacture, as well as the one under immediate observation. In this way, it was found that free ammonia in the unpurified gas was not only necessary to maintain the illuminating power, but was an aid to after-purification. It is well known that, if every trace of free ammonia is removed before passing the gas through lime, the action of the lime will liberate the fixed ammonia; and although no free ammonia is at the inlet, free ammonia will appear at the outlet in larger

quantities than is sometimes desirable. If oxygen be used, by leaving a little free ammonia to enter the lime purifiers, it will be found that the free ammonia at the outlet is less than when the gas enters entirely deleted, and further that the free ammonia and the ammonia freed by the lime entering into combination with the sulphur forming sulphide of ammonium aids greatly in keeping down the sulphur compounds.

It is not my intention to dwell on the general question of our bye-products; they are sufficiently discussed day by day. But let me make a remark or two in connection with the principal product—viz., coke—which is among the topics that interest companies, corporations, and the public alike, seeing that it has taken two generations to impress the public with the advantage to be derived from using this excellent fuel—not so much due to the stupidity of the public as to the indifference of the companies. The take-it-or-leave-it principle was displayed to perfection for half a century. What was not taken voluntarily by an unappreciative public, was barged or carted away to regions unknown, at such prices as to frequently allow it to re-appear in the same district, and enter into competition with the company from whom it was originally purchased.

Many interesting circumstances have tended to end the indifference of companies and corporations to coke sales. (1) Competition in illuminants; hence more dependence on returns from products. (2) The lower maximum price allowed by Parliament in the large number of cases where companies have applied for further powers; and therefore a better intelligence is shown in its sale, in preparing it for domestic use by passing it through a machine for breaking it, and by keeping its value as a fuel well before consumers through continued advertisements. There is one other point, however, which must not be overlooked—viz., the virtue ascribed to it by the public, who are influenced by press notices, that if a smokeless fuel such as coke, or coke assisted by gas, or gas alone could be brought into general favour and use, the nauseating fogs now so prevalent in most of our big cities (especially London) would be a thing of the past. And this is so. It may not prevent fog, that is from the nature of things impossible; but it may to a certain extent prevent its dreadful and sickening blackness.

By a marvellous apparatus, showing much inventive and constructive genius, Mr. John Aitken, of Falkirk, has counted the dust particles in the air. Glasgow air on a wet morning showed 7,500,000 dust particles in a cubic inch of air; in Edinburgh, 4,000,000; in a room, 49,000,000; and in the air above a Bunsen flame, 489,000,000. Even in country districts, he counted 155,000 particles in the cubic inch; and the lowest count, at Lucerne, was from 3000 to 32,000—indeed, that there is dust in the upper regions of the air, is perfectly evident from the millions of meteors which fall into the atmosphere every day. Now, without dust particles in the air there would be no fogs. This, a simple but interesting experiment will prove. If two closed glass receivers are placed side by side, the one containing ordinary air, and the other, air filtered through cotton wool, a jet of steam being introduced successively into them, the following will be the effect: In the vessel containing ordinary air, the steam will rise, and a white foggy cloud will be formed, rendering the vessel thoroughly opaque. In the vessel containing filtered air, the steam remains invisible, without the slightest appearance of cloudiness. Invisible dust therefore is necessarily in the air to aid the formation of fogs—the reason of which is clear and apparent. There must be a free surface for condensation of vapour particles; and this is furnished by fine dust particles. Hence, the greater the number of dust particles, the greater the fog; for a dust particle forms the centre of every vapour particle. In our big cities, how are these dust particles formed? Is it due solely or principally to the combustion of raw coal? No. The brilliant flame, as well as the smoky flame, is a fog centre. If gas is burned in filtered air, there is an immediate production of intense fog when water vapour is introduced. The products of combustion from a clear fire and from a smoky one produce an equally foggy atmosphere. It is the sulphur emanating from coal combustion that is the active agent of fog in large towns. Burnt sulphur condenses in the air to very fine particles; and the quantity thus formed is very great. It is calculated that in London nearly 100,000 tons of sulphur are produced annually, and thrown into the air in

this way; or in one winter's day about 350 tons. Professor Roscoe remarks that no evil is without its compensation. This enormous daily formation of sulphur is spread by natural means over the entire area of the great city, and serves to counteract the death-laden germs constantly being discharged from the refuse heaps and sewers, and so guard the entrances to the houses by its deodorizing and anti-septic properties. This is somewhat of a digression; but it is introduced as interesting to some who have not thought of the causes of the formation of fogs. It is also important that these facts should be kept well before the general public, in order that the due advantage of coke and gas as fuel may be better understood and appreciated by the community at large.

Press of other matter not a whit more interesting has interfered with my intention to deal at considerable length with the subject of consumption. The original articles on "Lighting," published in the JOURNAL OF GAS LIGHTING early in the year, calling attention to a subject much, if not altogether neglected, and which furnished good, useful, and reliable information treated from a scientific standpoint, were a real contribution to the literature of the Industry, reflecting credit alike on the author and publisher; and are in marked contrast to compositions bearing the clear impress of hurried writing, which mislead rather than guide. Among the most useful books published or in course of publication in connection with gas literature, is one entitled "Bibliography of Coal Gas"—being a subject-index to articles published in connection with coal gas to the end of the year 1891, edited by a well-known member of this Institute, who has done good service in bringing together in reference form that which would otherwise be lost to a very large majority of the profession.

The rapid improvement in gas-burners and in methods of heating and consuming gas for other purposes can be definitely traced back to the Exhibition held at the Crystal Palace in 1882. The regenerative system, then in its infancy, has now accomplished nearly, if not as much as can fairly be expected in that direction; while incandescent lighting will in the future occupy more of our attention. Indeed, much that does not appear on the surface is intimately dependent upon this further development; and although at the present moment there seems to be no incandescent burner in use that thoroughly satisfies what should be demanded of a burner of this class, yet there are indications that it may not be long in arriving.

The uppermost question of the hour, **Oil Gas.** agitating the minds of thinkers in our profession, is the value of oil as a substitute for coal, either completely or in part; and the subject naturally ranges itself under these two heads of complete or of partial substitution. With regard to the first, the subject for a limited time was treated with a seriousness that in this country at no period up to the present has it really deserved. Complete information with regard to oil-gas manufacture is not at our disposal in England; but America furnishes us with sufficient instruction, if sought for with an open mind. With this end in view, early in the year, the best authorities on the question in that country were communicated with; and from information furnished me by Mr. Alex. C. Humphreys, of Philadelphia, together with Mr. E. C. Brown, the Editor of the *Progressive Age*, and the late Mr. George Shepard Page, an endeavour has been made to form some opinion on the subject, which may be of interest.

Under the first head of "Complete substitution"—that is to say, where gas was manufactured from oil instead of from coal—it was thought that a comparison of the total capital employed under the respective systems, the price charged, and the illuminating power obtained, would be some guide as to the estimation in which these rival manufactures were held by investors of capital, and through them, the opinion of the public who support them. The task undertaken, you may be assured, was an onerous one, the result of which will now be given as shortly as possible. The 289 works manufacturing oil or water gas employ in round figures \$88,000,000 of capital, or about £17,600,000; the 538 works manufacturing gas from coal employ \$173,000,000 of capital, or about £34,600,000. In 1891, the price at which oil gas was sold for lighting purposes averaged, for works with a capital of \$250,000 and over (= £50,000), \$1.60 per 1000 cubic feet (about 6s. 6d.); for works with \$100,000 and under \$250,000 of capital (£20,000 to

£50,000), \$1.91 (about 8s.); or an average throughout of \$1.77 (about 7s. 3d.) per 1000 cubic feet—the prices ranging from \$0.30 to \$3.25; for works employing a corresponding capital, coal gas was sold at an average of \$1.72 (about 7s.), ranging from \$1 to \$3.50 (4s. to 14s.); and \$2.17 (or about 8s. 6d.), ranging from \$1 to \$5 (4s. to 20s.). The average illuminating power was as follows: Oil gas, 25 candles; coal gas, 19 candles. The minimum was: Oil gas, 18 candles; coal gas, 16 candles. Figures in a paper are tedious, and they have therefore been cut as short as possible; but the details will be found filed in the Library of the Institute for future use by any of our members.

It needs but little acumen to point the moral of these figures. It is true that capital outlay in America is considerably higher per thousand cubic feet of gas made than in England, but the range of price for oil and water gas, however manufactured, cannot possibly compete with coal gas, even in our northern cities, at anything like the price obtaining for coal in this country.

On Jan. 5 of this year, the late Mr. George Shepard Page wrote me as follows:—

Coal gas is steadily gaining ground again, and cannot fail to occupy the principal place; water gas being used mainly as an enricher. Water gas cannot be made as cheaply as coal gas at any point in the United States 150 miles distant from the anthracite coal-fields and the oil regions.

This opinion is not, however, shared by the water-gas men of America; and it may therefore be well to quote from another letter received from Mr. A. C. Humphreys, who, in February and April of this year, wrote:

The term "oil gas" is used to denote gas made by the ordinary distillation of oil in retorts, as distinguished from water gas made in cupolas and enriched by oil. It is estimated that during the past year (1891) there has been erected water-gas apparatus of a capacity of 24,700,000 feet per day, which means an increase of about 11 per cent. of the water-gas plants. This shows the activity in this special line of the gas business, accounted for by the fact that we have cheap oil, with which to co-operate; but it is also largely accounted for by the fact that the American public demands probably more than any other people on the globe, a high candle power light. This was very clearly demonstrated when the Pintsch light was first introduced in America. While its admirable mechanical details met with the approval of the railroad men of the United States, the lamps as first sent over by Pintsch were judged as being entirely insufficient; and those of the railroad men who had been travellers were opposed to the introduction of Pintsch, because they had formed their opinions from the poorly lighted cars which they had travelled in on the Continent. To make it a success on this side, therefore, it was necessary to expand in the direction of high candle power lamps; and nothing could be done with the railroad people until it was demonstrated that you could read perfectly in every seat of a long car. Electric light has been a very strong competitor of gas, and met with a very warm reception from the gas consumer of America, because it offered something new, and something more brilliant than he had been used to. It has been found, in the running of gas-works, that the only way the electric light could be competed with, was by supplying, say, not less than a 25-candle power water gas, or coal gas enriched with water gas. It has also been found that, where this course has been followed, care being taken to always treat the consumers as they had a right to be treated—supplying them with a uniformly even quality of 25 to 30 candle power gas—at the end of two years, we had nothing to fear from the electric light, especially the incandescent. Our larger cities are now almost entirely lighted with water gas. In New York, but little coal gas is made. I think I am correct in saying that it is only made at the old Manhattan station; all the other stations being water-gas stations. We have recently finished for the great Consolidated Company, at their Twenty-first Street station, one plant of 7,000,000 feet capacity per day; and they have there a like capacity from their old sets, under the Tessié du Motay patents—water gas. They have many other stations in the city equipped with water gas. Chicago is making all water gas. Baltimore, I think, is making all; if not, there is a comparatively insignificant amount of coal gas made. Boston is making both—I think about half and half; and so on through the list. Here, in Philadelphia, where the gas-works are run by the Municipal Authorities, coal gas was deeply rooted; but to-day, about one-third of their output is water gas, supplied under contract, into the city's holders, at a given price in the holders.

Reluctantly, I am compelled to bring to a close my remarks under this heading, and acknowledge my desire to pursue the subject further. My own distinct opinion, however, is that any system of using oil that does not properly crack it up in the presence of some good and suitable carrier of hydrocarbons, is wasteful, and to be avoided. On this point, I am tempted to again quote from Mr. Humphreys, in reply to certain queries I had put, where he says:—

There has been a great deal of work done in connection with the use of oil in retorts, both in the making of an oil gas direct and in the making of it in connection with coal gas, and in the ordinary coal-gas retort. Considerable carburetting is done in this direction, and some of it is more or less successful. I always, however, regard this as a subterfuge. Of course, you can, if you are willing to put up with the annoyances, &c., enrich your coal in this way; but you must not expect to obtain the advantages that can be obtained through the

enrichment by oil of the water-gas process, because in the latter case you have a diluent which is an extremely good one for the carrying of hydrocarbons. In the case of oil introduced into the retorts, you simply put the oil gas into the gas to be enriched, without adding any diluent specially capable of carrying it.

In leaving this part of my subject, allow me to call attention to the unsatisfactory method pursued at most works where enrichment must take place, to raise the illuminating power to a certain point. This is generally done by mixing the gases in the retorts, either by injecting oil or admixture of cannel, sending the mixture as made on to the gasholders. This is a most extravagant mode of procedure; involving an unnecessary margin in the material used for enrichment, as well as the certainty that the better quality gas will leave the holder without mixing with the general contents. Enrichers, from whatever material made, should be suitable to the gas to be operated upon, should be manufactured and stored in a separate holder, and should be mixed intelligently with the gas to be enriched as it is being delivered to the district. In this way, any desired illuminating power may be maintained without an unnecessary margin for safety, and with absolute reliability. It will be found that great economy follows the use of this plan.

The Royal Commission on Labour may certainly be regarded as a notable event, if only from the point of view of the opportunity it has given to observers to acquire a more complete knowledge than heretofore of the general state of the labour market in all trades, and amongst all sorts and conditions of men. Indeed, your Council has thought the events sufficiently important to request your President to comply with an invitation received to give evidence before the Commission, as coming from, and representing your Institute. The President consented; and involved himself and the Secretary right away in a mass of correspondence and work. The returns were so voluminous, so difficult to handle, and so complex to arrange, that he trusts he will receive the forgiveness of any who think more could have been accomplished.

As most of you are aware, eleven questions in all were addressed to the chairmen of the companies and corporations carbonizing about 5000 tons and upwards annually. These questions embraced, as far as the Council could determine, the essential points under review by the Commission. Circular-letters and lists of queries were addressed to 170 works, representing 4,380,090 tons of coal carbonized per annum. Replies were received from 110 works, representing 2,886,501 tons, or 65.9 per cent.; the 60 works not answering represented an estimated quantity of 1,493,589 tons, or 34.1 per cent. In the 110 works making the return, there were employed 5570 men in the yard, 1124 mechanics or artisans, 6067 stokers, and 749 firemen, or a total of 13,510; and in 60 works not replying, the *estimated* number employed was 2872 men in the yard, 596 mechanics or artisans, 3129 stokers, and 350 firemen, or a total of 6947; making the total number employed in the works 20,457. These numbers are without taking into account any of the London works.

The following is a short summary of the replies received. Questions 2 to 5 inclusive referred to the pay received by men employed in gas-works, each set of questions being divided into the following: Number employed (maximum and minimum); average wages per week; number of days per week; number of hours per week; rate of overtime; rate for Sunday labour; bonuses and gratuities, if any; percentage of increase in wages since 1887. Questions 6 to 11 inclusive had references to systems of conciliation, labour disputes, holidays, fines, Sunday rest; and the general remarks of the manager with regard to strikes, or other matter of interest connected with the Labour Commission.

Yardmen and Labourers.—In answer to Question 2, with regard to yardmen and labourers, the pay was found to vary from a minimum of 15s. to a maximum of 26s. per week. The number of hours employed varied from 49½ to 72. The payment for overtime varied from ordinary rate to time-and-a-half. Sunday labour was paid for at from the ordinary rate to double time. The percentage of increase in wages since 1887 was from 3 to 30 per cent. above the amount paid in that year.

Mechanics (Question 3).—The wages paid per week varied from 22s. to 39s. 9d. The number of hours employed ranged from 49½ to 84. The payment for overtime

varied from the ordinary rate to time-and-a-half. Sunday labour was paid for at from the ordinary rate to double time. The percentage of increase in wages since 1887 was from 3 to 38.6 per cent. above the amount paid in that year.

Stokers (Question 4).—The wages paid per week varied from 22s. 6d. to 44s. The number of hours employed ranged from 48 to 90. Sunday labour was paid for at from the ordinary rate to double time. Increase in wages since 1887, from 3 to 50 per cent. above the amount then paid.

Firemen (Question 5).—The wages paid per week averaged from 25s. 8d. to 37s. 6d. The number of hours employed ranged from 48 to 90. Sunday labour was paid for at from the ordinary rate to time-and-a-half. Increase in wages since 1887, from 6 to 50 per cent. above the amount paid in that year.

It has been my endeavour to convey as briefly as possible, in a short synopsis, the information given in answer to these statistical questions (Nos. 2 to 5 inclusive). The impression conveyed, however, would be incorrect without some further remarks accompanying it. For this purpose, we will return for the moment to Question 2, with regard to yardmen and labourers, where it is true the rate of increase in wages since 1887 has been from 3 to 30 per cent. It should, however, be borne in mind that the bulk of works supplying the information asked, have only increased the wages either 5, 10, or 15 per cent.; only eleven works paying an increase of 20, 25, and 30 per cent.

Mechanics and Artisans (Question 3).—The principal increase in wages was from 5 to 15 per cent.; only 14 works paying an increase from 20 to 38.6 per cent.—six of these 14 paying from 15 to 20 per cent. more; and eight, from 20 to 38.6 per cent. more.

Stokers (Question 4).—The increase in wages is stated to range from 5 to 50 per cent. The bulk of the works making the return are under 20 per cent. increase; eleven works, from 20 to 30 per cent.; nine works, from 30 to 35 per cent.; two works, from 35 to 40 per cent.; nine works, from 40 to 50 per cent.

Firemen (Question 3).—The increase in wages since 1887 is stated to be from 6 to 50 per cent. In most cases, the increase is under 20 per cent. But in five works it is from 20 to 30 per cent.; in one, from 35 to 40 per cent.; and in one, from 45 to 50 per cent.

To return again to the yardmen and labourers, the wages are given at from 15s. to 26s. per week. This works out at an average of 21s. 9d. Mechanics' and artisans' wages vary from 22s. to 39s. 9d. per week; or an average of 30s. 5d. Stokers' wages average from 22s. 6d. to 44s.; or an average of 31s. 1d. There are only five works, however, where the wages range from 40s. to 44s. per week; and in every case, it is for seven days' work. Firemen's wages average from 25s. 1d. to 37s. 6d. per week; or an average of 32s. 5d. We may therefore recapitulate the information as far as wages are concerned, as follows:—

		Per Week.
Average amount paid to yardmen and labourers . . .	£1	1 9
" " " mechanics and artisans . . .	1	10 5
" " " stokers	1	11 1
" " " firemen	1	12 5

In reviewing generally the answers given to these statistical questions—answers full of information and instruction—the conclusion forces itself upon us that there is no indication of general over-pay in any of the works' departments; and one is, therefore, compelled to agree that any increase that has taken place was to be expected, as the legitimate outcome of surrounding influences other than those caused by the dictation of Trades Unionists. Our manufacture being a continuous one, wages should be liberal; and we cannot conscientiously admit that they are at present too high. Whether a man provides for the future or no, he should have the opportunity. He ought not to be in such a position as to advance the plea of inability; then if he neglects his duty in this respect, he will gather no sympathy—which is a great point with us all. If we would be served by good and intelligent labour, we must offer it something better than the workhouse or the benevolent fund, after years of faithful service.

I now pass to questions the answers to which may perhaps be more interesting, as they are those recording individual opinions, and may not be such dry reading. Most people's original opinions are more entertaining than their figures.

Question 6, was worded: "Does any system exist in your district providing for conciliation, arbitration, sliding scales,

or other means of preventing or arranging labour disputes?" Only 25 replies were received to this query, from the 110 returns made; and all but one said that they knew of none in connection with gas-works. Many were, however, aware of Conciliation Boards in connection with the iron trade. One gentleman replied "Labour is king," presumably meaning to imply that "Kings do not require Boards of Conciliation."

Question 7 was: "Can you suggest any means of avoiding or arranging labour disputes, and promoting cordial relations between employers and employed in gas-works?" To this question there were 53 replies; and the answers covered five pages of closely-written foolscap. Summary is difficult. The suggestions made were as wide as the poles—ranging from a coercive Act of Parliament to open treaty with the Trades Union. There were sensible suggestions of payment by results, bonus systems, the formation of a superannuation fund, profit sharing, and Boards of Conciliation. It was indeed gratifying to find that the large majority had no desire for any power beyond that of kindness, firmness, and justice; and a large number had never had, nor did they anticipate, any disturbance—their relations with their employees being good.

Question 8 was: "Have you any system of holiday or other privileges to workmen, deferred pay, sick payment, pension, pecuniary assistance in case of accident, or other insurance fund?" Here 101 replies were given out of a possible 110; and although they occupied the space of the last, were not so difficult to summarize, seeing that every works gave to their men holidays of some kind, ranging from 3 to 10 days, with payment during absence. Most gave certain gratuities, payments in case of accident or prolonged illness, double pay for Christmas Day and Good Friday, annual excursions, and other privileges not expected from employers in other trades.

Question 9 was: "Do you make deductions by fines or other forms of stoppage?" Answers to this were received from 104; and were all practically a negative.

Question 10 was: "Have you any system of Sunday rest for men employed seven days to the week?" All but one—viz., 109 out of 110—answered this query. I was glad of this, as, from my point of view, it was one of the most important. Three works ceased work from 6 a.m. to 6 p.m., and two from 6 a.m. to 10 p.m.; but all the others, except in one instance (that of my own), had no system of seventh-day rest. Many said they rested when they could; some, that they did no more work than they could help; in 37 cases no attempt was made to deal with the question. There were three on the light-hour system, which allowed each man 16 hours out of the 24; and in one case only was the return worded: "All employees work six days only, though the rest day for the stokers and firemen does not necessarily fall on Sunday."

Question 11 was: "General remarks on strikes or any subject of interest connected with the Labour Commission." Advice under this head was considerably varied, although only 24 attempts were made to answer. Several advocated compulsion by law, and more stringent application of punishment in cases of picketing or intimidation; some, mutual forbearance, kindness, firmness, argument, and moral suasion, believing that men were amenable to reason, and that motives of self-interest had a sufficiently restraining force. Many had found it so. Others advised agreements for long terms, combination amongst employers, and others a Board of Conciliation, the members to be furnished by this Institute.

In reviewing the answers to Questions Nos. 6 to 11 inclusive, which give individual opinions formed by experience as well as from observation of surrounding circumstances, they must be regarded by us as a very valuable contribution to the general knowledge of the subjects to which they refer, and may be seen in detail by any of the members of the Institute, a copy having been placed in the Library for that purpose.

This impression is left on my mind by a study of the question as a whole, for although given in great detail, they lead up to one general consideration—viz., "Is everything done that might be done to give more general satisfaction to our workmen; or is something done that would be better left undone?" Most of the suggestions were made as a remedy for an existing disease—the disease of discontent, which we all heartily deplore and would gladly remove. All will agree that prevention is better than cure. This will

lead us to examine the ground carefully, to ascertain if there exists anything that might be removed, or if some means can be discovered by which the recurrence of periodical discontent may be prevented.

Again, running through the evidence given, we find the rate of pay fairly good; the intentions of the managers excellent; their desire for a good understanding undeniable. Bonuses, extra pay, holidays, and various other privileges are all accorded with but one object in view—viz., the desire to create contentment. But we fail, and fail most miserably, and why? Why this constant cropping out of discontent? In my opinion, the cause is not far to seek; it is close by, contained in every answer to Question 10—"Have you any system of Sunday rest for men employed seven days to the week?" Only one works out of the number making a return could answer "Yes, we have;" every other works had to confess to only partial attempts, the greatest being one or two who ceased work from 6 a.m. to 10 p.m. This is not a seventh-day rest. To do what is done necessitates the presence of caretakers on the premises, men responsible for the fires and pressures; and a great amount of anxiety and heavy work remains for those who have to start a dead works in the dark on a Sunday night. If anything has been gathered from the returns made, it is the strong evidence that it is in this we are behind other manufactures of an even more arduous character, where the pay is not so good, and the privileges are *nil*. We must set ourselves to face this seventh day's rest question, or we shall never be able to enjoy peace by giving satisfaction to our workmen employed seven days to the week. Evidently it is here we are wrong; and when we try to understand what seven days' labour means, are we surprised? It is more to be wondered at how human endurance can go as far as it does; but at what sacrifice is it done? Seven days' work not only lowers the physique, it undermines the health, and weakens the mind of every man who attempts it. Should we wonder then if we are met by unreasonable demands from men, who are not ungrateful but whose minds and bodies have been degenerated by ourselves and prepared for the hands of the professional agitator? My own opinion is that gas manufacture is a seven days' arrangement, and works cannot be stopped without loss and damage; but, Gentlemen, a seventh day's rest, although it need not—indeed, cannot—always fall on Sunday, is essential to us all, and cannot be disregarded without serious consequences to all. Let me then urge you to set about arranging for a seventh day's rest to each of your men now working seven days to the week. It is not a difficult matter to overcome, nor is it an expensive one. But even were it both, it should nevertheless be granted, from motives of justice to yourselves, to your employers, and to your workmen.

To my mind the question of old-age pensions can be more easily undertaken by gas companies than by most other manufacturing bodies. If gas companies and corporations would combine and form a central association or fund, into which all employers and employed contributed a fair and equal amount, based as a percentage of the amount received by the employed, surely there would be no great difficulty in providing pensions for old age for gas-works employees. At the present time one of the weak parts of the bonus or other systems is that they are confined to individual works, generally large ones. But if the principle were universally accepted or made compulsory in gas-works, large and small, then the removal of a man from one works to another would not interfere with the amount of claim he would eventually have upon the general fund, which should from time to time receive a fixed percentage of the wages earned by the workman or officer as the case might be, together with an equal amount paid by the gas company or corporation. This would then entitle a workman or officer, on attaining a certain age, to receive a pension for the rest of his life, calculated according to the gross amount of pay received; and although a person on reaching a certain age might be legally entitled to this pension, it need by no means follow that he *must* retire on reaching this specified age.

Increased wages paid under the head of profit-sharing would, I think, only act as a temporary stay of agitation; and eventually the cure would rival the disease. If the principle of profit-sharing be admitted, the more serious contention arises, How much of that profit is the equitable share of the workman? To-day he may accept 5 per cent.; but human nature will prompt him within a limited time to

ask for more, and it will be difficult to draw the line as to where that share should end. I rely far more on a fixed rate of wages, maintained as high as can equitably be done, with some arrangement for compulsory saving. When it is remembered that for a payment of 5d. per week, commencing at, say, the age of 21, a sum of £10 per annum can be secured when the age of 65 is reached, or that 1s. per week, paid between employer and employed, will secure at that age a pension of £25 a year, it is worth attempting—always bearing in mind that, should the intended pensioner not reach that age before death, a sum equal to the capital amount paid, with 2½ per cent. per annum added, would be at the disposal of his family. Bonus paid in the shape of profit-sharing is a variable amount, as has been already experienced; and the question suggests itself, if the workman is to share the profit is he also to share the loss? If not, it is a one-sided arrangement—imperfect in principle; the fact being that no remuneration for service rendered can give satisfaction unless it is *wholly* dependent on a division of profits and at the same time embraces loss; or by an arbitrary payment of a wage such as at present exists.

Before taking final leave of the subject, allow me to say a word or two on a kindred topic which more or less directly affects every member of this Institute—viz., the plan followed by companies and corporations when about to engage educated men as officers of their undertakings. It is no uncommon occurrence to find advertisements in the public press in reference to positions in and about a gas-works, from the engineer downwards, which there can be no hesitation in stigmatizing as objectionable and degrading to the self-respect of applicants who should, if suitable for the appointment, be gentlemen. To have reasonable expectation that young men will properly prepare for the profession, and that men in the profession will continue actively to give interest and attention to the important matters that are within their domain, a fair stimulant must be provided by companies and corporations, by offering sufficient remuneration for the services which the members of our profession are called upon to render. It is notorious, however, that whilst companies and corporations fail to provide the one, they rigorously demand the other. How often has the warm blood rushed to the head to see a bare-faced advertisement for an engineer or manager, or both, demanding of applicants full qualifications for these important posts, with an altogether insufficient, or indeed decent sum named as remuneration; and more often than not the candidate is himself to mention the sum at which he is willing to undertake the duties of the appointment. To my mind this is nothing better than putting up to Dutch auction the best interests of consumers and shareholders. This mode of proceeding is now common enough to demand some notice, in order that the attention of directors and committees may be directed to such a suicidal policy, and to point out what will be the inevitable consequence.

Thirty years ago, the want of educated men was keenly felt in the profession. Some clever men outside it saw this and encouraged their sons to study and prepare. The result has been a very marked improvement in all the executive departments of a gas-works. Sufficient margin is left for still further improvement; but how is this to be accomplished if companies assume that there are so many good men already in hand as to make it safe to allow them to compete among themselves on the question of remuneration? Many men now in the profession may from circumstances be compelled to serve their employers at an inadequate salary because they cannot help themselves. They being already in, must remain; but will they educate their sons to follow? No! Indeed, they cannot. To educate their sons as professional men is outside their means—it is more than they can accomplish. What then will be the consequence? Good men will once more be as scarce as they were thirty years ago; and in the place of earnest, striving, hard-working enthusiasts, endeavouring by intelligence and industry to keep pace with the march of Science, and conserve the interests of the great gas industry, we shall see those, who from want of intelligence or interest, or both, will be powerless to prevent other competing industries passing them in the race for existence. The right understanding of this subject is of such vital importance to companies and corporations, that a word or two in season may have the desired effect. Every position, from the

engineer to the office-boy, has what should be its standing market value at the moment of the engagement. Let that value be paid. Do not set up competition amongst the anxious seekers for employment at a time when it is impossible for them to put a proper value on what you wish to purchase from them. Give the man you put in a certain position, whoever he may be, the means of doing what you demand of him—viz., that of occupying the position with self-respect and credit to you. When a position is vacant, let the salary attached to it be known and fixed high—let the remuneration be what it should be; no money can be better spent. There are prizes in our profession as in all other professions. Let those prizes be worth obtaining. Increase their value, and you will raise the standard. Companies and corporations may then rely on securing men of education and judgment, who will do justice to their works and credit to themselves.

It is not too much to say that most writers and speakers on this all-engrossing subject of “capital and labour” end their discourse with the consideration of one or both of these allied subjects; yet there is another consideration more important than either—knowledge. It is known to all how largely the success of an undertaking of any nature rests on the individual. This may be less so in the case of companies, who are the inheritors of what has gone before and who are only called upon to continue existing practices. But without capacity, judgment, and training, how are the new problems arising from time to time for consideration to be properly disposed of by the “Individual” on whom after all rests success or failure? It is acknowledged by all to be impossible for a body of shareholders or ratepayers to act for themselves, and perforce they must elect directors or a committee to act for them. But the usual board or committee can only carry on that which they have inherited, suffering in proportion as they are without good expert advice. They cannot devise new methods, nor suggest fresh developments; their duty properly ceases with the “Organization.” It is impossible to stand still—to attempt it is to retrogress; and without the patient intelligent labour of the individual, no possible work can go forward. Yet companies, corporations, and municipal authorities act as if this fact were unascertained or uncertain, and are too often willing to sacrifice many thousands of pounds, paid uselessly, rather than as many hundreds in fair remuneration that may command servants possessing the necessary qualifications.

I would in conclusion, say that, **Conclusion.** conscious of the deep responsibility that devolves upon the President of this Institute for the time being, it has been my earnest desire to approach the subject-matter of the annual address with a due sense of the importance attached to it by its members. At all times during its preparation, the impression was prevalent in my mind to deal impartially and faithfully with the various topics referred to; and although these may have been imperfectly or superficially disposed of, I am satisfied if I have succeeded in making a few remarks that may be regarded by some as useful; or if I have in any way impressed our younger members with a due sense of their responsibility to themselves, to their employers, or to this Institute; or if any words of mine should be the means by which may be made known the earnest character of the bulk of the men who constitute the members of this Institute, who by their patience and perseverance acquire sound scientific knowledge which they communicate to each other, when they meet from time to time, and who are bent upon showing their determination that this Institute shall worthily continue to hold its legitimate place as the body representative of the great gas industry.

ANNUAL REPORT OF THE COUNCIL.

The following are the principal matters referred to in the annual report of the Council, which forms the subject of the second paragraph in the foregoing address:—

The Council commence by stating that, closely following the successful meeting held at Carlisle last year, an invitation was received from Committee C of the Royal Commission on Labour, under the chairmanship of the Right Hon. A. J. Mundella, M.P., to submit the name of a witness on behalf of the Institute to give evidence before the Committee. In response to this invitation, and to meet the unanimous wishes of the Council, the President (Mr. W. A. Valon) consented to undertake this responsibility. As will have been seen by the address, a great many

details connected with the subject were obtained; and the Council express to those gas authorities who, at their request, supplied statistical and other information, their very cordial thanks for the kindly interest they took in the matter. They also thank the President for the unsparing manner in which he devoted his time and labour in order to carry out efficiently, and to the credit of the Institute, the duties he thus voluntarily undertook. They remark that only those who have had experience in the tabulation and comparison of returns can adequately realize the nature and extent of the labour involved. Provided the necessary official sanction can be obtained, the Council propose to publish in the Transactions the evidence given in connection with the gas industry. In order to continue the procedure found so effective heretofore in dealing with the various matters which, from time to time, come under the consideration of the Council, the three Committees mentioned in last year's report—viz., the Publications Committee, the Technical Committee, and the General Purposes Committee—were re-appointed early in the present session. Allusion is next made to the reference last year to the action of the Inland Revenue Department in seeking to bring sulphate of ammonia works under a clause in the Act 9 & 10 Vict., cap. 90, which makes it compulsory that a "still" licence should be taken out at a cost of 10s. During the past session, the question was again brought under the notice of the Council by an application from the Association of Sulphate of Ammonia Manufacturers for the co-operation of the Institute in aiding the Association to bring the matter to a decision. Acting upon the favourable recommendation of the General Purposes Committee, to whom this communication was referred, the Council agreed that, to a limited extent, the Institute should share with the Association the expense of obtaining Counsel's opinion upon the question. Passing on to deal with the progress of the Institute, the Council state that the position at the close of last year, as regards members, was as follows: Honorary, 21; ordinary, 427; extraordinary, 45; associate members, 30; and associates, 57—making a total of 580. Last year 26 candidates were elected as members, eight as associate members, and one as an associate; two additions were made to the list of honorary members, and four transferences took place to the class of members. While regarding these figures with satisfaction, the Council call special attention to the fact that the capabilities of the Institute, and the advantages it can offer, are largely dependent upon the number of its members; and they point out that it is important not merely to keep up, but also to increase, the numerical strength. Reference is next made to the loss the Institute has sustained by death. The members who have passed away are: Samuel Barratt (Manchester), William H. Bennett (London), Charles E. Broadberry (Waltham Abbey), Joseph C. Colver (Sheffield), Josiah Deakes (Worcester), Neill Meiklejohn (Longwood), George Shepard Page (New York), and John Stores Smith (Sheepbridge). Feeling reference is made to Mr. Bennett's work as Secretary of the Institute from 1869 until 1888; and the Council consider that, in placing upon record a few words expressive of respect for his memory, they are acting not only in accordance with their own sentiments, but also with those of the members generally. A list of donations to the library is appended to the report; and the Council tender, on behalf of the Institute, their thanks to the respective donors. With respect to the financial position of the Institute, attention is called to the fact that on Dec. 31 last, to which date the accounts are made up, the legal expenses in connection with the incorporation of the Institute and those attending the publication of the Transactions were still outstanding. The Council are, of course, anxious to clear off these liabilities as quickly as possible; and they think that, to a great extent, this could be accomplished out of the ordinary income, without having recourse to the realization of invested funds, if the subscriptions in arrear were promptly remitted. Having in their recollection the financial support formerly accorded to the Institute by various gas companies and corporations, the Council issued towards the end of last year a circular to the various works represented in the register of membership, soliciting the continuance of this support. The appeal, although made late in the year, brought a number of responses before its close; and further contributions have been received during the present year. The Council place on record their thanks to the subscribers, and assure them that they will endeavour that the work of the Institute shall be productive of good to the gas industry; and thus merit the support received. The final paragraph of the report states that, in accordance with the regulations connected with the Birmingham Medal, the Council have decided to make the award of the medal this year.

An appendix to the report contains the recommendations from the three Committees referred to therein. The Publications Committee, of which Mr. J. Hepworth is Chairman, suggest for the consideration of the Council the desirability of giving, in an early issue of the Transactions, a general index to the papers and communications which have appeared from the commencement. Expenditure in this direction would, in the opinion of the Committee, be amply repaid by the advantage of having at hand so useful a reference to past proceedings. The Technical Committee, which is also under the chairmanship of Mr. Hepworth, having in view the importance of the gas industry to the public in connection with the supply of light, heat, and power,

suggest to the Council the propriety of endeavouring to obtain a subsidy from the grant which is annually made by Government to scientific institutions for the purposes of research. The Committee are aware of the limited funds at the disposal of the Institute; and therefore recommend that, with a view to extending its general utility, an application should be made in the proper quarter for assistance in prosecuting scientific research in matters connected with the gas industry. The Committee have under consideration several important subjects, and the results of their investigations thereon will be presented in due course. The General Purposes Committee is under the chairmanship of the President (Mr. W. A. Valon). The Committee report that they have had under consideration a letter from the Association of Sulphate of Ammonia Manufacturers, asking the assistance of the Institute in bringing forward a test case, in order to settle the legality of the action of the Inland Revenue Department in regarding sulphate of ammonia works as being subject to the operation of the Inland Revenue Act. Having taken into consideration the fact that many members of the Institute are manufacturers of sulphate of ammonia, and that the final settlement of this question would be a matter of considerable interest to them and their undertakings, the Committee recommend, as already intimated in the Council's report epitomized above, that the application of the Association should have favourable consideration.

The Berthelot-Mahler Calorimeter.—An interesting feature of the meeting of The Gas Institute this week will be the exhibition, by Mr. B. H. Thwaite, Assoc. M. Inst. C.E., of Liverpool, of the Berthelot-Mahler Calorimeter, which he described in the course of a paper read at the recent meeting of the Iron and Steel Institute in London. He will also, if permitted, give a few notes on the calorimetric value of gas, determined by M. Pierre Mahler in conjunction with M. Sainte-Claire Deville, son of the distinguished French chemist and engineer.

Presentation to Mr. J. Chadwick.—The members of the Oldham Gas Students' Association have recently presented their President, Mr. John Chadwick, the Engineer of the Oldham Corporation Gas-Works, with a handsome carbon portrait of himself, on porcelain. The presentation was made on the occasion of a picnic to Marple and Romilly. Mr. Arthur Andrew, on behalf of the members, asked Mr. Chadwick to accept their gift; and, in doing so, he traced the history of the Association during the 25 years of its existence. Their President was one of the founders; and he had been at their head for a number of years. Mr. Chadwick, in acknowledging the present, confessed that he had been taken completely by surprise; and he thanked the members most sincerely for their kindness.

A Water Supply Map of London.—We have received from Mr. E. Stanford, of Cockspur Street, Charing Cross, a copy of the Water Supply Map of the County of London, which he has lately published. It forms one of the "Government of London" series; and it shows the boundary of the jurisdiction of the London County Council, and the areas supplied within the county by the eight Water Companies. The district served by each Company is coloured a light tint; the portions under constant supply being tinted a darker shade. This is a good plan, because it allows the extensions of the constant service to be recorded from time to time as they are made. Where two Companies supply the same district (as in the case of the Southwark and Vauxhall and Lambeth Companies), the area is tinted in bars of the colours assigned to each Company. The map bears in one corner some useful statistics relating to the Companies, and concise information as to their sources of supply and storage capacity. At the present time, when so much attention is being given to the Metropolitan Water Question, the map will be found to be specially valuable to all officials.

The Portland Cement Trade of the World.—According to a paper recently read by Mr. Giron before the Engineers' Club at Philadelphia, dealing with the Portland cement trade of the world, the annual production of this article in Europe amounts to upwards of 20 million barrels, the commercial value of which is about £7,200,000. Cement manufacture was first introduced into Germany in 1852. Now there are in the Empire 60 large works, the annual production of which is the same as that of the English works. In France the industry grew slowly. The total production in 1880 hardly exceeded 750,000 barrels a year; now it is 1,800,000 barrels. The works of the Company of French Cements at Boulogne form the largest Portland cement factory in the world, turning out about 800,000 barrels a year. In Russia the first works were established in 1857; and there are now eight factories, producing annually 900,000 barrels. In Belgium there are four works, turning out 800,000 barrels. In Italy the industry does not really exist, although a certain kind of natural Portland cement is made. In Denmark and Norway and Sweden there are ten factories, making about 800,000 barrels yearly. Portland cement was taken into the United States as early as 1868. In 1882 the amount imported was 370,406 barrels, last year it exceeded 3,000,000 barrels. Little effort has been made to develop the manufacture across the Atlantic; the cost of the system being very much too great to make it successful.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1136.)

LAST week was an extremely quiet one in the Stock Markets. The weather was too fine for the Whitsuntide holiday makers to hurry back to town; and consequently the attendance was decidedly light at first, while later on the approaching settlement engrossed most attention. The event of the week was the stoppage of the New Oriental Bank; but that created very little disturbance, and none at all beyond its own legitimate sphere of influence. There was some disposition to sell at first. But it did not last long; and a full recovery was effected before the end of the week. Money continues in the same state of plethora—seeking employment, and finding none. Never was there a greater supply of any commodity when it was least wanted. The Gas Market has been exceedingly quiet; transactions throughout the week being so extremely restricted as to be scarcely worth mentioning. Changes in quotation also have been few and slight. The tendency on the whole has been rather downward, although the chief issue—Gaslight “A”—has moved in the other way. The best prices of the week, however, were in the early part of it, from which point they gradually drooped away—marking 208 at the close, against 212 on Wednesday. Hardly anything was done in the debenture and preference stocks; but several transactions were effected in the “H” 7 per cent. limited at good prices. In South Metropolitan, the “A” has been put down 5 more; but no business was marked in it. A few dealings were done in the “B” at figures rather below the average. Commercial were little touched; but the new stock was offered on easier terms; the quotation falling 2½. The Suburban and Provincial Companies were without any feature whatever. Business was just as quiet in the Foreign department as in the Home. Among the Continentals, Imperial continued to recede to a slight extent; the quotation showing a loss of 1. The rest presented no point calling for notice, except Chicago First Mortgage Bonds, which rose 2½. The Water Companies, on the whole, were very firm, though East London fell 2; and pretty well all transactions marked were at good prices.

The daily operations were: Gas was very quiet on Tuesday, the opening day; but the tendency was favourable, Gaslight “A” advancing 1. East London Water fell 2. Wednesday was just as quiet. Gaslights were firm; but South Metropolitan “A” fell 2. Chicago First Mortgage Bonds rose 2½. Thursday brought no increase of activity; and everything remained quite stagnant. There was not much more done on Friday; but quotations moved down—South Metropolitan “A” receding 3; and Imperial Continental, 1. In Water, Lambeth rose 1½; and ditto, 7½ per cents, 1. Saturday was like the rest of the week; for it could not easily be quieter. The only change was a fall of 1 in Commercial new.

ELECTRIC LIGHTING MEMORANDA.

Another Illusion Gone—No Profit on Electric Lighting in America—The Blackpool Corporation Electric Lighting.

It is to be feared that by the inconsiderate publicity given to the messy cooking by electricity at the Crystal Palace, a deadly blow has been struck at one of the most cherished privileges of the modern mystical story-tellers of whom Marie Corelli may be taken as the best representative. These writers, some of whom, like the clever authoress named, appear to take themselves quite seriously, have been very fond of dragging in electricity to explain all sorts of things for which no intelligible *rationale* could be given. Like the old lady with that “blessed word Mesopotamia,” our imaginative novelists thought they had safely laid up in the mysterious form of energy known as Electricity a measureless store of occult power which could always be drawn upon to good sensational effect. But this must now be given up. It was all very grand and noble to write about “electric circles” while electricity was hardly known even by name to the novel-reading multitude. But to a Philistine who has seen shaving-water boiled by electricity, omelettes fried, and curling-irons heated by it, there is little romance left in the word. It is a mournful disillusionment; but we fear it is impossible any longer to conceal the crude truth that there is nothing essentially more awe-inspiring in electricity than there is in the weight, the bulk, or the chemical affinities of that unromantic matter, the very name of which is so repellent to the fine spirits of the mystics. May it not be said, moreover, that there is a spice—just a suspicion—of vulgarity about these recondite people, in respect of their ignorant haste to pay homage to electricity, merely because it is the latest attribute of matter which the laboriously inquiring human mind has been able to envisage? What our modern mystics have done in respect of electricity, is only the same as their forefathers did when chemistry was the very latest thing out, and their ancestors in the yet earlier time when mechanism was coming to the front in a world of animal power. How little of originality there is in the human (literary) imagination! *Omne ignotum pro magifico* is still the universal rule; and with none more than with those who profess to be most “emancipated.” The truth is

that there is nothing in the universe more wonderful than another thing—no aspect or effect of Nature more mysterious or awful than another; but all things and processes are part of the Cosmos which we know of as existing, because we ourselves exist, but which we shall never comprehend.

The National Electric Light Association of America is an organization of the same class as the many Gas Managers' Associations of the Continent—that is to say, its membership is chiefly made up of men who are practically engaged in the industry from which its title is derived. The associated electricians meet and read papers and discuss them once a year; but anyone who may have had an impression that there must be something very scientific and abstruse about even commercial electric lighting would be cruelly undeceived by perusal of the printed records of one such meeting. Like all other traders, the Yankee electricians think more of dollars than of physical science problems; and their papers and debates are consequently of little interest or value to anybody, even if engaged in the same business, who has to deal with a different set of circumstances. Yet it is worth while to bestow an occasional glance over the transactions of the associated American electricians, for the purpose of correcting the roseate view of the condition of electrical industries in the United States to which we are occasionally treated by our advertising electrical specialists. At the last meeting of the Association, which was held in Buffalo, a Mr. Ernest Wiman read a paper which was a singular mixture of “high-falutin” and frank admission of facts. It is unnecessary to repeat any of the former; but some of Mr. Wiman's rational statements are worthy of notice. He confessed that while electric lighting is in the United States “an article of merchandise of real value, for which there is a strong demand,” the “question of profit remains to be decided in very many localities.” He had instituted a general inquiry into the condition of electric lighting business all over the States, and had come to the conclusion that, in order to make it go down with the public, the price of incandescent electric lighting was generally too low to pay the suppliers. “The public estimation of the cost of electric lighting has been allowed to prevail to an extent destructive of profit.” Mr. Wiman goes on to admit that, “taken as a whole, the result in the shape of a total profit on the total investment in electric lighting is not to be seen in the shape of dividends.” What a commentary is this upon the parrot-talk of our English electricians about the wonderful popularity of electric lighting in the States, and the injury inflicted upon the British industry by the Electric Lighting Acts! Mr. Wiman quotes one gentleman—the president and manager of five electric light companies, some of which are bankrupt, and not one being in a really satisfactory position—as saying: “I am aware that books can be kept so as to show an earning; but this is, in many cases, at the expense of a constantly depreciating capital investment.” We seem to hear an echo of this remark from more than one locality nearer home.

In another column we give some particulars, taken from the report of the Superintendent, Mr. William Chew, upon the working of the Blackpool Corporation Electric Light Department. This is an exceptional venture—only arc lighting being at present supplied, and this even being confined to the Marine Parade, where it forms an attraction to promenaders during the summer months. We cannot gather from the report the exact number or consumption in amperes of the lamps now in use for this purpose; nor do we understand when, or under what conditions, the Blackpool Corporation contemplate supplying incandescent lighting, with the exception that they will not be empowered to charge more than 8d. per unit, at which price it will be four times the cost of gas to the local consumer. Taking all working charges into the account, but not including anything for depreciation or interest on capital, Mr. Chew finds that their electricity cost the Blackpool Corporation after the rate of 8·70d. per unit last year, or 6·48d. per unit without the maintenance and renewal of the masts. If this is the cost of electricity to the Corporation of Blackpool, working under unusually favourable conditions, with the son of their own Gas Manager taking the supervision of the plant, and doing his best to keep expenses as low as possible, one can but form the opinion that there must be an unpleasant “secret” in store for those local authorities who fondly imagine that they can sell current at a profit for 6d. per unit.

The Transactions of the Sanitary Institute.—We have received from the Secretary of the Sanitary Institute (Mr. E. White Wallis, F.S.S.) the volume of Transactions of the Institute for the past year. It is somewhat smaller than usual, owing to the usual autumn meeting not being held, in consequence of the holding of the International Congress of Hygiene and Demography. It, however, contains, in addition to the annual report and statement of accounts, three papers read at sessional meetings; one being on the “Sewerage of the Town of Maldon (Essex),” by Mr. R. F. Grantham, M.Inst.C.E., which has been already noticed in the JOURNAL. There is also a lecture by Sir Douglas Galton, on “Ventilation and Measurement of Cubic Space.” In addition to the usual lists of members, &c., there is given in an appendix a catalogue of the Parkes Museum, the plan and general arrangements of which are shown on a plate.

FRENCH RULES FOR LIGHTING.

(Continued from p. 1056.)

AFTER discussing the subject of the mean lighting of a surface, as noted last week, Dr. Palaz takes up that of the distribution of lighting from sources which, like the electric arc, do not radiate equally in all directions. Electricians always endeavour to make a great point of the peculiarity of arc lights, in radiating their strongest light not immediately underneath the lamp column, but at an angle of about 40° with the horizontal. M. Wybauw has prepared some clever diagrams to illustrate the effect of different kinds of light-sources, which are noticed by Dr. Palaz; but we are soon led to consider the method of studying the problem of lighting proposed by M. Loppé, of which the author appears to think highly. M. Loppé proceeds upon the assumption that the luminous intensity of his light-sources is equal in all directions; and he poses the problem of lighting a surface from sources placed at the summits of equal squares. So far as we are aware, this treatment of the subject has never before appeared in English. It proceeds as follows: Let us suppose four sources of equal uniform intensity, of equal height, placed above a horizontal plane, at the summits of a square, what is the point of the plane situated in the interior of the square which has the lowest lighting intensity? It is found that the point of meeting of the diagonals of the square receives the least light when $h > a\sqrt{3}$, where a = half the distance of the lamps apart, and h = their height.

The next problem to be dealt with is the lighting of a horizontal plane by means of sources of uniform intensity, so that the intensity of lighting at any point whatever shall be at least equal to a given quantity, using for the same the smallest possible expenditure of energy.

There are two cases of this problem: (1) A plane area to be lighted. In this case, the lamps are to be put in projection on the summits of squares; (2) a street to be lighted. In this case, the lamps are usually placed in quincunx, from one side of the street to the other. In the first, the greatest amount of light which falls on any point of the interior of one of the squares evidently comes from the four sources projected on its summits. If $2a$ is the side of one of these squares, it follows that, whilst the condition $h < 1.732a$ is realized (which is generally so in practice), the point of least lighting is the meeting of the diagonals. The spacing of the sources can be calculated so as to produce at this point the minimum effect required, neglecting the additional lighting coming from the more distant sources. If h = the height of the lamps above the plane, $2a$ = the spacing, or the side of the squares, I = the luminous intensity of the sources, the intensity e of the lighting at the intersection of the diagonals is given by the formula

$$e = \frac{4Ih}{(h^2 + 2a^2)}$$
 This formula enables us to solve the following problem: The height of the lamps above the floor being given, to determine the luminous intensity I , so that the expenditure of power shall be the minimum. The number N of the sources required to

light a surface S being $N = \frac{S}{4a^2}$, the next step is to solve the

$$\text{equation } I = \frac{(3) \frac{3}{4} h^3 e}{4h} = 1.30 e h^2$$

Photometrical calculations relating to the lighting of open spaces deal with a number of particular problems. The height of the lamps is an important element in any system of lighting. The spacing of the lamps being equal to $2a$, the lighting at a distance a from the source is a maximum when the height of the lamp-post is given by the formula $h = \frac{a}{\sqrt{2}} = 0.707a$. This

height is seldom adopted in reality, chiefly because the expense would be too great with lamps of any reasonable height. Dr. Palaz says that no street-lamps placed along the curb should exceed 100 candles illuminating power. If, however, for streets (especially when narrow), sources of low intensity are preferable to powerful lamps, this does not follow for large open spaces, for which high-power lamps on lofty posts are indicated as most effective and economical. Thus, he states that posts for 10 ampère arc lamps should be 10 metres high; for 13 ampère lamps, 15 metres high; and for 15 ampère lamps, 18 metres high, disposed in quincunx according to the minimum effect that is desired.

From the point of view of the uniformity of lighting over a large area, it is evidently advantageous to employ a large number of small lamps; but when powerful lamps are employed, the effect of these cannot be strictly compared with that of a number of small lamps upon the basis of the minimum effect alone. They give much more light in places than the small lamps; and it has been a question among specialists whether the excess of lighting round the bases of the columns of the powerful lamps should be reckoned in the comparison of their useful effect as against smaller lights. M. Wybauw and others will not recognize this superabundance of lighting at all; because they argue that it is wasted, and that a place is never lighted better than in its darkest spot. Others, and especially electricians, claim that the lighting even of superfluously brilliant spots should be taken into consideration. M. Weissenbruch chooses the middle course, and introduces the

two elements of mean and minimum lighting in his calculations relative to the lighting of railway stations in Belgium.

Passing from considerations of outdoor lighting to those related to the lighting of interiors, Dr. Palaz admits that if the problem of the lighting of a horizontal plane by means of many sources is difficult, that of the lighting of interiors is particularly complicated. He makes the general observation that the lighting of a hall depends in reality upon many factors, amongst which the illuminating power of the lights employed does not play the preponderating part which might be imagined at the first glance. Beside the lighting effects, there is another element to consider, which M. Wybauw calls the *illumination effect*, which is really a consequence of the lighting, strictly so called, but is not related to it in any definite proportion, and is able to modify, in a fashion often very important, the final judgment passed upon the lighting of halls. The numerous flames of a lustre create an impression of brilliancy superior to that given by a single light of the same illuminating power. Two gas-flames, or two electric lamps, may differ greatly in illuminating power; but when they are not absolute neighbours, they both produce the same effect upon our eyes. The light of a simple candle is visible by night to a considerable distance, even to 500 yards or more, while its illuminating effect is not perceptible upon objects at such a distance. It is the same with a white wall lighted at night. A line of "Vauxhall lamps" placed thickly along the *facade* of a house on the occasion of a general illumination, produces at a certain distance absolutely the same effect as a line of gas-jets of much greater illuminating power. These *illumination effects* have no measure in common with the intensity of lighting; but since they go to affect the ultimate results, they must not be lost sight of.

Diffused light is also an important element in the lighting of interiors. Really, it has a utility greatly in excess of what can be ascribed to it as a result of measurement of quantity, in comparison with simple, direct light. In a hall illuminated by gas-flames enclosed in opal globes, the eyes are deceived by appearances into crediting the lighting with more brilliancy than it actually possesses, as an attempt to read a book or a newspaper will show. A diffusing surface becomes, when lighted, a source of light from every part of its area. If a mirror is placed behind a light-source, the apartment appears to be lighted by two sources. If the glass is replaced by a white wall, the effect is much more striking, although, in reality, the light reflected by the dull surface will be of less intensity than that reflected by the mirror. All bodies reflect light, but with exceedingly varying intensity, according to their distance from the source, their colour, and the degree of polish or roughness of their surface. This diffused light is a powerful auxiliary to the lighting effect produced by direct light. It is its diffusion which gives daylight its enormous superiority over artificial light. The latter only illuminates objects according to one direction; leaving their sides or opposite faces in a strong shadow, which is but feebly reduced by the artificial light reflected from surrounding objects.

It is difficult to take full account of the enhancement of lighting produced by diffusion from the ceiling or walls of an apartment. M. Mascart attacks the problem mathematically upon the assumption that the proportion of light diffused is analogous to the reflection from a polished surface, and which in some instances amounts to 90 per cent. Without assigning any numerical value to the coefficient f of diffusion, let us suppose that a system of lamps placed in an interior radiates a total quantity of light Q . A portion of this light is definitely absorbed by the walls, and the other portion fQ , being diffused, spreads anew through the room. The second diffusion gives in the same way a quantity of light which can be represented by f^2Q , and so on; showing the total light used to be $Q(1 + f + f^2 + \dots) = Q \frac{1}{1-f}$. The mean brilliancy of

a sheet of paper placed in any position will be, with black walls, proportional only to the quantity Q of light emitted by the lamps; and with walls having a reflective power f , it will be proportional to the quantity $Q \frac{1}{1-f}$. The enhancement of

the lighting is therefore represented by the ratio $\frac{1}{1-f}$. If we take $f = 0.95$ as the extreme diffusive value of white walls, the apartment will appear to be *twenty times* as brilliantly lighted as when the walls are black. It is doubtless seldom that such a high value is actually reached; but the benefit of white walls to the general lighting is not far short of this.

(To be continued.)

The Electric Lighting Scheme for Brussels.—In connection with the particulars given in another column in regard to the gas undertaking of the Brussels Municipality, it may be mentioned that the Technical Committee of the Council who had to examine the various tenders submitted for carrying out a scheme of electric lighting in the city have decided to recommend the acceptance of that of the India-Rubber and Gutta-Percha Telegraph Company, of Silvertown. The decision has, we learn, given rise to much criticism.

NOTES.

Mr. John Aitken on Steam Condensation.

Mr. John Aitken, F.R.S., is continuing his interesting and valuable researches upon the composition of clouds and mists, and the various phenomena related to the presence of dust in the atmosphere. He recently submitted to the Royal Society another communication bearing upon the general subject, but specially relating to some phenomena of cloudy condensation. It has already been placed upon record that Mr. Aitken has found gas-flames to be prolific sources of dust in the atmosphere which receives their products of combustion; and he has now corroborated this observation by fresh experiments with gas-flames and steam-jets. He was studying the condensation in air of steam-jets, and trying various means of causing this process to become more dense than it generally is; and, among other influences, he applied that of flames. He found that flame itself had no effect on the steam-jet; but on bringing the products of combustion into the jet, it at once became dense, and remained so as long as the supply was kept up—the jet having exactly the same appearance as when electrified. When in this condition, electricity does not increase its density any further. The increased density is here due to the large number of dust nuclei, causing a great increase in the number of water drops, which are very small, and therefore do not come into mutual collision, which would otherwise reduce their number. Other experiments which have been carried out point to the same conclusion—that the increase of the density of the cloud of steam is due to greater number, and not to greater size of the drops.

A Method of Measuring Light and Colour.

At a recent meeting of the Physical Society, Mr. Joseph W. Lovibond read a paper upon a suggested unit for the measurement of light and colour; and he exhibited an arrangement for employing the unit in practice. The principle of the measurements depends upon the selective absorption of constituents of normal white light by coloured glasses—red, yellow, and blue. The depths of the tints of these glasses are carefully graduated to give absorptions in numerical proportions. For example, two equal glasses, each called “one-unit red,” give exactly the same amount of absorption as a “two-unit red,” and so on. The units of red, yellow, and blue are so chosen that a combination of one of each absorbs white light without colouring the transmitted light. Such a combination is called a “neutral-tint unit.” By the use of successive neutral-tint units, white light can be gradually absorbed without showing traces of colour; and the number of such units required to produce complete absorption is taken as a measure of the intensity or luminosity of the white light. Various results in colour-matching and measurement are found to be attainable by this method, which was shown in use by Mr. and Miss Lovibond.

A Strange Pipe-Line Project.

One of the latest and perhaps most startling of all the pipe-line projects yet mooted is that for the conveyance of coal from the Pennsylvanian pits to the Atlantic seaboard, in the form of a mixture of finely-powdered dust and water. The scheme has been quite seriously put forward in several New York newspapers; the idea being that the coal is to be ground at the pit's mouth into a powder as fine as flour, then mixed with water in equal parts, and the mixture pumped into pipe-lines leading to the port of shipment, exactly as petroleum is treated now. The fluid is to be received in large settling-tanks at the end of its journey, when the coal dust is to be allowed sufficient time to deposit, after which the water is to be drawn off, and the damp dust collected for use, either as it is, or after having been moulded into briquettes. The object of the scheme, as stated by its promoter, is reduction in the cost of transportation, with consequent cheapness of the coal to the consumer at a distance from the coal-fields. Several American technical journals honour the project with an argued refutation, although it might be thought that the absurdity of the notion would have been obvious.

The Recovery of Sulphocyanate from Gas Purifying Material.

Herr J. V. Esop has communicated to the *Chemische Industrie* a memorandum upon the occurrence of sulphocyanic acid in illuminating coal gas. He remarks that the dry distillation of coal engenders, besides ammonia, hydrocarbons, phenols, &c., a distinct class of nitrogenous bodies—such as cyanogen and its derivatives—in quantity not negligible. De Romilly explains the formation of cyanogen by the action of ammonia upon carbon at a red heat. Herr Esop does not stop to discuss this theory, but proceeds to deal with the best means of recovering the cyanogen compounds from ammoniacal liquor and the products of coal gas purification. The proportion of cyanides in coal gas depends upon the method of manufacture; it appears to increase with the weight of the charges in the retorts. While the crude gas preserves a temperature above 100° C., the cyanogen and the ammonia remain separate; but as soon as the temperature falls below 80° C. in the apparatus, there is a formation of ammonium cyanide, sulphocyanate, and ferrocyanides (by contact with salts of iron in

the purifiers). In the ammoniacal liquors of the gas-works of Wiesbaden, Carlsruhe, and Mayence, Herr Esop has found, from the distillation of Saar and Ruhr coals, from 1.22 to 2.33 grammes of sulphocyanic acid and from 18.05 to 36.05 grammes of ammonia. In the spent materials of purification as much as 4.25 per cent. of sulphocyanic acid, 4.38 per cent. of ammonia, and 4.38 per cent. of ferrocyanide of potassium has been found. On the average, the spent purifying masses contain more and purer sulphocyanic acid than the ammoniacal liquors. By methodical extraction and concentration, it is generally easy to obtain crystallized sulphocyanate of ammonia. If the washings are very impure, and but little charged with sulphocyanate, it is better to isolate the sulphocyanic acid by means of its insoluble cupric salt. To make the best use of the spent purifying materials, it is necessary to preserve their soluble salts by keeping them in covered stores, in layers not too thick and at a low temperature. If their temperature rises above from 16° to 20° C., their green colour passes into red, they disengage an acid odour, decomposition spreads through the layers, and in a few days the sulphocyanate is nearly all decomposed. In these conditions, the sulphocyanate is transformed partly into ferrocyanide and partly into volatile compounds which are lost. Spent purifying material contains sulphocyanate of ammonia, chiefly in the state of microscopic crystals very irregularly distributed. It is often found enclosed in hard lumps, stuck together by moisture or by tar. For good working, it is necessary to crush these lumps, in order that the soluble salt should be washed out. The material is treated by soaking in fresh water, pressing the insoluble residue, and digesting it again in another bath. If the sulphocyanide and ferrocyanide are to be extracted at one operation, alkaline lessives are used hot, in closed vessels, in order to catch the ammonia, which comes off abundantly. If the washings are tolerably pure, they are fractionally distilled at once; if they are too impure, the sulphocyanic acid is isolated with a copper salt, generally the sulphate. The sulphocyanate of copper is washed and transformed into an alkaline salt by the addition of a corresponding sulphuret—whether of potassium, calcium, barium, &c.—the copper being recovered for use over again.

Coal and Coke Duties in Russia.—Information received at the Foreign Office from Her Majesty's Chargé d'Affaires at St. Petersburg is to the effect that the duty on coal imported by the Black Sea and the Sea of Azov is fixed at 4 copecks per pood, instead of 3 copecks and 40 per cent.; and that the duty on coke imported by the same seas is fixed at 5 instead of 4½ copecks and 40 per cent.

The Birmingham Water Scheme.—It seems that the Birmingham Corporation Water Bill is to be strongly opposed in the House of Lords. According to the *Daily Chronicle*, Lord Rosebery has been asked by the Special Water Committee of the London County Council to move a resolution on the second reading of the Bill. Its terms are that “in view of the possibility of its being ultimately established that the present sources of supply cannot be extended, and that additional sources are required, and in view also of the fact that the possible fresh areas of supply are limited, and are already being drained for other large communities, Parliament may well consider, before granting any powers for further encroachment upon those areas, how far provision ought fairly to be made for the possible requirements alike of the Metropolis and of other large populations upon the lines of supply.”

The Measurement of High Temperatures.—In connection with the exhibition by Professor Roberts-Austen, at the first *conferenza* for the present session of the Royal Society, of M. Le Chatelier's optical pyrometer, to which reference was made in the *JOURNAL* for the 10th ult. (p. 845), attention may be directed to a paper on the “Measurement of High Temperatures,” read by him at a recent meeting of the Institution of Civil Engineers. The object of the communication was to show that measurements of high temperatures can be readily and accurately effected. The author did not attempt to give the history of pyrometric methods; but from the various appliances which have been devised, a few modern examples were selected, the use of which was justified by experiment. These depended on the measurement of heat either by the aid of electricity or by optical methods. Siemens, and more recently Callendar, had, he said, shown that very trustworthy results might be obtained by employing the increased resistance of a platinum wire, due to heating it, as a measure of the temperature to which the wire was raised. On the other hand, Professor Le Chatelier had perfected the use of thermo-junctions, the electrical equilibrium of which was disturbed by heat, and the measurement of the difference of potential thereby produced afforded a means of ascertaining the temperature to which the junction was subjected. The author then described at length his method of rendering the indications of the Le Chatelier thermo-junction self-recording, and incidentally compared the testimony afforded by an air thermometer and by a thermo-junction as to the temperatures of highly-heated bodies. The new optical pyrometer above alluded to, which is based upon the photometer of Cornu, was described at length, and a series of measurements of high temperatures made by its aid were given.

COMMUNICATED ARTICLE.

COAL GAS: ITS MANUFACTURE, DISTRIBUTION, AND CONSUMPTION.

A Series of Articles for Gas Students.

(Continued from p. 1058.)

Several modifications have been introduced into annular condensers. For instance, Messrs. C. and W. Walker construct them of wrought iron, and dispense with the bottom box altogether; thus reducing the weight of the apparatus to probably less than one-half that of the original pattern. They retain the diagonal pipes connecting the upright annular pipes, but use them on both sides of the apparatus, so as to ensure the perfect circulation of the gas around the annular space. They also introduce into one column of the series a number of screens, through which the gas passes; the tar being there, in great part or wholly, separated. Cutler's and Dempster's condensers are also of wrought iron; but these makers arrange the connecting-pipes alternately at the top and bottom of the columns, so that the gas, entering at the bottom end of the first pipe, passes upwards to the top, and through the short connection into the top of the second column, down which it flows, and so on alternately up and down the columns until the outlet is reached.

Mr. W. J. Warner has introduced a mid-feather, or partition, into the annular space, which reaches to within a short distance of the top and bottom ends. The gas, entering at the bottom of the column, passes upwards on the inlet side of the partition and over the top, down on the opposite side, to the outlet of the column, and through the connection to the base of the next column, where a similar course is again taken. The partition is carried down sufficiently to be sealed in the liquid, which thus has no obstacle to its free passage along to the liquor outlet.

The Ordinary Plain Pipe Condenser.

This is well known, and will be found in most small and in not a few of the larger works whose engineers prefer the simpler apparatus.

The vertical form consists of a series of upright pipes, rising from a cast-iron box or closed trough. They are connected at the top in pairs by \cap -shaped bends (usually fitted with plugs for cleaning), bridge-pipes, or, when but of small diameter and of wrought-iron, not unfrequently with a wrought-iron cross fitted with nipples or short pieces and plugs—a plan which greatly facilitates the cleaning of the tubes. In the trough below, all the products of condensation are collected and run off by a suitable outlet-pipe to the tar and liquor well. The troughs may be made separate—one for each pipe, or, as is usually the case, they may be constructed in one continuous length, and be provided with baffle-plates or diaphragms placed at intervals to direct the right passage of the gas into the proper pipes, and prevent it travelling directly along the trough. In this case, the liquor outlet will be fixed at such a level as to ensure that there is always a certain depth of liquor in the trough. The diaphragms or baffle-plates referred to will dip into this liquor; and they are made sufficiently deep to provide only the necessary seal. Thus they do not present any obstacle to the easy flow of the condensed tar and water.

The passage of the gas through the apparatus is therefore from the inlet up pipe No. 1, down No. 2, into the trough. A baffle-plate here prevents further passage along the trough; so the gas goes up No. 3 and down No. 4 into the trough again, when another baffle-plate directs it up No. 5, and so on right through the series until it reaches the outlet-pipe. A somewhat similar arrangement to the bottom trough can be applied, if desired, at the top ends of the vertical tubes, in place of the connections referred to. In this case, there will be fixed a cast-iron trough, through the bottom of which the top ends of the tubes will pass, and project some inches upwards. The trough is filled up to the level of the tubes with water, which is afterwards displaced by the liquor of condensation. All that is now necessary to correctly direct the flow of gas is, instead of using the \cap -tubes or other connections, to cover the successive pairs of pipes with cast-iron hoods, sealed in the liquor referred to. To remove them for cleaning out or examining the pipes when required, is but the work of a few minutes.

In the horizontal form, the pipes are arranged almost horizontally, one above the other up a wall, or on a frame especially constructed for carrying them. A gentle inclination is given to the pipes, and they are connected at the ends by \cap -shaped bends. There is thus a gradual fall from the top pipe to the bottom one; and an easy flow provided for all the products of condensation.

The pipes are sometimes connected together by T-pieces, the flanged branches of which, on either pipe, are brought face to face, and bolted together; the connection forming the letter I. The ends of the pipes are also flanged, and are closed by a blank flange bolted on. The inlet to the apparatus is, by preference, at the top; the gas passing down the top pipe, then back by the \cap -tube or other connection along the next below, and turning and re-turning again through each successive pipe—finally leaving the apparatus by the gas outlet at the bottom. The condensed tar and liquor follow the same direction, and

are carried away by a separate outlet. This simple form of condenser may, if the pipes are of sufficient diameter and length, be employed exclusively, or they may be used in conjunction with the annular condenser; the latter assisting in graduating to the required degree, the ultimate temperature of the cooled gas.

Cleland's slow-speed condenser is a vertical tube condenser but differs materially in construction and work from all others. The apparatus consists of a series of upright tubes resting in, and open to, a box or trough, and having an inlet-pipe running along the top, and open to all the verticals. Thus the gas is subdivided, and freely and slowly passes down the various tubes to the boxes, where it enters an outlet also connected to all the upright pipes. The inventor calculates that the gas is quite cool on arriving to about two-thirds the depth of the pipes; and from this point to the bottom it is fitted with arrangements for washing the gas, and depriving it of the whole of the tar and much of the ammonia.

The Battery Condenser.

This is a cast-iron box or vessel divided at intervals by internal plates, which extend to the top and bottom of the box alternately. In the chambers thus formed, a large number of tubes are fixed from side to side, and open at either end to the atmosphere outside. The gas entering at the inlet is caused, by the intervening baffle-plates, to pass alternately up and down the various chambers; and it is further cooled by contact with the air-tubes referred to. Moreover, these tubes and the baffles serve also to break up the gas, and tend to aid much in the deposition of all condensable matter. The apparatus is very efficient; and its power can be regulated at will by putting in or out of action, as desired, more or less of the cooling-tubes.

Water Condensers.

The use of water for cooling the crude gas is more simple of application than the atmospheric system, and will not require much space for its consideration. The most important principle to be borne in mind is that *the cool water must meet the cooled and not the hot gas*; thus obviating a too rapid condensation, and the consequent deposition of the hydrocarbons. The water will therefore enter the apparatus at or near the gas outlet, and, as it proceeds and meets the hot gas, it gradually absorbs its heat, and ultimately leaves the condenser at or near the inlet at a temperature not far below that of the crude and uncooled gas itself. The process of cooling will thus be very gradual, and can be readily adjusted to meet any requirements or any gradation of temperature.

Messrs. Morris and Cutler's "Perfect" condenser is of this type. It consists of a cast-iron box, divided at intervals by a series of horizontal baffle-plates, not so long as the case; the intervening spaces alternating at either end of the condenser. The crude gas, entering at the bottom, goes along the first chamber, until reaching the end of the first baffle-plate, it passes upwards and flows in the opposite direction, along the next chamber, and so on, following a zig-zag direction right through the series, until it emerges from the apparatus at the top. Water-pipes, entering the condenser at the top, follow precisely the course taken by the gas, only in exactly the opposite direction; thus meeting it all the way, and becoming hotter and hotter until it finally leaves the condenser at the bottom. The water not having come into contact with the gas in any way, it is uncontaminated, and fit for use in the boilers, or for any other purpose for which hot water may be required.

Mr. Livesey places his condensing-pipes in a tank of water, which is divided into channels. The amount of water can therefore be easily regulated at will in accordance with the varying requirements.

Pelouze and Audouin's Condenser.

The principle of this condenser is the breaking up of the gas into very minute streams, whereby it is not only efficiently cooled, and ordinary condensation secured, but much, if not all, of the suspended tarry matter that escapes deposition by simple cooling is broken down and deposited. The condenser consists primarily of three concentric cylinders; an outer cast-iron one forming the case, and provided with the usual inlet and outlets, with the necessary tar and liquor outlet-pipes; and two inner cylinders, both of which are perforated—the inside one with very finely-divided perforations, the outer one with slots, and so arranged that the blanks are opposite the perforations of the inside cylinder. The gas issues through the latter in very finely-divided streams, dashing against the blank portions of the second cylinder. The globules of tar are here thoroughly broken, and flow downwards to the liquor outlet; the gas passing through the slots to the outlet chamber.

Carburetted Apparatus.

Carburetted apparatus, such as Young and Aitken's, the St. John, and others, are generally referred to in this connection; but, in view of the steps now being taken, in the Metropolis and elsewhere, for the adoption, in practical work, of various types of carburetters and enrichers, the writer prefers to postpone for the present the consideration of this matter, in order to give the whole question, in a supplementary article, the full discussion its importance demands. Meantime still further developments and improvements will doubtless be introduced.

(To be continued.)

TECHNICAL RECORD.

MIDLAND ASSOCIATION OF GAS MANAGERS.

The Quarterly Meeting at Rugby.

As already briefly recorded in the JOURNAL, a general meeting of this Association was held at Rugby on Thursday, the 26th ult.; and the Directors of the Rugby Gas Company kindly granted the use of their Board-Room for the occasion. Mr. Lawrence (the Vice-Chairman of the Company) and Mr. Wrattislaw (the Secretary) were present, with Mr. Simpson, to welcome the party on their arrival.

On the PRESIDENT (Mr. W. Littlewood, of West Bromwich) taking the chair,

Mr. WRATTISLAW said they were glad to see the members of the Association at Rugby. The Rugby Gas-Works had been carried on since 1838, when gas was sold at 12s. 6d. per 1000 cubic feet; and they were now selling it at 3s., less a discount of 2d. Under the management of Mr. Simpson, the Company had progressed with the age; and it had been one of the objects of the Directors to consider the consumers as well as the shareholders. There were some things of local interest which Mr. Simpson would later on show the members of the Association; and if the Directors of the Company could do anything to promote the objects of the Association, he believed they would be glad to do it. They were indebted to the Association for the information mutually imparted to the members by each other, and which bore on the advancement of the gas industry.

Mr. LAWRENCE said, in the unavoidable absence of the Chairman, he might express the hope that the members would have an enjoyable day and fine weather. They had only to walk into the School Close to see "Young England" at play; and at the cement works, where they were going later on, they would see "Young England" at work; and they would perhaps be impressed with what Rugby people could do as boys and as men. The Rugby Gas Company were likely to sustain a great loss by the imminent retirement of Mr. Simpson, their Manager, after a lengthened service with them. In the 38 years Mr. Simpson had been at Rugby, he had enjoyed the respect of high and low, rich and poor. He (Mr. Lawrence) had had the pleasure of sitting at different times on various committees with Mr. Simpson; and if ever a practical man was wanted for any practical purpose, Mr. Simpson was the man whose knowledge they fell back upon. He had great tact, and admirable judgment; and it would be a difficult thing for the Rugby Gas Company to replace him. But it would be unkind of them to wish him to abstain from that well-earned retirement he so richly deserved.

The PRESIDENT said that the members of the Association would agree with him that they were sincerely obliged to the Rugby Gas Company for their invitation to hold their meeting at their offices. It must be gratifying to them as gas managers to hear such high words of praise spoken of one who was a member of their Association, and of their profession. It was to be hoped that the Rugby Gas Company would not suffer pecuniarily by Mr. Simpson severing his connection with them as their Manager; but that they would be able to find some one to carry on their works for them with as much success. He thought it was only right that they should pass a vote of thanks to the Rugby Gas Company for their invitation to meet at their offices.

Mr. W. NORTH (Stourbridge) moved a resolution thanking the Company for their kindness in allowing the Association to meet at their offices and for providing light refreshment for the members.

Mr. T. S. CRANMER (Stratford-on-Avon) seconded the motion, which was carried, and briefly acknowledged by Mr. LAWRENCE.

The HONORARY SECRETARY (Mr. C. Meiklejohn) then read the minutes of the previous meeting, which were confirmed.

THE PRESIDENT'S ADDRESS.

The PRESIDENT: The next business is that of reading my address to you. It is usual for the presidential address to be read at the first quarterly meeting of the year; but unfortunately I was unable to attend, owing to serious and sudden illness, to which for some years I have been liable. I thank you sincerely for the resolution of sympathy with me embodied in the minutes of the last meeting; and I will now proceed with the address itself. [This was given in the JOURNAL for the 31st ult., p. 1012.]

At its close, Mr. SIMPSON proposed a vote of thanks to Mr. Littlewood for his address. They all, he said, regretted very much Mr. Littlewood's inability to be present at the last meeting; and they ought to return him their hearty thanks for the address he had that morning given them.

Mr. W. NORTH seconded the motion; and it was carried with applause.

The PRESIDENT said that, when the members elected him, he told them it would be his endeavour to carry out the duties to the best of his ability; but that he hoped they would bear with him in his infirmities. He thanked them for the hearty vote they had just given him for his address.

THE MONIER SYSTEM OF CONSTRUCTION.

Mr. P. HUTCHINGS read a paper on this subject, and began by explaining that it was to have been read by Mr. T. C.

Hersey, who had made himself acquainted with the Monier system, from personal inspection of works carried out on the Continent; but, unfortunately, this gentleman was unable to be present. He (Mr. Hutchings) therefore proposed to give the members a few particulars of what he had himself seen. He then went on to say that the system had been named after the inventor, M. Monier; but that it had been developed and perfected through the energy and skill of Herr Wayss, a celebrated engineer and architect of Berlin. In combining iron and cement in the manner described in his patent, M. Monier had created an entirely new building material.* Bricks, stone, cement, or concrete, used by themselves, are only capable of resisting pressure; whereas cement or cement concrete, in conjunction with iron, will resist pressure as well as tensile strains. Another important feature of the combination is that iron and cement concrete unite firmly, and act together as a whole, owing to the fact that the expansions and contractions of both are the same. This being the case, constructions on the Monier system are fireproof and impervious to atmospheric influences. Floors (with either flat or arched ceilings beneath) on this system are capable of supporting considerable loads. The author cited an example of bridge construction with the Monier system. It was built for the accommodation of foot passengers at the Bremen Exhibition of 1890. The arch was made in 36 hours; and the whole construction, with abutments, stairs, platforms, &c., was carried out within six weeks. The width of the span was 131 feet; the pitch, 14 ft. 9 in.; the width in the centre, 9 ft. 10 in., gradually widening to 26 ft. 3 in. at the abutments. The thickness of the arch at the crown was 10 inches; at the abutment, 21½ inches. The safe load (calculating for a six times heavier load) was about a ton per square yard. Passing on to deal with the system as applied to the construction of conduits for water, sewage, &c., the author stated that Monier pipes are found to be cheaper than those of stoneware; while tests have shown them to be far stronger than ordinary glazed or iron pipes. The Engineer of the East London Water-Works Company (Mr. W. B. Bryan, M.Inst.C.E.) had, he said, inspected in Berlin the method of making the Monier pipes of all diameters, from 6 feet downwards; and the result had been a decision to have about 1200 yards of 24-inch for the Lea Bridge station of the Company. Coming to the adaptability of the system to gas-works construction generally, the author said the best proof of its utility was the fact that it had been employed in several Continental works in the building of gasholder tanks; and he thought his hearers would agree that, from the lightness and strength of the construction, it would be specially well suited for the purpose. With regard to cost, he believed it would compare most favourably with that of brick and iron tanks constructed in England. He was unfortunately unable to give definite particulars as to this matter; but the cost was certainly much lower. He quoted largely from testimonials in favour of the system, and gave a list of places where it had been employed. In conclusion, Mr. Hutchings invited the members to inspect a number of photographs taken from works, either complete or in course of erection, on the Continent, which would, he said, speak for themselves to a body of practical men.

In the course of the subsequent remarks of members,

Mr. CRANMER said he thought that this paper on the Monier system would be acceptable to the members, and very suitable on the present occasion, as they were about to visit two of the works in the neighbourhood where cement was made. Mr. Hutchings was not an engineer, and was not able to give them the information Mr. Hersey might have done had he been there; but the details in the paper just read would no doubt be of interest to them. He had seen some pipes, conduits, and specimens of work constructed on the system; and he believed that, for constructive purposes, the Monier system would come to the front. It was simple in construction, and very strong; and it must be cheaper than ordinary brick and cement work. He thought it was applicable in buildings such as retort-houses; and many large buildings had already been constructed abroad. He did not see why they should be behind people abroad in such a matter; and he believed there was a great opening for the use of the material in this country. It was very useful, among other things, for covering subways, where space was valuable. Sometimes, they could not get down as deep as they would like for certain purposes; and the system would come in useful in the saving of space compared with other material. The wires in the Monier system were interlaced; and, where they crossed, they were bound together. Besides the strength given to the material, there was a certain amount of pliability, which prevented the cement cracking.

Mr. MEIKLEJOHN asked if the wires which ran through the cement were continuous, or (if not) how were they joined? Were they laced by smaller iron wire, or simply placed side by side?

Mr. HUTCHINGS showed in an illustration the way the rods ran; pointing out that certain of the rods would be continuous.

Mr. G. WINSTANLEY (Coventry) said he had had some experience in laying concrete floors. The thickness he used was 4 inches. The material was simply laid flat between iron girders, and that had been also followed out in covering subways, with the result that, with any weight they liked to put over it, it was perfectly safe. He thought the Monier system was adaptable

* A description of the system will be found in the JOURNAL for Dec. 8, 1891 (p. 1035).

o gas engineering work, having had much experience in concrete work in floor construction; but in his case the work was flat and not curved or arched, as shown in the photographs.

Mr. HUTCHINGS said he believed that would be so; but in this case there was a body of work with iron rods running through it, and less thickness was sufficient.

Mr. WINSTANLEY said he did not see the necessity of the wires overlapping.

Mr. V. HUGHES (Tipton) asked if it required special men to lay the material? [Mr. HUTCHINGS: No.] Did they send out the material ready to hand, and leave it to others to use it?

Mr. HUTCHINGS said the Company might send out men in some cases ; but ordinary work could be done by ordinary men with a little supervision.

The PRESIDENT said he was sure they had all listened with pleasure to the paper submitted for discussion. It was especially interesting from being read in a town noted for its cement; the Monier system being dependent on cement and iron for its construction. Abroad, the system had no doubt been considerably used in the construction of large buildings of various kinds; and he believed in some gas-works. Personally he had no experience of it; but he could see very clearly from the materials of which it was constructed that, with judicious application, it must be of great utility under certain circumstances. Mr. Winstanley spoke of what they all knew was very generally adopted in this country for fire-proof flooring and railway work, and other purposes. He rose, however, not to go into the question, but to ask them to pass a vote of thanks to Mr. Hutchings for reading the paper.

Mr. W. W. WINSTANLEY (Newcastle, Staffs.) seconded the motion; which was passed, and acknowledged by Mr. HUTCHINGS.

This concluded the business of the meeting; and under the guidance of Mr. Simpson, the party afterwards visited Rugby Schools (founded in 1567), which it was stated has a roll of 499 boys. The Chapel contains memorials to old Rugby Scholars who fell in the Indian Mutiny and the Crimean war—a number of the boys going straight from the school to the Crimea. The chair and table of Dr. Arnold, whose connection with the school is so well known, were inspected with some interest. Carriages were in waiting near the school, and the party then started for a drive through the charming scenery of the neighbourhood—fresh and bright with its spring tints. The members subsequently divided into two parties, one going to the Old Rugby Cement works, and the other to the Newbold Cement Company's works. At the respective works, the process of the manufacture of cement was fully seen, and the great strength of the cement was exhibited by tests. Thanks were expressed on behalf of the Association for the great courtesy shown to the members. Mr. Simpson entertained the party at dinner at the Gas Offices on their return to Rugby; the excellent viands in the *menu*, it should be noted, being cooked entirely by gas. The chair was occupied by Mr. Simpson, and the vice-chair by the President of the Association (Mr. Littlewood); and a list of toasts suited to the occasion was duly honoured.

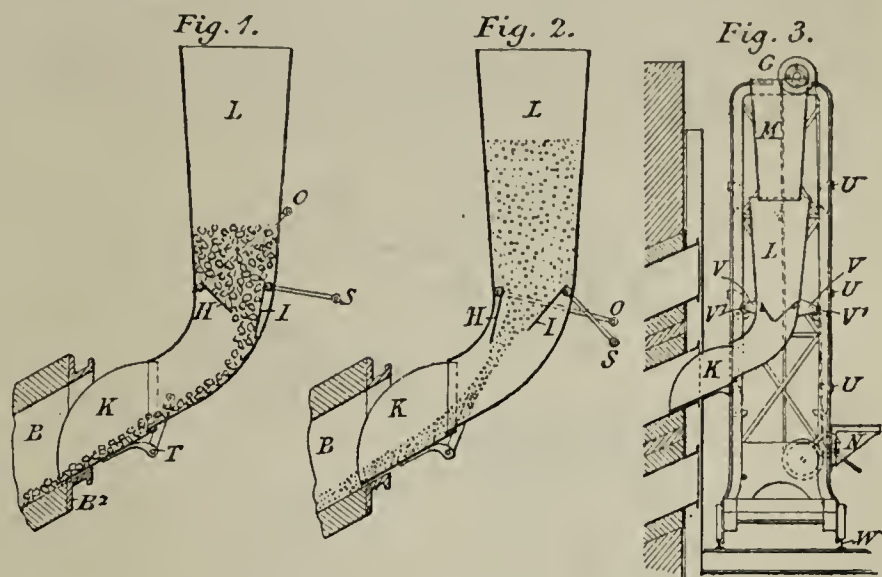
The Work of the Patent Office in the Past Year.—According to the ninth report of the Comptroller-General of Patents, recently presented to Parliament, 22,888 applications were made last year, against 21,307 in 1890; showing an increase of $7\frac{1}{2}$ per cent. The total income of the office from all sources amounted to £203,520, of which £181,777, or 89 per cent., accrued from patent fees. The expenditure, including £21,703 devoted to new buildings, amounted to £103,180; leaving a surplus of £100,339. Of the total spent, £54,267 went in salaries and wages.

A Long Span of Trussed Water-Pipe.—A few years ago, it was necessary to carry an 18-inch water-main across Black-water Creek at Lynchburg (Va.). The manner in which the work was done was described and illustrated in a recent number of the *Engineering Record*, from which the following particulars are taken: There were two existing stone piers 100 feet apart, on each of which rested a nest of columns supporting an iron bridge. In order to make use of these piers to carry the water-pipe over, the pipe and trusses had to be built so as to occupy a space between the struts, ties, and braces of the iron bridge, without, however, touching any part of the bridge. Additional columns were placed on these piers, and made high enough to leave a clear passage for railroad traffic under the water-pipe, which partly rested on the latter columns. Each end of the pipe was made to rest on a stone abutment. From these supports, the 18-inch cast-iron pipe and its load was carried—4-inch eye-bars being used to truss the pipe; and, changing the strain from flexure to direct compression, utilized the material of the pipe itself as a strut. As the trussing was made to cross from above the pipe to below it, it occupied very little space, and enabled the vertical posts to be short enough for the use of cast iron. Owing to the great length of pipe (235 feet) exposed to the atmosphere, an expansion joint was provided; and the ends were firmly secured to the adjacent rocks by means of 4 in. by 1 in. bars. Ever since its completion, the pipe has conveyed water, under a pressure of 140 lbs. per square inch, without a leak. The truss bars were 4 in. by 1½ in.; and, with the pedestals, saddles, and piers, weighed scarcely one-fourth as much as the pipe, the joints of which were flanged, faced and bolted together.

REGISTER OF PATENTS.

Charging Inclined Retorts.—Boult, A. J.; communicated from A. Klönne, of Dortmund, and F. Bredel, of Milwaukee, U.S.A. No. 9318; June 2, 1891.

The improvement in charging inclined retorts which forms the subject of the present invention consists in a particular construction of charging-machine G, the particular features of which are shown detailed in figs. 1 and 2. Fig. 3 is a view of the frame supporting the charging-machine.



The improvement consists in the arrangement of the moveable discharging gates H I, which enable materials of different degrees of fineness to be charged. If fine material is to be charged (as shown in fig. 2), the gate H is opened by a lever O; thus giving the material free entrance and high velocity upon leaving the charging-hopper L and shoot K, and when entering the retort B. If coarse or lump material is to be charged, the gate I is opened by the lever S (as shown in fig. 1), thereby causing the material to change its direction and letting it slide slowly down the lower part of the charger L and shoot K and enter the retort B at a moderate speed. If necessary to charge the retorts more fully either in front or back, on account of the different heats of the retorts, this can be effected by varying the opening of the gates H and I.

The apparatus is supplied with the material to be charged by suitable means, and preferably from above. To prevent waste of material in filling the hopper L, a funnel M is arranged in such a way that it will not interfere with the charger when the upper retorts are charged. If the lower retorts are to be charged, the material can either drop from the funnel M into the charger L, or a telescoping arrangement can be made, which will prevent dust from flying around. The charger can be raised or lowered by hoisting mechanism N. A frame (with automatic stops U engaging with projections V) is provided to keep the charger and shoot in their respective positions to the height of the charging mouthpiece or opening B². The shoot is moveable upon a pivot T, so as to enable it to be adjusted, and admit of the charging apparatus being run freely on rails W in front of the charging mouthpieces. The charging apparatus G may be arranged to hold one or more charging-hoppers L, and more than one can be charged at the same time.

Pipes or Tubes for Liquids and Gases.—Armstrong, J., of West Bromwich. No. 9997; June 12, 1891.

This invention has for its object to make pipes or tubes for conveying liquids and gases (and for protecting and insulating electric conductors and for other like purposes), the internal surface of which is of glass, and having an external support of concrete, cement, pitch, or other like non-metallic material; and, where great strength is necessary, there would be a further covering of sheet metal or wirework, or coils of thin sheet metal, and where the pipes were to be laid underground, a final coating of concrete.

Silencing Boxes for Gas-Engine Exhaust-Pipes.—Bilbie, J., and Hobson, W., of Queen Victoria Street, London. No. 10,047; June 13, 1891.

The usual method of silencing the exhaust of gas-engines, the patentees point out, is to place in the ordinary exhaust outlet-pipe one or more vessels of suitable shape and size to allow the gases which escape at a high pressure from the engine to reduce the pressure before reaching the outer air. Another method is to make a pit of brickwork, and fill it with loose stones or shingle. The exhaust passes into this pit; and, not having free exit, the pressure is reduced, and the noise at the outlet silenced. The first of these methods will not totally silence the exhaust; and the second entails considerable expense, while the stones and shingle become pulverized, and have to be frequently replaced.

The present improvements consist in providing an expansion chamber of cast iron, and carrying the exhaust-pipe or branches from it a considerable distance into the interior of the box; the end being plugged to form an abutment, so as to receive the rush of the incoming gases. The part of the pipes inside the box at their incoming ends are perforated with small holes of suitable numbers and size, so that their combined area shall be equal to the area of the exhaust, or be otherwise arranged to suit conditions.

Charging Sloping Retorts.—Braidwood, J. F., of West Greenwich.
No. 10,902; June 26, 1891.

The patentee explains that, in order to conduct the coal from above—say, from a tipping wagon, such as the one described in patent No. 15,888, of 1890—into the mouth of a sloping retort, and in order to obviate the necessity of an upturned mouth on the retort, he arranges

a moveable shoot of suitable length mounted on a carriage, the wheels of which run on rails along the face of the upper ends of the retorts. The inside of the shoot is provided with a series of baffle-plates, or deflecting surfaces; while the lower end is just sufficiently curved to enter the mouth of the retort. The baffle-plates may be fixed on a framework, which drops into the shoot, and is secured therein or thereon, so that different arrangements of baffle-plates and different sized deflecting surfaces may be interchanged as desired. When the coal is tipped from the wagon into the upper end of this shoot, its rapid descent into the retort is checked or retarded by the baffle-plates; and thus the coal emerges from the lower end of the shoot into the retort at the desired speed, and spreads itself (approximately) evenly right down the length of the retort. The retort can thus be made with the lid mounted either vertically or at any desired angle thereon, at both top or bottom; so that, when the lids are removed, a clear opening in a straight line is obtained from end to end.

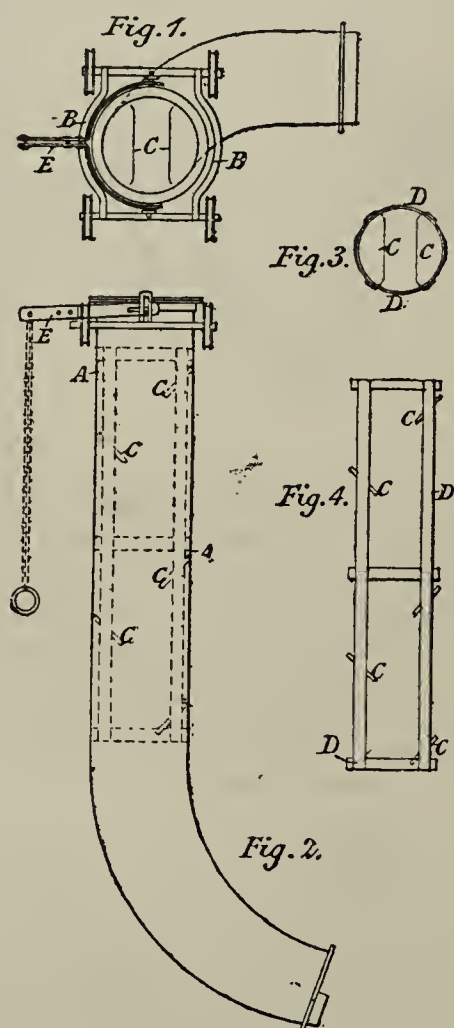


Fig. 1 is a plan of the shoot and wheeled carriage on which it is mounted. Fig. 2 is a side elevation, showing the baffling apparatus dotted in. Fig. 3 is a plan of the removable arrangement of baffle-plates—removed from the shoot. Fig. 4 is a side elevation of fig. 3.

The shoot A is made curved at the lower end, so as to readily enter the mouth of the retort. At its upper end, it is mounted in a carriage B, having four wheels running on rails; or it may be swung from a crane or derrick, or supported in any other desired manner. The projecting lever E with forked ends (the latter encircling the shoot) is provided for the purpose of raising or lowering the shoot in its carriage, so as to adjust it to the mouth of the retort should the level of the latter vary in any way. The lever is operated by the chain shown, or in any other suitable manner. The baffle-plates C may be permanently fixed in the interior passage of the shoot, or else in an open frame D (fig. 4). Any suitable number of these baffling surfaces are mounted (according to the length of the shoot), and at any suitable angle, so as to ease the descent of the coal, by causing the latter to glide from one baffle-plate or surface C to a lower one, and so on; thus checking the fall, and causing the coal to enter the retort at a reduced speed.

Producing Gas for Motor Engines.—Bénier, L., of Paris. No. 13,870; Aug. 15, 1891.

This invention relates to apparatus for producing a combustible gas composed of carbonic oxide and hydrogen, designed for supplying gas motors or other similar engines, and comprising a closed fire-place charged with any fuel through a closed pipe, and into which the air can pass only through the grate and under determined conditions. An annular space, constantly supplied with water, surrounds the base of the fire-place, and is designed to produce the steam to be injected below the grate; a starting valve communicating with the chimney. Apparatus, if desired, is connected with a cooler formed of small tubes (into which the gas passes), through which a current of water circulates. After having traversed the cooler, the gas leaves through a pipe which has at its end a valve arranged on the engine for the purpose of regulating the introduction of the gas. At the same time that air is drawn by the piston of the engine into the cylinder, a certain quantity of gas is also drawn in through the valve, and, owing to this suction, a certain quantity of air enters the fire-place; and thus gas is formed only as long as the same quantity of gas is introduced into the engine.

Regarding his invention, the patentee remarks: "It is well known that gas-engines utilize heat in the most advantageous manner by transforming it into work. A steam-engine, under good conditions, needs about 1 kilo. of coal per hour and horse power—that is to say, on an average 6000 calories—whilst the gas-engine for the same work requires only 800 litres of gas, or 4800 calories; which constitutes a saving of 1200 calories in favour of the gas-engine. But the 6000 calories of the steam-engine cost only about 3 centimes, whereas the 4800 calories of the gas-engine cost about 16 centimes in the case of lighting gas."

Increasing the Illuminating Power of Gas.—Rudd, J., of Atherton, Lancs. No. 5994; March 28, 1892.

This invention relates to means for increasing the illuminating power of gas by providing a suitable receptacle for receiving liquid such as benzene or other hydrocarbon, the gas of which intermixes or diffuses with the coal gas, as it is passed over the surface thereof before reaching the point of combustion. The receptacle is connected with the supply-pipe from the gas-meter in such a manner that the coal gas, after leaving the meter, passes through a pipe into the receptacle where gaseous diffusion takes place. Instead of the charging receptacle being connected at the gas-meter, as an alternative it may be attached to the gas-jet or other part of the connecting-pipe, so as to prevent the gas passing direct to the burner. It would be only needful to plug or stop the pipe, and provide apertures one on each side of the plug, so as to communicate with the charging receptacle beneath, in order to compel the gas to pass down the first aperture into the charging receptacle and then up the second aperture to the burner, and in doing so to intermix with the gas from the benzene.

APPLICATIONS FOR LETTERS PATENT.

- 10,063.—HUMPIDGE, H. T., HUMPIDGE, J. T., and SNOXELL, G. E., "Gas and oil motor engines." May 27.
 10,069.—POLLOCK, R., "Gas and oil engines." May 27.
 10,112.—WALL, E., and FRECKNALL, G. H., "Condenser for use in the manufacture of gas." May 27.
 10,194.—IRWIN, D. H., and BRADLEY, H. W., "Igniting apparatus for gas or oil motor engines." May 28.
 10,206.—DOWSON, J. E., "Gas-heated ovens, chambers, or furnaces." May 28.
 10,219.—DOULTON, H. L., "Apparatus for softening and purifying water." May 28.
 10,246.—JEAVONS, W. R., "Hydrocarbon burners." May 30.
 10,316.—M'INNES, D., and M'LACHLAN, A., "Incandescent gas-fires." May 31.
 10,328.—WIGHAM, J. R., "Lighthouse illumination." May 31.
 10,402.—CLAREMONT, E. A., "Gas-engines." June 1.
 10,444.—DOIG, W. B., "Gas-meters." June 1.
 10,481.—EZARD, G. W., "Gas-stoves." June 2.
 10,485.—KILLEY, E. W., "Gas-burners." June 2.
 10,486.—WILLIAMS, H., "Illuminating gas." June 2.
 10,605.—BARTLETT, J., and WILLIAMS, G. A., "Incandescent gas-lamps." June 3.
 10,666.—BOULT, A. J., "Water-meters." A communication from M. Esser. June 4.
 10,683.—HELBERGER, H., "Automatic calculation of electric, gas, or water distribution." June 4.

Salisbury Corporation Water-Works.—The Water Committee of the Salisbury Town Council are proposing to make some important additions to the plant at their water-works, at an approximate cost of about £4000.

The Public Lighting of Bucharest.—Her Majesty's Chargé d'Affaires at Bucharest has intimated that tenders will shortly be invited for various public works for the improvement of the town; including lighting by gas and electricity.

Main's Gas Cooking and Heating Appliances.—We have received from Messrs. R. and A. Main, of London and Glasgow, an exceedingly well-printed illustrated catalogue of their gas cooking and heating appliances. It is of oblong shape, bound in cloth; and is in every respect worthy of a place among gas managers' works of reference.

A New Reservoir for the Belfast Water Commissioners.—Last Tuesday the Belfast City and District Water Commissioners paid a visit of inspection to their various works; and the event was of unusual interest, as the occasion was taken advantage of to perform the ceremony of laying the first stone in connection with the Leathamstown reservoir. This was done by Mr. John Laird, the Chairman of the Works Committee, who was presented by Mr. L. L. Macassey, the Engineer of the Commissioners, with a handsome silver trowel. The reservoir will occupy an area of about 50 acres, will have a storage capacity of 120 million gallons, and will cost, it is estimated, £20,000.

The Borrowing Powers of the Rochdale Gas Department.—At the last meeting of the Rochdale Town Council, on the recommendation of the Gas Committee, it was resolved that application be made to the Local Government Board for their sanction to the borrowing of £65,000 for the purposes of the proposed extensions of the gas-works. Alderman Petrie explained that the amount intended to be borrowed had been increased from £60,000—the sum originally mentioned as the estimated cost of the extensions—to £65,000, because, when the plans were finally gone through, it was found that a large gasholder which was to be erected should have four lifts instead of three. This would make it serve the purposes of the Committee a good many years more, at a less capital cost than would be involved in any subsequent enlargement.

Annual Report of the Middleton Corporation Gas Committee.—In moving the adoption of the minutes at the meeting of the Middleton Town Council last Thursday week, Mr. G. Booth commented at length upon the accounts of the department for the year ending March, 1892. He stated that the amount of profit was £340, as against £796 in 1891. The increase in the manufacture of gas was 3,899,000 cubic feet; and in the amount of gas sold, 2,342,000 feet. The leakage was 11.89 per cent., against 10.29 per cent. in 1891. The Gas Manager accounted for this extraordinary figure by the fact that a larger number of gas-mains—something like three miles—had been laid down in the borough, and other small portions had been laid to supply lamps, &c., while a great deal of waste had been caused by the dismantling of one of the old gasholders for the purpose of erecting a new one. The extra cost for coal and cannel had been £198; and they had incurred additional expenditure by increasing the illuminating power. This cost them 2d. per 1000 cubic feet, which, on a make of 80,000,000 feet, made £250. The minutes were passed.

MISCELLANEOUS NEWS.

THE ROYAL COMMISSION ON LABOUR.

Tuesday, May 31.

(SECTION C.—*Present: The Right Hon. A. J. MUNDELLA, M.P., Chairman; the DUKE OF DEVONSHIRE, Mr. J. C. BOLTON, M.P., Mr. AUSTIN, Mr. TAIT, Mr. TROW, and Mr. MAWDSLEY.*)

The Evidence Relating to the Gas Industry.

The hearing of evidence in connection with the gas industry was resumed to-day.

Mr. G. C. Trewby, Chief Engineer of The Gaslight and Coke Company, examined by the CHAIRMAN, said the Company was incorporated in 1810, and was therefore one of the oldest gas undertakings in the kingdom. Their authorized capital was £12,000,000. They had 2000 miles of mains, and eleven manufacturing stations, where they carbonized about 2,000,000 tons of coal a year. The number of men employed varied, according to the season of the year, from 5000 in summer, to 10,000 in winter.

The CHAIRMAN: What are the earnings of your men?

Witness: Scoop drivers are paid 5s. 7d. to 5s. 11d.; stokers, 5s. 4d. to 5s. 7d.; and firemen, about 5s. 6d. per day of eight hours.

Is their employment regular?—We have them on a monthly agreement, which requires a month's notice on either side.

What becomes of the extra 5000 men who are employed in the winter?—They are only too ready to leave us in the spring for brick-making and other kinds of employment; but a certain proportion of the men are engaged in the works in repairing the wear and tear, and in the construction of new works. The same men return to us year after year. We keep a character book containing a record of the men's services; so that we can turn back and see when we first employed a man, and what his character has been.

And you think that, with your work and other work, these 10,000 men are fairly regularly employed?—5000 are with us all the year round, and the other 5000 part of the year. We begin putting on new men at the latter end of August, and go on gradually until we reach the maximum in the depth of winter; and then about February we commence to decrease again, depending, of course, on the weather.

I understand that your employment of these labourers is at a time when outdoor work is scarce?—Yes.

Do they work on Sundays?—On Sundays we do not make gas as a rule between six o'clock in the morning and ten o'clock at night. If we have to make gas, we pay double; but, as far as possible, it is discounted.

Can you tell us anything about the healthiness or otherwise of this employment; have you any statistics or information throwing light on the general health of the men?—Yes; I have here a report of the Medical Officer of the Company, which gives an account of the health of the men. He says that the average number of sick during the year has been 153. The rate of sickness is 2.5 per cent., as against 2.9 per cent. in the Metropolitan Police. So that practically the gas workers come very near to the Metropolitan Police in point of health.

Will you tell us something about the Workmen's Provident Society?—It is managed by a Committee of the workmen at each station, and a representative Committee at the head office. It is subsidized by the Company to a large extent—in fact, the amount which the Company give is about equal to the pay of the Medical Officers. The men themselves contribute 6d. per week; and they obtain 12s. a week in case of sickness. In connection with this Workmen's Provident Society, we have a Consulting Physician, whom we pay ourselves. Then, in addition to him, there are 28 other medical men in the districts where the works are situated, to whom the men have access in case of sickness or injury. These are appointed by the men themselves.

Do you know what proportion the contribution of the Company bears to that of the men?—I think it amounts to something like 5s. 6d. per man per annum.

I see that the prevailing diseases, according to the report for the half year, are rheumatism, catarrh, and bronchitis. I also see injuries to 45, and burns and scalds to 33; and only one case of infectious disease is reported in the half year?—Yes, that is so.

It may be summed up, may it not, that your men earn, on an average, from 33s. to 35s. a week?—That is without the double time.

And you allow them certain holidays?—Yes; we allow them a week's holiday in the summer time, for which we pay them. We give them leave of absence and a week's pay; and then, in addition to that, in the case of the men who work, we give them a holiday in proportion to the time they have worked. If a man had worked six months, he would get three days' holiday.

Are your men members of Unions?—We do not know who are members, and who are not.

You make no inquiry?—We make no inquiry whatever.

And you do not discriminate between members and non-members?—No; the men are free to join or not. We do not make any inquiry; and all our foremen have strict injunctions not to express any opinion, or interfere in any way whatever.

When did you first begin the eight-hour system?—In 1889. The men said they would benefit very much by having three shifts instead of two; that they would have more time to devote to their homes, and to improving themselves. The Directors then went into the matter to see what it would cost; and it was conceded without demur.

What has it cost you?—It works out to about £70,000 a year.

I suppose the increased expenditure would be put upon the price of gas to the consumer?—To a certain extent. Of course, some part of it comes out of the dividend of the shareholders. As the price of gas is increased, the dividend decreases.

What is the total amount you pay in wages now?—In carbonizing wages, we pay about £260,000 a year.

What are your total wages?—I should think they would be something like £800,000 a year, including wages for carbonizing, purification, wear and tear, and all the labour.

On the whole, are you satisfied with the eight-hours' experience?—Well, I cannot say that we were altogether satisfied shortly after it

came into operation; because we found that the men did not do their work so well, and we did not get the same return from our coal. I am bound to say, however, that since last year things have improved; and the men are working in a much more satisfactory manner.

I suppose it necessitated your putting on a number of new men who were not so familiar with the business?—Yes. There were a certain number of men, too, who did not do their work in a satisfactory manner; and they thought that, because they belonged to the Union, it would keep them in their places, and this caused a lot of trouble.

What steps did you take to put an end to the trouble?—There was one case in 1889 in which we had to discharge a man for not performing his work in a proper way; in fact, he used to charge the retort with the wrong amount of coal. He tried to recover his wages. But the Judge decided that, as he had refused to obey the order of his superior, the Company were justified in dismissing him; and he gave a verdict for the Company, and with the costs of Counsel, which came to five guineas.

What was the order which he did not obey?—To put the amount of coal into the retort with which it had been previously charged, and which had been carbonized in it for years. I may say that this very man managed to get into one of our works some time afterwards under another name, and caused a great deal of trouble.

Is he now in your employ?—I do not think he is at present. The rest have since been doing better.

Have you introduced any improved machinery since 1889?—Yes; we have introduced machinery for the purpose of drawing and charging the retorts, and that is working satisfactorily.

Did the men take kindly to it?—At the time, they did not. We had to put the machinery into the hands of the firm who erected it. They provided men to work it; and after this had been done satisfactorily, they handed it over to us. When we first introduced the machinery, we had a great deal of trouble. The men who were employed on it were assaulted. The consequence was we had to keep men on the premises, and to house and feed them; and in order to protect them, we had a body of police.

About how many men were employed?—61.

And you had to protect those men against their fellow-workmen?—Yes. On one occasion, when two of the men were leaving work, they were in the train ready to go off; and some of the old hands came up and dragged them out of the carriage, and threw them on to the platform, and they were left behind. A telegram was sent to me in London; and I immediately went to the police station to get protection for the men. But I found that the only way was to keep them on the works; and I had a body of 34 policemen there as well. This went on for about seven weeks.

Was the cause of this strike the introduction of improved machinery, and nothing else?—We believe so.

And these men were assaulted simply because they worked at improved machinery?—So far as we can ascertain.

What is the tendency of the machinery? Does it lighten and diminish the amount of labour?—Yes; and the men instead of having to go close to the retort to draw it, have simply to operate the machine, which makes their task easier. The machines are working well now; and we have extended them. We are waiting now to see the result of inclined retorts, with which we have been experimenting. There is continuous improvement in machinery for the manufacture of gas, which renders the work less arduous and less dangerous.

Have you had any trouble with the Gas Workers' Union since 1889?—Yes; we have had trouble from time to time. The Union is not like the old one of which we had experience—the Engineers and Boiler Makers' Union; we had no trouble with them. But this particular Union seem to devote their efforts to forcing everybody to belong to it, whether he likes or not. At the very commencement of it, we had a cessation of work simply because there was a man in a retort-house who did not belong to the Union; and the other men, although we had a monthly agreement with them, threw down their tools, and insisted on his being removed. We thought it better to temporize with them until we were thoroughly prepared; but it is a most serious thing that the lighting of London should be jeopardized in this way. The old Unions were well and courteously conducted by the leaders; and we did not object to them. But the Gas Workers' Union have always been, what they call themselves, "a fighting body."

You think they have been capricious, and rather tyrannical?—Yes.

Do matters go more smoothly now?—I think they have lost a number of their members.

Did you hear Mr. Thorne's evidence?—No; but I read it afterwards.

Mr. Thorne himself has "learnt a lesson," I think he said?—Yes.

I believe you complain that the Union called a meeting in the works against a non-Union man do you not?—Yes. We had a great objection to that; and I told them that the Company were perfectly neutral, and did not inquire whether a man belonged to the Union or not, and that, if any meeting was to be held, it must be outside the premises of the Company.

Has not the monthly agreement been carried out faithfully—or have any of the men thrown up their work and gone off at a moment's notice?—I think there have been one or two cases, but nothing of any importance.

The Union has not attempted to break through that regulation have they?—No; although we have had rumours that they might do so; and it might be necessary to provide against that.

Is there anything more you would like to say with reference to the Gas Workers' Union?—At one period, in 1890, they were holding meetings in different places, and trying to force everybody to join the Union; and we had some notion that they might strike without any notice whatever, because they struck once, on Dec. 27, 1872, without the slightest notice. We employed 500 stokers at that time. There had been a secret meeting of the Union the night before; and the delegates told the men not to go to work. Though I expostulated with them, and told them what they were liable to, they said there was a dispute at the works of another Company; and, until that was settled, they had instructions that the men employed at Beckton were not to go to work, and 400 men went out of the works. Having that experience before us, we thought we ought to be prepared; so in 1890

we had buildings put up at all our stations, at a cost of more than £20,000, and made every provision, so that, in case of a similar state of things occurring, we should be able to house the men, and keep them all on the premises, and protect them.

In 1872, the state of the law was not as clear as it is now. Did you take any proceedings against those men?—We prosecuted six of them for conspiracy; and they were sentenced to twelve months' imprisonment, which was reduced to four months. We took out 500 summonses, and went on with fifty; and those fifty men were sent to prison for terms ranging from a fortnight to six weeks. But we have been told that, though men know they are liable to three months' imprisonment, they will run the risk of it. Practically, they have never done so; but we felt we ought to be prepared for every emergency.

So far as the Gas Workers' Union are concerned generally, are they displaying more moderation and giving you less trouble?—Yes. I am simply speaking now of the state of things as it existed in 1890.

I believe you have something to tell us about the coal porters?—Yes; in December, 1889, there was a meeting held at the Mansion House, at the instigation of the Coal Porters' Union; and we were told that, unless 4d. per ton was given for the unloading of coal, the whole of the coal discharging would be stopped the next morning. We had already made arrangements for the men who discharged our ships to pay them 4d. a ton. But it is a totally different thing discharging coal-barges, where, in some cases, the men are satisfied with 2d. a ton; and it pays them very well, as they earned 7s. 6d. a day. The very fact of raising the price by 2d. per ton was to send the wages up to 15s., which we considered most extravagant pay for that class of work. However, we agreed to pay rather than have our works stopped; and we have paid it from that time to this. But not knowing the extent to which the rise might go, we turned our attention to labour-saving appliances; and the result has been that the work for which we paid those men who insisted upon it 4d. a ton, we now get done for 10d.—2d. a ton would cover it all. Practically, therefore, we are unloading at a much lower rate than before our attention was fortunately drawn to labour-saving appliances; and if it had not been for this demand on the part of the men, I do not think we should have been so eager.

Do you provide cottages for your workmen to any extent?—Not to any very large extent; in fact, we find that the men prefer to live as near to London as possible. Our Beckton works are about two miles away from the outskirts of London; and we provide for workmen's trains to take them backwards and forwards to the Beckton works. We have about 118 cottages there for the foremen and the principal men who require to be on the premises. The workmen are all within a radius of three or four miles round the works—at Barking (from which place they can walk across the fields in 20 minutes), Canning Town, East Ham, and Woolwich.

The men are eight hours a day inside the works; and it takes them on an average an hour a day to go backwards and forwards?—Half-an-hour each way.

Compared with other occupations you consider that this is a well-paid one?—Yes; we have no difficulty in getting men to do the work, especially in winter time. The supply is rather in excess of the demand.

How much a week does it cost these men to go by train?—I think they pay 2d. a day—1s. a week. A good many of them walk.

You have practically no competition in your district?—Just so. We have what is called a regulated monopoly under statute.

And your dividends descend as your price ascends?—Yes.

What is your average dividend now?—Twelve per cent. That is a good dividend for those who bought their shares originally. But a considerable portion of the capital has been raised under what are called the auction clauses; and I do not think the holders realize more than 5 per cent. I myself have paid £260 for shares; and they are now down to £210.

How is it that they have fallen so much?—Because the dividend has fallen. The cost of manufacture has increased; and the profit earned has not been so great.

You do not attribute this entirely to the increase in the price of labour?—Not entirely; of course, the increase in the cost of coal has had a great deal to do with it.

At the price of the day (£210), what do the shares pay?—You can buy shares to pay a little under 6 per cent. At £200, of course they pay exactly 6 per cent.

Have you any suggestions to make to the Commission for improvement in the state of the law as to the relations between masters and workmen?—I think that a gas company is in a different position from any other trading concern. We have the responsibility for keeping our district lighted; and I consider it ought to be put out of the power of any Union, or any body of men, to try and enforce their terms, and say, "If you do not do so and so, we shall all leave our work."

But they cannot leave their work in your case without giving a month's notice?—No, not legally; but you heard what Mr. Thorne had to say as to the men quitting their work without notice.

But if they do leave without a month's notice, they are liable to three months' imprisonment, with or without hard labour. Do you want the law to be more severe than this?—No; but their idea is that, if a body of men make up their minds at one time to leave their employment, the law is powerless to prevent them.

Do you mean to tell me that the law is not strong enough to punish evil-doers in England?—That is the idea.

If the law is not properly administered, what more can you have. The law, you say, is severe enough, and it gives you ample protection; therefore you have no case that you can adduce to the Commission except failure of administration?—Except that the men have ignored their agreement, and put down their tools.

In the last ten years?—Yes. Within the last two years we had a case at our King's Cross station where they stopped work for the whole of one shift, because there was a non-Union man employed. We told them, if they persisted in that, summonses would be taken out against them; and then they went on again to the next shift.

You did not prosecute?—We did not.

You overlooked that breach of contract, and did not bring it under the cognizance of the law?—No.

You cannot complain of the law then, if you have never appealed to it?—I suppose we cannot.

It is not an unusual case to overlook a petty breach of that kind in the interests of peace and quiet is it?—It is not.

You never discharge a man, I suppose, in any circumstances without giving him a month's notice?—Except where a man absolutely refuses to obey reasonable instructions.

Has it ever occurred to you whether it was possible to establish a Board of Conciliation and Arbitration in connection with the gas-works in London?—I think such a thing would be very desirable in case the representatives of the Company and the representatives of the men were not able to come to terms.

Is it not well to have such an institution working before your difficulties arise, so as to prevent them?—I think so.

And you think, so far as your Directors are concerned, they would have no objection to that?—I cannot speak for my Directors; but, for myself, I am quite prepared to advocate it. In 1889, we were prepared to lay our case before the Committee of the Mansion House; but the men would not bring theirs.

But that was not exactly a typical case?—Things were not quite as quiet then as they are now.

Furthermore, it was not a time at which a Board of Arbitration was in existence. It was simply a case in which they were attempting to mediate between the employers and the employed?—There was no organized Board of Arbitration.

Mr. George Livesey, Chairman of the South Metropolitan Gas Company, was then examined. Replying to the CHAIRMAN, he said the Company employed 2940 men in the summer of last year, at wages amounting to £4770, or £1 12s. per man, per week; and in the winter, they employed 3641 men, at wages amounting to £6424, or £1 15s. 3d. per man, per week. These amounts included piecework, and a small quantity of overtime—£125 2s. and £143 18s. 11d. respectively. It was mainly the stokers' piecework and unloading coals that ran up the average.

The CHAIRMAN: In what capacity are they engaged?

Witness: Besides many minor occupations, there are three principal classes of workmen—(1) Yard labourers; (2) fitters and mechanics or artisans; and (3) stokers and retort-house men.

What are the hours of labour?—For yard labourers and mechanics they were: 59½ per week prior to 1860; 58½ per week prior to 1862; and 56½ per week from 1862, when the Saturday half-holiday commenced. They were reduced to 54 hours per week in 1889. Prior to 1889, the men were always paid for 60 hours; but in that year the half-holiday ceased to be a gift, the unit for calculating wages was altered from a day to an hour, and the weekly amount was increased.

What about the stokers?—Their work is continuous day and night. Prior to 1889, they worked on the two-shift system, being on duty about eleven hours; but actually they were at work about half the time.

Is that system still in force?—In 1887 and again in 1888, following the example of Liverpool, where about forty years ago the three-shift system had been introduced by the Engineer (the late Mr. King), also Bristol, Southampton, and other places, I suggested it to the South Metropolitan men, but there was no response. However, in 1889, the stokers formed a Union; and, being captured by the Socialists, they demanded the eight-hour shift, which, having been already offered, was immediately granted at a slight increase of pay.

Are you now working on that system?—At two of our six stations, yes; at the rest, no.

How is that?—Immediately after the strike, the choice was left to the men; and at three stations they elected to go back to the two shifts—of course, at a corresponding increase of pay—and another station went back last year.

Can you give the rates of wages, say during the last fifty years?—Yes; I have examined the wages-books since 1850, and have otherwise been able to go back to 1838. The results are set out in the table I will put in.

Speaking generally, what has been the increase in wages in the fifty years?—About 60 per cent. In some cases more; but in none less, than 50 per cent.

Do you know anything about house accommodation and rent?—Yes; it has increased from 80 to 100 per cent.

Are there any sick or benefit funds in connection with the Company?—Yes; in 1842, a sick fund was founded. Shortly stated, for 3d. per week, 12s. for three months, and 6s. for another three months, is provided in sickness, and £12 10s. on the death of a member and £7 10s. on the death of a member's wife. The funeral benefits are mainly met by a special levy. The Company subscribe yearly such sums as shall be required to make the fund financial. They give, in fact, about 2d. to every 3d. paid by the men. Membership is compulsory. In 1855 a superannuation fund was founded; the subscription being 3d. per week. The Company contribute an equal amount. The present benefits are a pension ranging from 10s. to 18s. a week, according to the length of membership, which can be claimed at 55 years of age, if a member is incapacitated, and without any condition at 65 years of age. By one of the rules, provision is also made for men who are not incapacitated becoming annuitants at 55 years of age. Last year's balance-sheet shows that there were 62 annuitants.

How and by whom were these funds founded?—The men were called together; and the proposals laid before them by the late Mr. Thomas Livesey, who was then Secretary and Manager. A free discussion took place; and I believe the men unanimously agreed to start the funds—the Company in both cases commencing them with a special donation, and guaranteeing their starting. The men have also a widows' and orphans' fund, managed by themselves, to which the Company give an amount equal to the men's subscriptions.

Are any holidays allowed with pay?—Good Friday and Christmas Day have been holidays, with full wages paid for nearly fifty years. In 1860, the late Mr. Thomas Livesey started the week's holiday, with pay, for all regular workmen. He proposed it to the Directors on the ground that there was no reason why the clerk should be paid during his holiday and not the workman. There was, and is still, one condition attached to the gift, which is that the men shall go into the country and not loaf about the public houses in the neighbourhood. In 1872,

Rates of Wages, Hours of Work, Holidays, and Benefits of the Workmen employed at the Old Kent Road Station of the South Metropolitan Gas Company

Date.	No. 1.—YARD LABOURERS.			No. 2.—FITTERS AND MECHANICS.	Hours of Work for Nos. 1 and 2.		No. 3.—STOKERS.		Hours on Duty for No. 3. Number for each Shift.
	Rate per Day of 10 Hours.	Average Rate.	Proportion of Men at the Lowest Rate.	Rate per Day.	Per Lay.	Per Week.	Rate Per Day.	Rate Per 7 Days.	
1838	s. d. 2 6	s. d. 2 6	All	4s. od. and 4s. 6d.	10	59½	s. d. 3 8½	s. 26	About 11 to 11½
1840	3 0	3 0	All	4s. 6d. and 5s. od.	10	59½	4 0	28	Do.
1850	3 0 3 3 3 6	3 1½	74 p. ct.	s. d. 5 0 5 6 6 0	10	59½	4 0	28	Do.
1860	3 0 3 3 3 6	3 3	52 "	5 0 5 6 6 0	10	58½ and 56½ from 1862	4 3½ And in 1866 5 0	30 35	Do.
1872	3 6 3 9 4 0 4 3 4 6	4 0	23 "	5 0 5 6 6 0 6 6	10	56½ but always paid for 60 hours per week.	5/2 and 1/6 37/8 for 7 days per week. 32/6 for 6 days Sunday work from 1872 stopped in daytime.		Do.
1880	3 9 4 0 4 3 4 6	4 2	4 " 45 "	5 6 6 0 6 6 7 0	Do.	do.	Do.	do.	Do.
1889	3 9 4 0 4 3 4 6 4 9	4 3	6 " 24 "	5 6 6 0 6 6 7 0	Do.	do.	Do.	do.	Do.
1890	Per Hour. Per 9½ Hrs. 5½d. 4s. 2d. 5½d. 4s. 4d. 5½d. 4s. 7d. 6½d. 4s. 11d. 6½d. 5s. 2d.	4 7½	3 " 32 "	Per Hour. Per 9½ Hrs. 7½d. 5s. 11d. 8½d. 6s. 6d. 8½d. 6s. 11d. 9½d. 7s. 6d.	9½	54 From 1889 wages have been calculated by the hour, and 54 hours paid for as the week's work.	On the two-shift system : 6/4 & 1/6 45/10 for 7 days 39/6 for 6 days On the three-shift system : 5/4 & 1/6 38/10 for 7 days 33/6 for 6 days		Do. 8 hours,
	Increase of wages in 50 years about 60 per cent.			About 50 per cent.			About 60 per cent.		

REMARKS.

Holidays with Full Pay for all three Classes of Workmen.—In 1838, no holidays were given. Soon after 1840, Good Friday and Christmas Day were allowed. This continued till 1860, from which year one week's holiday was granted, with full pay, to all men in constant employ. In 1872, the week's holiday was given, with double pay after three years' service ; and this was continued till 1890.

Benefit Funds.—A sick fund was started in 1842. The subscription is 3d. per week; the sick benefit, 12s. per week for three months, then 6s. for three months; also £12 10s. on the death of a member, and £7 10s. for a member's wife. The Company guarantee the stability of the fund, and contribute what is necessary—about 2d. per week per member. A superannuation fund was started in 1855. The subscription is 3d. per week; the Company contributing an equal amount. The pension ranges from 10s. to 18s. per week, according to age and length of service.

double pay was granted with the week's holiday to all men who have been in the service of the Company three years. The total amount paid for holidays last year was £5847 2s. 8d.

What about Sunday work prior to 1872?—The stokers everywhere worked just the same on Sundays as on other days. Some attempt had been made to give a day off once a month; but the working on Sundays was [not suspended, it being generally believed to be impracticable. About 1872, however, Dr. Gritton, the Secretary to the Lord's Day Observance Society, invited the Engineers of the London Gas Companies to meet him to discuss the question. He found many of them very favourable to the movement, with the result that gas-making was, and is still, entirely suspended from 6 a.m. to 6 p.m. on Sundays, except in cases of emergency. To the credit of the men, it must be said that they willingly surrendered the pay, in order to enjoy the day of rest. They are now paid time-and-a-half if required to work on Sundays.

Is anything else done for the men?—The Company have from time to time purchased land, some of it suitable for gardens; and this the men have been allowed to use without rent. These gardens are highly appreciated. In 1890, the Company undertook to receive the voluntary weekly or other savings of the workmen, and to pay 4 per cent. interest thereon, as an aid and incentive to thrift. This has been very successful, some of the men having already nearly £100 to their credit. When we started the profit-sharing scheme, we paid them the calculated bonuses for three years as a sort of "nest-egg."

How does it pay you to allow 4 per cent. interest on the men's savings?—We are continually requiring additional capital to meet the extension of business. Part of the capital has to be raised by the sale of ordinary stock by auction, which costs the Company 5½ per cent. The other part has to be raised by debenture stock, at a cost of about 3½ per cent. Taking the average, we find we can afford to give the workmen 4 per cent.

You give them 4 per cent.; and although you have some trouble in keeping accounts, you do not lose by it, and they profit by it?—That is so.

The CHAIRMAN: That is very satisfactory.

Witness: As to overtime, we have always found the men anxious to obtain overtime; but the practice has been discouraged, although every week some is necessary.

What proportion does it bear to the general wages?—In the weeks ending June 25 and Dec. 17 last year, it amounted to 2½ per cent. and 2¼ per cent. respectively of the total amount of wages paid. There is a considerable amount of piecework.

Has your general experience, extending over 40 years, been that you have had many or few disputes?—Until 1889, none whatever. Disputes may be said to have been unknown until the Gas Workers' Union was formed early in 1889, when they became continuous until they culminated in the great strike in December. Since then, they have again disappeared.

Was there a strike in 1872?—Yes; but it did not affect us. It was a strike of stokers at many of the gas-works in London, mostly north of the Thames. It was for an increase of wages, which was refused. The men left their work; and navvies, and others, provided by railway and other great contractors, temporarily took their place. There was no picketing, and no thought of forcibly interfering with the new men. The strike lasted only a few days. The stokers to some extent simply changed places—leaving one works and going to another; but practically they all returned to work. There was a large advance in wages, by gradual steps, from 1838 to 1889, and we have tried to give to every man the wage we thought he was worth. Many of the advances were made without being asked for; and we have always tried to make the rates of pay within the works rather better than those outside. The work of the stokers is more arduous than that of outside labourers; but that of the yardmen is not. The work in the retort-house is exhausting, because of the heat.

Does the work create great thirst?—Yes. We supply the men with oatmeal and water.

Is that the best means by which they can slake their thirst?—Yes. At one time it was thought beer was best, and they were allowed to have barrels of beer on the premises; but it was found not to be good. We disallowed it, and now supply oatmeal water instead.

And are the men better for the change?—Yes; I am sure of it. They are better in health for it. I am a little prejudiced perhaps; but I am certain it was a mistake to have beer on the premises, as the men were tempted to spend their off-time in drinking.

Were there no Unions in 1872?—Not affecting gas-works.

You do not complain of the Unions of skilled artisans?—Not at all.

Was there any increase of wages in 1872?—Yes; but not what the men asked for. In our case, we, on Nov. 1 in that year, gave 1s. 6d. a week as good time money. The men wished to have it in the form of 3d. a day; but it was successfully contended that a man who could be relied on to do regular work was worth 1s. 6d. a week more than an unsteady man. Good time money was adopted in 1889, as one of the demands of the Gas Workers' Union.

Now tell us all about 1889?—The circular of the Commission asks for a statement of the "causes, development, organization, and cost" of strikes. This will be a rather long story; but it should be given.

What was the beginning?—The stokers at Beckton, in the early part of 1889, asked for certain alterations, to enable them to have more time at home, which being refused. The Union was formed there in March, 1889; and they then began to agitate for eight-hour shifts. Between March and June, the movement extended from Beckton all over London; and in June they made a simultaneous demand for eight-hour shifts. The South Metropolitan Directors met their stokers' representatives in conference on June 19, when the demand for eight hours was granted; and on July 1, a formal notice of the alteration was given. The work was reduced greatly, but the pay remained the same, or was slightly increased. The work was diminished by about one

sixth; and this increased the cost 20 per cent. The men obtained the eight-hour shift so easily that I am afraid they felt it was a pity they had not asked for more. They soon made fresh demands for small concessions, some of which were granted. For instance, the stokers objected to do anything but draw and charge the retorts, which ultimately brought the increased cost to more than 40 per cent. I have here a comparative statement, showing that the cost of carbonizing went up from 2s. 5 $\frac{3}{4}$ d. per ton in 1888 to 3s. 7d. in 1889, or 44 per cent. advance. This was a great surprise to the Company, because, having conceded the eight-hour shift, they certainly expected the men would keep their promises, and work well; whereas, in fact, they so managed it that we had to put on more men to do all sorts of things. In August came the dock strike; and John Burns has said repeatedly that the success of the stokers was the cause of the dock strike. At any rate, at that time the coal porters left their work without notice. They had made no request whatever for an increase of pay, but stopped work in sympathy with the dockers. After being idle for some time, they said they would not resume work unless their pay was increased from 3 $\frac{1}{2}$ d. to 4d. per ton. These men were in our regular employ at East Greenwich. When they were not unloading ships, they were engaged in the yard. Early in September, 1889, a very trifling question arose, which I mention, from an historical point of view, because it originated the phrase about "smashing the Union." One day I was in the retort-house, and the stokers refused to oil the hinges of the retort-doors as usual. They said they had no objection to doing it, as it did not occupy five minutes a day, but that they had been ordered by the Union not to do it. I said to them: "If your Union does that sort of thing, it will not last twelve months." It was then reported all about the place that I had said I would smash the Union. After this, it became apparent that the stokers were determined to force all the men to join the Union. They gave us notice that rule 16 was to be enforced, which provided that all men working in the retort-house should be called upon to join the Union. The intimation was given in a letter from the Secretary of the Union.

You understood that no man was to be employed on your premises who was not a member of the Union?—That is so. At Vauxhall works a report was made to the Engineer about this time that a man named Purkiss had been trying, by unfair means, to force other men into the Union. This man was discharged by the Engineer. On the morning of Monday, Sept. 16, I was telegraphed for; and, on going to the works, found all the men assembled in rather an angry mood, and a notice was handed to me demanding the reinstatement of Purkiss. I said: "Well, you ought first of all to ask me to inquire into the justice of his having been dismissed; and I promise you, if justification or proof cannot be given me that he deserved dismissal, he shall be reinstated. Will you withdraw your notice?" The men, having retired to consider the matter, said they would not withdraw the notice. On the Wednesday, I called the Old Kent Road men together, told them of the circumstances, and promised that Purkiss should be reinstated. They said: "Will you meet the delegates on Friday?" and it was arranged that the Directors should meet them at twelve o'clock; but at eleven o'clock on that day, to my great astonishment, the men at all the stations handed in their notices. I thought it was a very unfair thing. We were not prepared for a strike, and so I said Purkiss should be reinstated, and that we would pay his wages for the time he had been out. They next asked that another man who had left Vauxhall should be reinstated; and I agreed to that also. An agreement was then drawn up, which was signed by myself and the representatives of the stokers, to this effect: "The South Metropolitan Gas Company hereby agree and undertake that members of the Gas Workers' Union shall not, in consequence of such membership, and so long as they faithfully perform their duties, be interfered with by the foreman; and the representatives of the Union agree not to interfere with men who are not members of the Union." At the time the men made this bargain, they said: "Although we will not intimidate or interfere with non-Union men, you must not ask us to work in the same gangs with them, because you know it will be impossible for Union and non-Union men to work in the same gang." I knew what was meant, because, in working retort-scoops, it would be awkward for any man who was not in harmony with those with whom he must co-operate, who could easily injure him. I therefore assented to that.

Then an agreement was entered into by both parties and carried out?—Yes, for a few weeks; but the Union men succeeded within a month in bringing all the men into the Union.

Did you interfere with their doing that?—We did not, because we had engaged to leave them free to do as they pleased. What had taken place, however, was sufficient to convince us that a strike was likely to take place at any moment without warning; and the Company therefore began at once to make preparations to meet it. We had frequent conferences with the Engineers of the various stations to discuss matters, and proceeded with arrangements for housing and feeding men on the works. We took steps to obtain police protection, arranged about advertising for new men, provided for protecting the vulnerable parts of the works, and decided upon efforts to retain the loyalty of such men as were not in the Union. All this was done quietly and secretly; because, while we wished to be prepared for any emergency, we were most anxious to avoid irritating the men.

What was the Union doing?—There was a strike at Bristol in October, creating discontent; and it was an open secret that another is. A day would be demanded in December. At the end of October, a printed notice was given by the Union for double pay on Sundays from 6 a.m. to 10 p.m., to take effect on Sunday, Nov. 10.

Did you yield that point?—I asked the delegates of the Union to meet me and the Engineers at our office, and they did so. I asked them why they made the demand; and they said it was to stop Sunday labour. I reminded them that we had not worked on Sundays at all, and that they had agreed, so lately as June, that Sunday labour should be paid for at time-and-a-half from 6 to 6. I told them I considered it unfair of them to so soon depart from the agreement. They said that that was not intended to last for ever. I asked what further demands would be made. Thorne, the Secretary of the Union, said that he thought it would have been better to wait until the half-yearly accounts were out in February, showing how the Company stood,

before making the demand; but the others told him he could only speak for himself, not for them. I conceded the double time under protest, but told them I should take it back as soon as I could.

What was the attitude of the men towards the Managers and foremen?—Anything but friendly; indeed, the control of the work had completely passed out of our hands.

Was there any real ground for anticipating trouble?—Yes; we were continually receiving information which convinced us of that. I went to the police because I thought it only fair we should inform them of what might happen. I pointed out to Mr. Monro, the Commissioner, that there was a difference between our case and that of the docks, inasmuch as the stoppage of the gas supply would be a public disaster. He said: "Everything the police can do within the law will be done." Then, as another and last means to prevent the possibility of a strike, the thought occurred to me that it would be far better, instead of fighting the men, to conciliate them. I have here in my hand the original rough draft of the profit-sharing scheme as introduced to the Board at the end of October. I suggested that the money had better be spent in this way than on a strike; and that, by means of a sliding scale, we should let the men share with the public the benefits of the reduction in the price of gas. The Board adopted the proposals. I then called a meeting of representatives of all classes of our employees at Old Kent Road, and explained to them the profit-sharing scheme. The representatives of the non-Unionist men at once said it was the finest thing they had ever heard proposed. The delegates of the Gas Workers' Union agreed that it seemed a good thing, but said they could not pronounce upon it until they had consulted the Executive. The same afternoon I met a number of the representative men at the Vauxhall works. But they did not appear to appreciate or understand the scheme, and the same was the case at two of the other works; and we thought therefore it would have to be dropped. In the course of the week, however, some of the free men asked themselves why they should lose such a good thing merely because the stokers would not go in for it. Therefore it was resolved by the Directors—unanimity among the men not being a necessary condition—to offer the scheme to any man who chose, by signing the agreement, to accept it. The following notice was then issued to the workmen:—

In order to give to every regular workman employed by the Company a direct interest in its prosperity, the Directors are prepared to place to the credit of every such workman who will sign the form of agreement herewith annexed, a sum of money annually as a bonus or percentage on his wages, regulated by the price charged for gas on the principle of the sliding scale, so that the workmen as well as the shareholders shall be benefited by reduction of price.

The shareholders get $\frac{1}{2}$ per cent. additional dividend for each reduction of 1d. per 1000 feet.

The workmen's scale will be 1 per cent. on their year's wages for every 1d. reduction below 2s. 8d. per 1000 feet.

The annual profit-sharing will be limited to those men who serve under agreement, and will be calculated on the 30th of June each year, when the amount will be credited to each man's account, who may withdraw it on giving seven days' notice, or it may be left to accumulate at 4 per cent. compound interest. The money so left shall remain the absolute property of the man in whose name it stands, and at his disposal so long as he remains in the service of the Company, or is placed on the superannuation list, in accordance with the rules and regulations settled by the Committee appointed for that purpose, and set out in full in the employees' pass-books.

This offer is made as a recognition of faithful service in the past, and as an inducement to the same in the future.

The proposals in regard to the regular men were also to apply, in a modified form, to the winter men. In order to give the men a substantial benefit immediately, it was agreed to calculate bonuses for three years' back, and place the same to the men's credit as a "nest-egg." None of this nest-egg money, except in case of death, was to be withdrawn in the first year, nor in the first five years, except in case of death, superannuation, or termination of service with the Company. Any man who struck would forfeit his bonus. One of our objects was, so to speak, to protect the men against themselves, and to help them to save money. The original rule was that, at the end of five years, any man might withdraw half his accumulated money on giving three months' notice, or the whole of it on giving six months' notice. We were afraid that, but for some such rule, the bonus would be drawn at once, and so do the men little good. I do not approve of this restriction now; but at that time our scheme was crude, and capable of improvement. During the specified period of five years, any man who was party to a strike, whatever the provocation might be, was to forfeit his right to share in the bonus.

Then you practically placed him at your mercy as far as that was concerned?—Yes.

Supposing you reduced his wages?—There was a clause in the agreement that the Company should make no alteration in the wages to the disadvantage of the men.

Do not you think five years is a long time to bind men to your will?—Yes; but that has been altered now, although all the non-Unionists accepted it at the time, and within a fortnight about 1000 men had signed. These men were invited to select 10 per cent. of their number to meet the Directors in conference on the subject. Certain parts of the agreement, including the strike clause, to which the stokers had objected, were eliminated; and we agreed to let the men draw their bonus every year. They generally accepted the concessions; and it was one of the most satisfactory meetings of working men I had ever attended. On the last occasion when the agreement was under discussion before the Commission, a good deal of objection was made to it by the witnesses; and it was said that it placed the men in the absolute power of the Engineer—that, if we had good men whom we did not want to lose, the Engineer might refuse to let them go. It was suggested to me privately that it might be desirable to drop the agreement altogether. But last Wednesday I asked the representatives of the workmen to meet me for the purpose of ascertaining their opinions; and I found they were strongly in favour of it—in fact, the one anxiety of every man who comes into the works is to sign the agreement; and as their agreements expire, the men are very careful to come and sign their renewals. There has not been a single case of a man wanting to leave being refused permission.

I produce a letter to that effect sent to me voluntarily by a man who left us to go to a better situation at Sheffield, and who testifies to having received every kindness and assistance at the hands of our foreman and the Engineer. The following is the form of agreement:—

MEMORANDUM OF AGREEMENT made the
day of _____ 189 between
for and on behalf of the South Metropolitan Gas Company, of No.
709A, Old Kent Road, in the County of Surrey, of the one part, and
_____ of the other part.

1. The said _____ for South Metropolitan Gas Company agrees to employ the said _____, who says that he is not a member of the Gas Workers' Union, for a period of _____ months from the day of the date hereof at one or other of the stations of the said Company, if he shall remain sober, honest, industrious, and able to do the work allotted to him, and shall not at any time during the said period become a member of the said Union.

2. The said _____ agrees to serve the said Company for the said period of _____ months in whatever capacity he may from time to time be employed by the said Company at the current rate of wages applying to such capacity.

3. The said _____ agrees to obey the orders of the foreman in charge.

4. The hours of working for yard men to be 54 hours per week.

5. The Company undertakes that, during the continuance of this agreement, the different rates of wages in force at the date hereof, and which, under clause 2, may become payable to the said _____ shall not be reduced.

6. The said _____ to be entitled to the benefit and be bound by the conditions of the annexed notice, so long as he shall continue in the service of the Company under agreement.

As witness the hands of the parties,

No obstacle will be thrown in the way of any man engaged under the above contract who may wish to leave the Company's employment before the expiration of the period of service therein agreed for, provided he shall notify such wish to the Engineer of the station at which he may for the time being be employed; and, on receipt of such notice, the Engineer shall, in his discretion, consider whether the services of such man can be dispensed with without detriment to the Company, and, if so, permission will be given at the expiration of the usual week's notice.

The CHAIRMAN: Now tell us what took place when the strike began, and how it began.

Witness: Three men at Vauxhall—Harvey, Kerr, and Beadle—had signed the agreement. The Union delegates watched all the men most closely. Any men who were seen talking to the Engineer or foreman had to be very careful. The three men named, having signed the agreement, it came to the knowledge of the Union; and the Union sent a letter to me, enclosing a resolution declaring that the men at Vauxhall would be justified in striking if the three men in question were not removed. That came on the 2nd of December, when I had thought all our troubles were over. The answer I gave was that, as there was no reasonable ground for the demand, it would be refused. I had a conference about it with the Chief Engineer and the Secretary. I said: "This means a strike; and I take the responsibility by refusing the demand." We had a somewhat similar difficulty at Rotherhithe the same day. We then agreed to set to work and make our preparations openly. On Wednesday, Dec. 4, just as the Board was about meeting, there came a letter containing a resolution passed at a meeting of delegates of the Gas Workers' Union, stating that, in the opinion of the meeting, the action of the Company in forcing them to work with men who had signed the bonus scheme, and whom they looked upon as blacklegs, was unjust and unfair, and that all the men in the Company's employ would be justified in giving in their notices, unless the profit-sharing scheme was abolished, and all the men who had signed agreements removed from the works. We had been watching our opportunity; and we saw it on the receipt of that letter. We sent a copy of the letter to all the papers, and informed the public that a crisis had arrived in regard to the gas supply of South London. On the following day, an answer was sent to the Union, stating that their demand could not be conceded. On the Friday, they sent word that there had been a clerical mistake in their letter, which should have said the scheme must be dropped, "or" all the men removed from the works, instead of "and;" but that made no difference. By eleven o'clock on Thursday, Dec. 5, 2005 notices were personally handed in by the stokers.

What did the Company do?—Immediately telegraphed to advertisement contractors to insert the prepared advertisements. Clerks and inspectors and workmen were sent as agents to obtain men from all parts; the terms having been settled beforehand. Large posters were ordered to be put up all over London; and everything was done to make known the need of men to take the place of the strikers. High terms were offered.

How did the Unionists take it?—On Friday, Dec. 6, barge loads of provisions arrived at all the stations, which, with the other active preparations going on, convinced them that this time the Company were in earnest. They sent agents into the country to counteract our agents. On Saturday, Dec. 7, events showed that, unless protected, the buildings for housing the men would probably be wrecked, and watchmen were accordingly appointed. During the Sunday night 130 blankets were thrown into Deptford Creek from our Greenwich works. Monday was a very anxious day. Some of the watchmen, being Unionists, could not be relied on, though the others were perfectly loyal. The destruction of beds at Greenwich was one evidence of intended mischief. The tools of the stokers were also being destroyed or thrown into the canal and the river. The men stopped work in the morning at Rotherhithe and Old Kent Road, and again in the afternoon at all the stations, because a few new men had been introduced. These were removed, and work was resumed. Some of the men had assumed a threatening attitude, but were restrained by others. I had been in communication with the police. The Directors considered it absolutely necessary to have police protection inside the different yards and depôts of the Company, as without it they could not hold themselves responsible for any consequences that might ensue. We felt certain that, with such large numbers of men, mischief would be done; and therefore we asked Mr. Monroe, the Commissioner, to send some police within the works.

Mr. Monroe said they would give any support outside the works; but they must be satisfied there was danger before they could go inside. However, later in the day, I had an intimation that police would be sent in to each of our stations. When they did come, they behaved splendidly. Fifty men went into each of the works, and were kept on by relays all the week. About 700 police were engaged in protecting our works during that week. The effect that the presence of the police would have on the men was at first a little doubtful. Mr. Monroe stayed until midnight to see how it was taken. He thought perhaps the stokers would refuse to go to work. He told me the stokers would have had to go out, not his men; and I quite approved. However, the Unionists were awed by the police; and they gave no further trouble, except by doing everything they could, by neglect and so on, to injure the works. We informed the men that, if they withdrew their notices by Tuesday, at noon, they could remain; but that otherwise their places would be filled up. On that day, Mr. Causton, M.P., and Mr. Beaufoy, M.P., came to me as mediators. They acted very fairly and properly, and asked me if I would meet the men. I said I would, but they must come that afternoon, as the new engagements must be posted. Mr. Causton and Mr. Beaufoy tried to get the men to meet, but did not succeed in time; and, as a consequence, we had to send off our engagements. We received as many as 900 applications for work one morning. On the Wednesday morning, we had an interview with a Committee of the Union men. They were very determined; and I am sure they believed we should not succeed in doing without them. They demanded the absolute withdrawal of the profit-sharing scheme. We refused. In the afternoon of the same day, while the Board was sitting, Dr. Clifford, the Rev. Andrew Mearns, and the Rev. Hugh Price Hughes came as mediators. The last-named talked an hour-and-a-half about "the sacred right to strike," &c. At last, I rather lost my temper, and said, "It would be much better if you gentlemen would mind your business, and leave me to mind mine."

Was the Rev. Mr. Hughes referring to the bonus clause in your form of agreement?—No. No doubt the men were right in saying the scheme would prevent a strike, as the agreements would not expire simultaneously. I stated that, from our point of view, that was what we wanted. Dr. Clifford and Mr. Mearns were perfectly fair and reasonable; and Mr. Mearns told me afterwards they were not responsible for what Mr. Hughes had said.

Had any other of your men given notice?—No; but the coal porters, who unload barges, made a demand for increased pay, which led, on Dec. 12, to a threatened stoppage of the coal trade. I attended a conference convened by the Lord Mayor at the Mansion House. The Lord Mayor was in the chair a portion of the time, and then Sir John Lubbock took his place. There were present Cardinal Manning, the Revs. Andrew Mearns and Hugh Price Hughes, Michael Henry, the Secretary, and several other representatives of the Coal Porters' Union, all the principal coal merchants of London, and representatives of the three London Gas Companies. Michael Henry demanded 4d. a ton from the coal merchants, which was conceded; and he then said they wanted 4d. a ton also from the Gas Companies. Mr. Jones and I pointed out the difference in the circumstances. Sir John Lubbock suggested that the question should be submitted to arbitration. The Gas Companies agreed to that at once; but Michael Henry said he could not accept arbitration, unless the Companies gave the increased pay at once. Then Cardinal Manning, who had moved the resolution in favour of arbitration, said he quite sympathized with the men. At the earnest request of Sir John Lubbock, we consented to pay the 4d. pending arbitration. Michael Henry then said he would accept that for The Gaslight and the Commercial Companies, but refused it for the South Metropolitan, unless they took their old stokers back. Personally I was very glad of the refusal, because our men were working for 3d. per ton, with which they were satisfied. Our coal porters left us, with the stokers, without notice; and we engaged others, who do the work at the old rates, and are contented. It was at two o'clock on Dec. 12 that the first shift of stokers left the works; a large force of police being present. At ten o'clock at night, the second shift left; and at six o'clock next morning, the last shift came out.

Did all the men leave?—Out of about 2000 retort-house men of all grades, only a dozen or two stayed in the works, having found hiding places. On Dec. 13, the new men came in from all parts. Great assistance was rendered by the railway companies, and to protect the new men in their passage through the streets against the many thousands of pickets, nearly 3000 police, mounted and on foot, were engaged, who, under the command of Major Gilbert, the Chief Constable for South London, in the most admirable manner, did their work without a single broken head. By eleven o'clock, the yards were full of men, and notices were put up that no more were required. There was, in fact, such an excess that about 2000, after being supplied with a good meal, were paid off during the day.

Was the picketing done by your old workmen, or by the ordinary crowd?—By both. There were sympathizers from all parts of London, determined, if possible, to prevent the new men getting in; and there were thousands of the loafers and idlers who welcome any chance of a row.

How had the old hands been working during their last week?—As badly as they could; in fact, it was the opinion of the foreman that, if the notices to leave had extended to a fortnight, instead of a week, the work would have come almost to a standstill.

Did they leave quietly?—Yes, the police took care of that; but the last gangs at East Greenwich and Old Kent Road set fire to the lobbies when they left.

In what condition did the new men find the works?—The furnaces were neglected, the pipes choked, and the retorts crammed with coal, rendering them most difficult to draw; in fact, in such a state that I do not know to this day how they did the work.

What was the effect on the make of gas?—On Dec. 4, the day before the notices were given, the old stokers made 27,500,000 cubic feet. On the last day, when they should have made considerably more (the demand having increased), only 23,250,000 feet were produced. The first day's working of the new men only yielded 13,500,000 feet, which was very good, under the circumstances.

Did the consumers suffer?—They went short of the supply of gas they required by about one-third; but they bore the privation very cheerfully.

How did the strikers act?—The pickets planted their men at our stations; and a great many violent assaults took place. The strikers circulated all kinds of false reports about the Company, and also about the new men. They abused the people who burnt oil-lamps, and turned on the public lamps in the day time, in order to run down the stock of gas.

Did any other men give trouble?—On the day that the stokers left, the coal porters at all the riverside stations struck without other notice than Michael Henry's threat on the previous day at the Mansion House. This gave much trouble. The same afternoon Michael Henry wired to the North to the Seamen and Firemen's Union to stop the sailing of our ships.

Did the lightermen strike?—Yes, those employed by the Company's contractors; but the Company's own men did not. There was much trouble on the river.

Did any other men strike?—Yes. During two months the Seamen and Firemen's Union picketed all the Company's steamers both on the Thames and the Tyne, calling out all the crews. Many responded; and their places were easily filled by other men.

What other difficulties had you?—Well, there was the housing and feeding of about 4000 men; and the teaching of new men to do the strange work. We also had to try and gain their confidence. Another thing was that every week when they got their wages, being unaccustomed to receive such large earnings, numbers left; and the same thing happened when the £4 bonus was paid; and, as the strikers would not return, additional new men had to be obtained. Then we had to deal, of course, with the great difficulty of getting down to ordinary pay and up to ordinary work.

What was the cost of the strike?—It is impossible to say exactly. The direct expenses were £62,328 charged in the two half-yearly accounts. To this must be added: Losses on coal and coke, about £7000; loss from less gas being made and sold, about £13,000; extra wages paid to new men, about £12,000; additional wages to new men in spring and summer, £5000. The total cost and losses were, in fact, about £100,000.

Was the result worth the cost and trouble?—Unquestionably. It checked from that day to this, for all the gas undertakings in the kingdom, the further aggressions of the Gas Workers' Union, one of which would have been the additional 1s. a day, or another 20 per cent. on wages, equal in our case alone to some £20,000 a year. But this was the smallest part of the gain—it broke down a system of tyranny over employers and employed that had become intolerable. But even that is not the greatest advantage—it gave in place of hostility and antagonism, peace and goodwill; in place of doubt and mistrust, confidence; and in place of sullen and discontented workmen, a body of cheerful, willing, and capable workers, with whom it is a pleasure to be associated. These last-named mutual advantages are worth all the cost and trouble the strike caused the Company, and all the inconvenience it caused the loyal men.

How were the costs met?—£30,000 was taken from the insurance fund, £30,000 from the dividend, and the balance from the reserve fund.

Did you raise the price of gas?—No. The consumers had most cheerfully borne their share of the burden, by going short of gas at the time of the year when they wanted it most. We, therefore, informed them by circular that they would not be called upon to pay any part of the cost.

Did you take back any of the strikers?—Very few after the agreement of Feb. 4 was signed. Less gas was required; and by that time all the worthless and useless men who came on at the strike had been weeded out. Consequently, there were very few vacancies; but such as there were were filled with the old stokers. No objection was made to them on the ground that they were members of the Gas Workers' Union. But, in consequence of a speech made by Mr. Thorne, the Secretary of the Union, at Plymouth, after the agreement had been signed, it was felt that the supply of gas to London must not be subject to the caprice of the irresponsible leaders of any Trades' Union; and therefore notice was put up at all the stations, which is still in force, to the effect that we would not employ Union men. It applies also to the Coal Porters' Union, which had twice stopped all work without notice. The men, however, had had quite enough of the Union, and were very willing to leave it; and at some stations the new men had been so badly treated by the strikers, that they strongly objected to the re-engagement of any of them.

Was there any black-listing?—Never. On the contrary, all the managers did what they could to assist the strikers to obtain work elsewhere.

You employ a considerable number of artisans; are they members of Trades Unions?—We employ between 200 and 300. We never ask the question when engaging them; but it has been found, as a rule, that, when they feel their situation safe, if they have been Unionists, they do not remain so. My experience as to conciliation and arbitration has been limited, and, so far, very unfavourable. The attempts at conciliation with the Gas Workers' and Coal Porters' Union prior to the strike were conspicuous failures.

Have you any remedy for the industrial war that now wages between capital and labour?—Yes; industrial co-operation between capital and labour; and, as an important step in that direction, and in many cases under present circumstances the only practicable step, is profit-sharing.

Why do you say that?—Because the wage-hire system has failed to produce industrial peace. In the words of our respected colleague Mr. Burt: "We have passed from slavery to serfdom, and from that to the wage-hire system, and we shall get beyond that some day."

What led your Company to adopt the principle of profit-sharing?—The immediate cause was the necessity to do something to retain, or to obtain, the allegiance of the workmen, which was fast passing away, in the autumn of 1889, under the influence of the Gas Workers' Union. The idea was not a new one. I had brought it before the Directors as the complement of the sliding-scale shortly after 1875. It was revived in 1886 in a somewhat crude form, when an annual

bonus, dependent on profits, was given to all the officers and foremen. But it was not until 1889 that profit-sharing was extended to the workmen under the circumstances already mentioned, beginning with the "nest-egg." None of the men now object to sign the agreement; quite the contrary. The scheme is working most satisfactorily.

What have been the percentages on wages which the men have received?—The starting point is when the price of gas is 2s. 8d. per 1000 cubic feet, at which price there is no bonus. The bonuses have been as follows, following successive reductions in the price of gas: June, 1887, 2 per cent.; June, 1888, 3 per cent.; and June, 1889, 4 per cent.—making a "nest-egg" of 9 per cent., to be left at 4 per cent. compound interest by the decision of the men, for five years. Then the bonus to June, 1890, was 5 per cent., to June, 1891, 5 per cent.; and to June, 1892, it will be 3 per cent. The Company have been unfortunately compelled to raise the price of gas to 2s. 6d. from Michaelmas last, which has the effect of reducing the shareholders' dividend and the bonus of all the employees from the highest to the lowest.

How do they take the reduction?—Very well indeed; they appear to understand that, if they share profits, they must share losses. They inquired how it was coke was sold so cheap while coal remained dear, and were satisfied the best was being done. They are certainly working as cheerfully and as well as ever, and some are beginning to make suggestions for improvement in working.

Have you anything to say about picketing?—Nothing against fair and legitimate picketing; that is, for giving information that a strike is in progress for the purpose of persuading other men not to go to work. But in my experience, if this were its only object and use, it would be very little practised. So far as I have seen, picketing is pursued for the purpose of intimidation, and is always accompanied by violence, unless restrained by the presence of a sufficient force of police. Unquestionably the thousands of pickets congregated on the day when our new men were brought in intended forcibly to prevent their entrance to the works, as this same Union did at Bristol the previous October, and as they did at Leeds the following July.

What about labour-saving machinery?—As long ago as 1860 machinery for drawing and charging retorts has been under the notice of gas makers; and since then, from time to time, new machines have been invented. But the trouble and expense attending its introduction have so stood in its way, that very little was done. Hand labour was satisfactory; and there was a dislike to making a change. From the formation of the Gas Workers' Union in 1889, however, all has been changed. Everywhere machinery is being adopted, and to such an extent that the makers are overwhelmed with orders. In fact, machinery has now been made to answer.

What is its effect?—In one of our retort-houses at East Greenwich, it requires 14 men to work the machine in place of 36 for hand work—a reduction of 61 per cent. in the number of men. At my first interview with the Unionists, I told them it would come to this.

Is machinery being applied in other ways?—Yes. Conveyers for coal and coke are being adopted, whereby large numbers of men are being displaced. At the Old Kent Road works 120 men now do the work of 170. Personally, I am very sorry it is so; but it cannot be helped. The continued success of gas companies depends upon selling gas at the lowest possible price; and the increased cost, caused by the great rise in wages, must be met.

Is the introduction of machinery troublesome and expensive?—Both; but neither will prevent its adoption. The Union has given the necessary impetus, and inspired the management with a determination to make it succeed; and it will succeed most certainly.

In regard to the profit-sharing, if you gave your men the bonus every week, would it not work as well?—No; the effect would be quite different. I believe our present system would answer even if we had no statutory monopoly, and had to compete with employers who did not adopt the same system. We can tell that by the accounts of other gas companies. We find that it costs them in retort-house wages about 5d. per ton of coal more than it does us for making gas, although we pay quite as high wages as they. But this is exclusive of the profit-sharing, which amounts to about 1½d. per ton. We are getting better results than we ever had before. Whether or not it is the consequence of the profit-sharing system, it is the fact.

You heard Mr. Thorne object to your profit-sharing scheme, on the ground that the men are bound for twelve months, and that it is absolutely within your discretion whether or not a man shall leave your service?—Yes; but the men are pleased with the agreement. They like to be assured of twelve months' certain work, especially when they know that in practice they can get away at a week's notice if they want to.

Mr. C. C. Carpenter, Engineer of the Vauxhall station of the South Metropolitan Company, stated, in answer to the CHAIRMAN, that the profit-sharing scheme, in his opinion, was working wonderfully well. The workmen showed a greater desire to economize; they took a more intelligent interest in their occupation.

Mr. Livesey, in further examination, said the Gas Workers' Union was started in March, 1889; and it was practically speaking founded by the Socialists.

You have spoken somewhat strongly about the New Unionists. Are you quite sure that the action of the Union was wholly unprovoked? Was there no cause for forming the Union? Why did the men join?—The men told me there was no cause as regards our Company, but that, in the case of some other companies, there was some reason for it.

Nevertheless, your men did join the Union?—Yes.

And became rather strong and violent members of it?—Yes, and are very sorry now that they ever did.

By Mr. TUNSTALL: I believe the workmen of this country have the sense to see the advantages of co-operation with their employers, and are willing to adopt it when it is properly put before them.

By Mr. AUSTIN: Although our rule is not to employ Union men, I do not think we should interfere with a Unionist so long as he kept quiet. I daresay we have one or two Unionists now. Although a man must declare himself a non-Unionist to participate in the profit-

sharing, he does not have to make such a declaration to obtain employment. I would have no objection to employ members of the Union if the Union was conducted with a little more moderation. We have never had any case under the Employers' Liability Act. If a man is injured in our employ, we consider it is our place to provide for him and his family.

By Mr. TAIT: I have considered the question of the men not only sharing the profits, but having a voice in the management of the business, by sending a representative to the Board of Directors; but, although it would not much alarm me, I cannot yet see that it is practicable.

Mr. TAIT: Now that you are in peaceful relations with your men, do not you think it would be well to introduce better counsels into the Gas Workers and Coal Porters' Unions by allowing your workmen to join?

Witness: I have no faith in that in regard to those two Unions, which are doing, and have been doing, everything in their power to shake the confidence of our men in the justice of our arrangements. I regard those two Unions as the organizations of the Socialists. I have nothing to do with the present leaders of those Unions, or their principles. If you (Mr. Tait) or Mr. Trow, were at the head, I would have no objection.

Mr. TROW: You do not object to Unions on reasonable lines?

Witness: Certainly not.

You do not object to conciliation on reasonable lines?—No; I want justice between the parties. If you can get it by conciliation, do so by all means.

Your idea of conciliation and arbitration is that matters should be reasoned out?—Yes.

You think your men are beginning to see that they are working for themselves?—Yes; and they are satisfied, and have authorized me to tell this Commission so.

In answer to the DUKE OF DEVONSHIRE, witness said he thought the profit-sharing system could be applied to other industries, as it had been in certain cases; and the men could be satisfied as to the correctness of the profit return by employing independent accountants.

The CHAIRMAN thanked Mr. Livesey for his evidence, and the Commission adjourned.

Wednesday, May 31.

Mr. Livesey was this morning recalled, and said he had omitted in his previous evidence to state what was rather important with regard to the rents of workmen's cottages. In 1850, a field adjoining the gas-works was covered with workmen's cottages, each of which contained four good rooms and a kitchen. The rent of these was then 5s. a week. They were now let at from 9s. 6d. to 10s., and were divided into two tenements—the top floor for one family, and the bottom for another. The rents had been increased, and the accommodation diminished by about one-half. These cottages belonged to private owners.

The CHAIRMAN: You believe that, in the period you have named, the rents in the neighbourhood of the great works in London have doubled?

Witness: They have certainly increased from 80 to 100 per cent. The rents of a slightly better class have not increased so much. For instance, for the first house I occupied in 1859, I paid £31 10s. a year, and it is now let at £32.

This concluded the evidence relating to the gas industry.

THE METROPOLITAN WATER SUPPLY COMMISSION.

Tuesday, May 31.

(Lord BALFOUR OF BURLEIGH, Chairman; Sir G. B. BRUCE, Sir A. GEIKIE, F.R.S., Professor DEWAR, F.R.S., Mr. G. H. HILL, M.Inst.C.E., Mr. J. MANSERGH, M.Inst.C.E., and Dr. W. OGLE, Commissioners.)

Continuing the evidence to-day on behalf of the Chelsea Water Works Company,

Mr. Albert A. Gill, District Engineer of the Company for about 9 years, said he was responsible for the distribution of the Company's water. The statement that the number of houses supplied by the Company on Dec. 31, 1891, was 36,250, required an explanation. Sir William Wyatt was under a slight misapprehension. The number of houses given included empty ones—rather less than 600 probably. But that would be compensated to a certain extent by the fact that all new houses were withheld from their monthly returns for six months after the water was laid on. This practice was in order that they might have something to stand against the empty houses—to make the number of supplies returned more like the actual number of supplies provided. The number of empties was a fluctuating figure; and the Company had not the means, except once in every half year, of checking the number. To get at a percentage or a formula applicable to the circumstances, he had made tests on three or four estates in the Company's district; and he found in the estate which contained the greatest number of empty houses that they did not come up to 5 per cent. Referring next to the estimate of 35 gallons per head per day for the whole district for the future extensions, he said he thought he should be able to show that this estimate was a very liberal one—not to say excessive. He had taken five typical estates, fairly representing the class of property that might be built. The first estate contained 383 occupied houses, of an average rental of £26, with two water-closets in each house; and the average supply per head per day worked out to 16.7 gallons. The next estate contained 664 houses, of an average rent of £28; and the average supply per head was 16.1 gallons. The next, a very similar estate as to rental, had 438 houses; and the average supply per head was 15.9 gallons. The next had a somewhat better class of property; the average rent being £34. It had 416 houses; and the average supply per head was 17.7 gallons. The next estate was considerably superior; the rents ranging from £40 to £42. Here the average supply per head was 19.5 gallons. Speaking of the con-

stant water supply, witness remarked that there was very little demand for it in the Company's district, and little appreciation of it.

The CHAIRMAN: I am in your district, and I appreciate it very much indeed.

Witness pointed out that in some large buildings—such as industrial dwellings—where the Company afforded a constant supply, the consumers themselves in a great many cases made the supply intermittent. Being interested in saving water being supplied by meter, they turned it on only a certain number of hours a day. Directing attention to the value of waste inspection, witness next pointed out that, after three waste inspectors were appointed in 1874, their efforts took effect in a few years; and when after he came into the Company's service at the end of 1883, and found there had been a relaxation of these efforts, he started them again, the supply from a maximum in 1885 of 305.4 gallons per house decreased. The next year it was 294 gallons; the next, 293; the next, 289.9; the next, 266 (when there was a wet summer); the next, 270; and now it was 278.9 gallons.

Mr. G. H. Gill, the Secretary to the Company, was next called; and giving attention to his Company's estimate for the future, he observed that they calculated upon supplying, 40 or 50 years hence, about 10,000 more houses than now. He found that in the year 1866 they were supplying 10,000 fewer houses than at present, and that the average daily quantity of water supplied since that year had only increased by 1,489,000 gallons; while in their statement they had allowed for the 10,000 houses which they might possibly be called upon to supply in the future no less than 3,250,000 gallons. As to the question whether the water which they proposed taking at Moulsey came within their quantity allowed of 20,000,000 gallons a day, he pointed out that the Company's Act of 1875, under which they constructed the works at Moulsey, gave them power to take water from any springs on or near the works by the Act authorized, provided the quantity taken from the Thames did not exceed 20,000,000 gallons a day.

The CHAIRMAN: Then arises the question what is a spring?

Witness: Well, this water was reported on by Dr. Tidy as spring water.

The case of the Grand Junction Water-Works Company was then proceeded with.

Mr. A. Fraser, the Engineer to the Company, spoke as to the statement submitted on his Company's behalf. With regard to the source of supply, he remarked that it consisted of two intakes, one upon the mainland at Hampton, and the other on a small island at Sunbury. They put forward as an advantage, which they possessed in addition, a complete system of works for natural filtration of the Thames water, which had been in use for more than ten years, and by means of which the river water was passed through extensive beds of gravel and sand characteristic of the neighbourhood, before being pumped into the reservoirs from which it passed into the ordinary filter. This was totally different to the East London Company's natural filtration, as described by Mr. Bryan. Then, in addition to this natural filtration, the water so derived was filtered as carefully as water taken straight from the river. Asked if he could give any information about the amount of water the Company took direct from the stream of the river, and the amount which they took from what they called the natural filtration beds, witness explained that they only used these beds when the river was not quite at its best. Regarding the report of a threatened extension of building on a large scale at Hampton causing apprehensions of such pollution of the gravel by cesspools as would render necessary the abandonment of the practice of drawing water therefrom, he stated that all danger was averted by the construction of puddle walls between the gravel beds and the estate laid out.

The CHAIRMAN: Have you, in drawing water from the gravel, any apprehension whatever (in the existing state of matters), or any ground for believing, that the danger spoken of exists?

Witness: None at all. It is simply the river water like all the other water.

And, as such, do you count it within the limit you are authorized to take?—Yes.

Therefore, you do not put that forward in any sense as a supply in addition to that which can be obtained from the river?—Certainly not.

Concerning the suggestion that the Company were depleting the Thames, witness affirmed that there was a sufficiency of water there for the purposes of navigation and anything else, and for the Company's purposes.

The CHAIRMAN wished to know if witness suggested that the fact that the level of the water of the river at his Company's works was not altered by these operations proved that they were not depleting the river.

Witness replied that the fact went a great way in the matter of proof. He was aware that there were a lock and a weir below the works, and that the lock and weir were used for regulating the level of the water; but he still maintained that the fact mentioned showed that the Company's operations did not affect the quantity of water in the river.

The CHAIRMAN said he was sorry not to be able to agree with the witness.

In reply to Professor DEWAR, witness affirmed that there had been a steady improvement in the quality of the Company's water, and that the experiments of boring in the chalk spoken of in the statement sent in by the Company showed that, should any necessity arise for their going further afield for supplies, these would be obtainable—that there was additional water in the Thames Valley in their neighbourhood. They had, however, no intention of applying for powers to enable them to go further afield.

Questioned again by the CHAIRMAN, witness said there was no part of his Company's district so near Chertsey as to make the statement of the Rural Sanitary Authority there, concerning pollution from wasting cesspools, relative to the Company's works. These must be 10 or 12 miles away from Chertsey, and were on the other side of the river to Chertsey.

The Southwark and Vauxhall Company's case was taken next; and Mr. F. W. Restler, the Engineer to the Company, first gave evidence. He stated that the Company never closed their intakes. They took flood water at all times, and found no disadvantage arising from doing so as regards quality. The filters were merely clogged more rapidly, and had to be cleaned more frequently. He agreed with other witnesses

that flood water was the worst with which a water company had to deal; but at the times of it in his Company's case, their draught from the Thames was minimized because the natural collecting wells gave them half their supply. He described these wells, and also steps which the Company had taken to protect their sources against possible pollution. He likewise illustrated that, as their constant supply extended, so did the quantity of water used decrease; and he expressed his belief that, under the constant system, the supply was less than under the intermittent, where there was proper control of the fittings.

Professor DEWAR pointed out that, according to analyses, the water of the Company had been on occasions markedly turbid; and he invited an explanation of this circumstance.

Witness stated that there was no want of filtering area, although his Company were making very considerable extensions at the present time. But there was just the possibility, he added, that at times, when the river was exceptionally bad, the filtering might have to be done a little bit hurriedly; and to provide against this, his Directors had decided to provide more accommodation. He believed that the extensions of the filters would certainly reduce the chance of a recurrence of what the Professor had referred to.

On the Lambeth Company's case being taken,

Mr. S. H. Louttit, the Secretary and General Manager of the Company, gave evidence. He mentioned, among other things, that their parliamentary area was 102 square miles, while the area they actually supplied was 71 square miles. They had power to take water from any point within the parliamentary area—they were not limited—if they acquired land by agreement, not compulsorily. He also informed the Commission that the question of their underground water was gone into fully during an inquiry in 1880, which lasted for 42 days, and that the Assessor on that occasion came to the conclusion that that water flowed from the direction of the Bagshot sands, and was a very valuable adjunct for the supply of London. The water flowed in a northeasterly direction, and came into the gravel beds in very large quantities. He took it that these beds all around their works, and for a long distance inland, were charged with water; but whether they might be in connection with the bed of the river, he could not say. What he knew was—at least, they were so advised by their late Engineer, Mr. Taylor—that there was a very noble source of supply and a most valuable adjunct to the river supply. Mr. Taylor, he added, was enamoured of the supply from the gravel, and wished them to use it more extensively than they did; but the feeling of the Directors was that, as they had ample powers to pump from the Thames, and it was their recognized water supply, there was no use going to further expense to develop this additional supply. They would simply recognize it as a sufficient margin with which to meet any exceptional demand. Alluding to the chance of pollution from Chertsey, witness said that was very remote.

Wednesday, June 1.

The CHAIRMAN, on taking his seat this morning, stated that, in accordance with an announcement he made the previous Monday on behalf of the Commission, that they would now set apart a short time for giving an indication of what they proposed further as regarded procedure, and for hearing any suggestions that might be made upon it, they would now devote a little time to these purposes. In the first place, he would indicate in very general terms indeed, as far as they had been able to settle it, what was in the minds of the Commission on the subject of procedure. At the same time, it must be clearly understood that in anything which he said at this stage they would be hardly doing more than making a tentative suggestion. They had come to no absolute decision; and he should confine himself to indicating what they considered would be desirable. Generally, then, they thought that the inquiry divided itself into two main branches. Such matters as they had been investigating through the Water Companies would form one branch—matters such as the amount of water per head of the population which the Companies were now supplying, the sources which these had at their command to meet the supply at the present time, and the grounds upon which estimates for the future ought to be based. The other great branch of the inquiry seemed to be what more or less expert evidence had to deal with—such as the geological character of the Thames and the Lea basins. Then, speaking generally, they would like to exhaust as far as they possibly could the first branch before taking up the other. They thought that the facts in this branch so far as they could be ascertained at all ought to be more easily ascertained, and more readily available for putting before the Commission, than those in regard to what he described as the second branch; for naturally the geological formations of the Thames and the Lea basins, and other matters of that kind, opened up a very wide field of inquiry, and the evidence upon it must take longer to prepare. At the same time, as everyone who had paid attention to the evidence so far must have seen, even in the matters with which they had been dealing, there was an unusually large scope for conjecture and estimate; and whatever the conclusions they might come to, they would be a very legitimate subject of controversy, and the Commission did not expect that any conclusion of theirs would be absolutely free from debate and discussion. Under these circumstances, they felt very strongly that it was their duty to endeavour to narrow the field of illimitable discussion as much as possible; and they thought that any controversy which there was to be, as to the premisses—such as the populations supplied by the Companies, the numbers of gallons per head, the areas to be built over, and these sort of questions—ought to be before them before their report was drawn up; and that they should, as far as they possibly could, arrive at some basis of agreement which would narrow the future of the controversy, and exclude those kinds of points from it. For this purpose they had endeavoured, and they should continue to endeavour, to get information from anybody who felt he had a right to advise them on points of this sort at the earliest possible stage. And when the information was obtained, they should be prepared to take up the second branch of the inquiry. As regarded both branches (and these observations were general), they attached the very greatest importance to having distinct and full information of what everybody wished to say placed in the hands of the Commission beforehand. The Commissioners could not, unless they had this, form any opinion as to whether or not the evidence

which was to be offered was going to be useful to them; and they wished to prevent anything being submitted in evidence which they did not think important. Of course, they should err on the side of taking too much evidence rather than on that of excluding anything about the usefulness of which there might be a doubt. But they were anxious not to have a single day, or a single hour, unnecessarily spent—spent in hearing evidence which should afterwards prove to have no practical bearing on the subject of the inquiry. They thought that was a paramount duty laid upon them; and, speaking from his own experience, a sufficient check was not always exercised at first in such inquiries in the matter of evidence. Then somebody thought that, because of evidence led which he considered detrimental to his interests, he must have an opportunity of contradicting it, even though, in the opinion of the executive body, the evidence-in-chief and the contradiction of it were of no practical value in dealing with the subject in hand. On this point, therefore, they made a distinct announcement, that they must ask everyone coming forward as a witness to place his evidence in their hands in advance, so as to give them the fullest information in writing or in print as to the points he wished to deal with. If now any gentleman interested desired to offer a suggestion, they would listen to it, and if necessary make a further announcement after consideration of what they should do.

Mr. JOHN HOLLAMS (Hollams, Sons, Coward, and Hawksley) observed that it was not quite voluntary on the part of the Water Companies their taking the initiative in the matter of submitting evidence. It was in response to a communication from the Commission, that they fully and fairly placed before the Commissioners the state of their affairs and undertakings; and he thought he might say they had shown that they were fulfilling, and were prepared still to fulfil, their obligations to the public. Then, as his Lordship knew, the Commission was not sought by the Water Companies. The Commission, it was no secret—it was notorious—was issued at the instigation of the London County Council. He ventured to suggest, therefore, that it was for that Council to support the kind of accusation—for he supposed there was an accusation, although they did not know—

The CHAIRMAN interposed. He said he was very anxious that the idea of any accusation should not be in the mind of anybody. They were there to conduct an independent inquiry into a matter of great public importance to the Metropolis.

Mr. HOLLAMS said he did not desire to use the word "accusation" in the sense taken by the Chairman. He simply wished to point out that the Commission had been issued at the instigation of the London County Council, and not of the Water Companies; and consequently he ventured to submit to the Commission that it would be natural, in the order of things, for the County Council to justify the necessity for the Commission, and to show what the evidence was that they proposed to bring forward—that it was not for the Water Companies to anticipate any evidence of which they knew nothing, and for which they knew no sufficient cause. In this position the Companies were fortified; because, before the Select Committee of the House of Commons in 1891, on the Metropolitan Water Supply Bill, Sir Thomas Farrer, giving sworn evidence as the representative of the London County Council, stated that he had nothing to bring forward against the Water Companies—that he wished to say distinctly—and Sir Thomas added that, in his opinion, London was well supplied with water. Consequently, the Companies did not know what charge or case they had now to meet; and he ventured to think that, having fulfilled their obligation by showing, as he supposed they had shown, the state of their respective undertakings, and that they were fulfilling their statutory obligations to the public, they ought to have fair notice of anything to be now brought forward concerning them. When he said the Companies had fulfilled all their obligations, he wished it to be understood that, if any Commissioner desired further information as to their internal affairs and resources or powers, it would be given. But his Lordship, he thought, would see that it was rather for the Companies now to become listeners, and to be supplied with some information of the kind of evidence to be submitted by those who had instigated the Commission, or asked the Commission to adopt a particular view. There was one other matter upon which he confessed the Water Companies felt very strongly. They did think—and he was very much disposed to think others would share the view—that a Commission of this kind, taking evidence, could hardly get satisfactory evidence unless the witnesses were examined, and cross-examined, and re-examined by Counsel.

The CHAIRMAN said Mr. Hollams need not re-open that subject. They were not going to agree to it.

Mr. HOLLAMS could only say this was the strong conviction of the Companies; but, of course, they must bow to the decision of the Commission.

Mr. H. L. CRIPPS thought that (as responsible for the case of the London County Council) he, after what Mr. Hollams had said, should perhaps address a few observations to the Commission, although Mr. Hollams's remarks were something of a general character and scarcely directed very specifically to the question of procedure, which the Commissioners wished discussed. Of course, his Lordship was aware that the case of the London County Council was certainly a peculiar one; and their position was one of very considerable difficulty in this matter. It was perfectly true that the Commission was asked for by the London County Council in the first instance; but it was not so much because they had any accusation to make against the Water Companies—it was because there was a considerable and growing feeling in London that inquiry into the matter of the water supply was really essential.

The CHAIRMAN remarked that they need not go into why the Commission was appointed. Mr. Cripps should rather address himself to the question of procedure, and what information he was prepared to give them in the first branch of the inquiry.

Mr. CRIPPS said the Commission having desired such information as the London County Council could supply, he had been instructed to at once communicate with those gentlemen whom the Council had been consulting as their advisers; and he should be prepared, in accordance with the desire of the Commissioners, to lay before them, at a very early date at all events, such evidence as might be offered on behalf of the Council. But there again, if he might be allowed to allude

to the difficult position of the Council, that body were perhaps really less informed of the specific matters which the Commission had to inquire into, than many other parties to the inquiry. Then he did not know whether the Commission might think it desirable, in the first instance, to deal with the question between the County of Hertford and the Water Companies deriving their supplies from that neighbourhood—a question which was exceedingly important, and with which the County of Hertford was thoroughly familiar, and with which he believed its representatives were nearly ready to proceed, and would do so in a much more authoritative manner than any witnesses could whom he might bring forward. Sir Richard Nicholson was present, representing Hertfordshire, and would be able to give explanations; and as a matter of general convenience, it might be better that that county should come before the Commission at the instance of its representatives.

The CHAIRMAN observed that Mr. Cripps was going rather further ahead than the Commission wished. They should judge of the order in which the evidence should be taken, when they knew what the character of the evidence was which was going to be submitted; and they must know what line was going to be taken. They understood, however, that the parties were quite agreeable that what he called the geological evidence should remain over till later.

Mr. CRIPPS believed so.

The CHAIRMAN then stated that they proposed to take the London County Council after the Water Companies upon any points in the first branch of the inquiry, on which they might reasonably give the Commission assistance. The Commission wanted the Council's opinions as to the population that would have to be provided for, as to the amount of water required per head, and so on; and the Commission did not see any reason why in a fortnight's time from that day the Council should not be ready to give their information and assistance. The Commission had now been going on two months and a half; and during that time the Council should have been preparing to submit evidence.

Mr. CRIPPS mentioned that the Council had been preparing; and, of course, if the Commission decided that they should come forward in the first instance as suggested, it would be their duty to submit.

The CHAIRMAN pointed out that the Commission did not dictate. But if the London County Council were going to give information, or express any views at all, they should do so at this stage, and not keep their opinions to themselves until the inquiry had been far advanced.

Mr. CRIPPS asked if his Lordship would intimate what day the Commission would desire to have these opinions laid before them.

The CHAIRMAN replied that they hoped to take the London County Council on Monday, the 13th inst. But they would not go further into that at the present time.

Sir RICHARD NICHOLSON presumed that Hertfordshire would follow the London County Council; and he subsequently stated that the former would be prepared to submit evidence before the 1st prox.

Mr. HOLLAMS offered another remark. He said the Water Companies should certainly desire to see the case of the London County Council, and learn how far it required answering. It was extremely difficult for the Companies to take the initiative now; and surely the County Council should be prepared with their case after all their expenditure on inquiries in the last year or two.

The CHAIRMAN pointed out that the Commission wanted to know, in the first instance, what everybody's case was, before everybody knew what everybody else's case was.

Mr. HOLLAMS suggested that then the Water Companies should not be tied down to what they sent in primarily, as they might have to refute some theories, &c.

The CHAIRMAN allowed that there was a great deal of force in Mr. Hollams's contention; but he said that, so far as anything the Water Companies wanted afterwards to put in was directed to answering what somebody else had put in, the Commissioners should be prepared as reasonable men to consider it. But they were very strong on this point—that anything of the sort subsequently put in, must be strictly directed to refutation, and not to the introduction of new matter.

Mr. HOLLAMS said they must bow to the decision of the Commission; but he suggested that it was entirely novel not to be made acquainted with the nature of the evidence of the opposite party before committing themselves. It was possible (but hardly satisfactory) to put in counter-statements; and, of course, the Water Companies could do it, but it would inevitably lead, he thought, to supplementary statements.

The CHAIRMAN added that the Commission had fully discussed the matter; and he repeated that they were of opinion that it was advantageous that they should know what was going to be submitted in evidence before they settled the order any further.

Mr. CRIPPS reverted to the difficulty experienced by the London County Council in preparing their case; and he asked if they might have till the 1st prox. instead of to the 13th inst. for the purpose.

The CHAIRMAN replied that the 1st of July was too far distant; and he remarked that the Commission would have to bear all the blame if the inquiry dragged on to the injury of people's interests. Besides, they thought that the County Council should have had time to be ready by the 13th inst.

Mr. CRIPPS said he felt, as Mr. Hollams did, that it was extremely difficult for either party to prepare a case of any sort in an inquiry of this kind until, to a certain extent, evidence had been adduced for the other side.

The CHAIRMAN said: You are all struggling for exactly the thing we are determined to prevent. He added afterwards, with regard to the expert evidence to be taken, that it should be submitted during July, and should be as far as possible from personal knowledge and personal observation, and that a full indication or account of it should be sent in (in writing or print) by the 1st prox.

Additional evidence on behalf of the Lambeth Water Company was then taken.

Mr. S. H. Louttit, the Secretary and General Manager of the Company, being recalled for the purpose of giving it, remarked that the Chairman had asked some questions to which he would now reply. The largest average daily quantity of water pumped by his Company in any one week was 22,561,743 gallons in the week ending Jan. 23, 1891.

The largest quantities of water ever pumped in any three consecutive months were in Dec., 1890, and Jan. and Feb., 1891, when the total of the monthly average per day for three days was 61,733,653 gallons; and the average per day for three months was 20,577,884 gallons. The average per day for the months of July, Aug., and Sept., 1887, was 20,268,231 gallons; for the same months in 1889, 20,439,600 gallons; and for Jan., Feb., and March, 1891, 20,420,820 gallons. With reference to a question by Mr. Mansergh, on paragraph 64 of the printed statement, it appeared that the quantity per supply was estimated in 1911 to be, for all purposes, 19.52 gallons, as against 25.89 gallons at present per head in the constant supply districts. Assuming 175 gallons per supply, that would be 25 gallons per head, or only 0.89 gallons less than it was at present. Assuming further an increase of 37,180 new supplies in the second twenty years, ending 1931, that would be an additional annual quantity of 5,506,500 gallons, at 175 gallons per supply or 25 gallons per head. Therefore, adding to the quantity stated in paragraph 64, of 22,904,525 gallons, the 5,506,500 gallons just mentioned, they had a total of 28,411,025 gallons, which would afford 175 gallons per supply, or 25 gallons per head of the population. To meet this possible demand, the Company had, from the Thames and gravel-beds, 30,500,000 gallons, irrespective of the water that could be obtained from the chalk; and the Directors were advised that they could obtain 3,000,000 gallons per day from a well at Selhurst.

Mr. T. F. Parkes, Engineer to the Company, also gave evidence and emphasized the remarks which had been made as regarded having more control over fittings. If the Water Companies of London had as much control over fittings as the corporations and provincial companies had, the reduction of the great waste in the Metropolis would be much facilitated. In other words, efficient control of fittings was a necessary incident to the proper working of any constant-supply system. He did not want to limit the supply of fittings to any particular tradesman, but simply to have them brought to the Companies to be approved and stamped.

Mr. Joseph Lucas, as a geologist, next came forward to speak to certain statements of the Southwark and Vauxhall Company. He gave it as his opinion that that Company could from the Streatham well raise at least 3,000,000 gallons a day without altering the flow of water in the Wandle, but affecting perhaps wells within 1½ miles in a certain direction.

Mr. W. Topley, F.R.S., gave evidence confirmatory of this.

The Kent Water Company's case was then proceeded with.

Mr. Alexander Dickson, the Secretary to the Company, spoke of the monopoly of supply in the Company's district, which was a prominent feature of their business. He pointed out that their sources of supply were fourteen deep wells; and he explained some of the details of the Company's statement sent in. He also mentioned that the number of houses in their district having the constant supply was increasing every year; and his experience of the supply was that, with a fair treatment on the part of the consumers, there was nothing in it detrimental to the Companies. The results of the constant supply on his Company's tables did not indicate any increase in the quantity of water per head of the population supplied; and no doubt, with efficient fittings and proper control, the average supply per head could be greatly reduced. He added that the 30 gallons per head per day estimated as a future supply might be reduced considerably; and it would not, he thought, be exceeded with proper precautions. In fact, while the amount of water which the Company supplied had increased by 6,500,000 gallons in the last twenty years, he did not think, having regard to the circumstances of the district, that it would increase to a greater extent in the next twenty years. In the last five years, the increase had shown a very sensible diminution.

Mr. W. Morris, the Engineer to the Company, testified to the ability of their present works to maintain the supply and even get it in excess.

This ended the preliminary investigation on the statements of the Water Companies; and the CHAIRMAN intimated that the Commission had been much gratified by the readiness and willingness of the Companies to supply information and facilitate the inquiry as far as they could.

The Commission then adjourned till the 13th inst. (yesterday).

Fenton Local Board Gas Department.—The annual report of the Fenton Local Board Gas Committee for the year ending March 28, 1892, states that the make of gas was 48,754,000 cubic feet; being an advance of 2,492,000 feet, or 5.38 per cent. for the year. The unaccounted-for gas was at the rate of 10.23 per cent.; being 0.23 per cent. less than in the preceding year. There was an increase in the make per ton of coal carbonized of 340 cubic feet. The total receipts amounted to £8475; being an addition of £492. The gross profits were £3486; and after providing £2137 for interest, and £28 for instalments on principal, a net profit is left of £921, which, added to the balance brought forward (after paying £300 to the Board), makes a sum of £3501 to the credit of the profit and loss account. The report was presented at the last meeting of the Local Board, and was considered a very satisfactory one.

Opening of Gas-Works at Woking.—For many years past the necessity of a gas supply for Woking has been severely felt, and accordingly it is gratifying to note that the enterprise of a number of gentlemen has at length provided for a supply to the neighbourhood. Last year the Woking District Gas Company, Limited, obtained a Provisional Order, conferring upon them powers to supply Woking, Horsell, Send, Ripley, Pyrford, and Byfleet. The buildings were at once commenced, and have been finished to the satisfaction of all concerned. The works, which have been erected on a freehold site in the Boundary Road, have been carefully designed by Mr. Jabez Church, of 55, Parliament Street, S.W., the Consulting Engineer to the Company, and have been carried out in a most satisfactory manner by the contractors, Messrs. Alfred Williams and Co., of Bankside, Southwark. A large number of consumers have already had the gas laid on, and further applications for supplies are being received. Mr. T. C. Webb, son of the Manager of the Egham and Staines Gas Company, has been appointed Manager. The works were formally opened last Thursday by Mr. C. H. Master, Chairman of the Company.

NEW GAS-WORKS FOR THE IMPERIAL OTTOMAN GOVERNMENT.

A very interesting ceremony recently took place at the Imperial Ottoman Gas-Works, Constantinople, on the occasion of the cutting of the first sod of the foundations for the new retort-house and gas-holder-tank. According to an ancient Moslem custom, rams were sacrificed, and their blood sprinkled on the threshold; while Mussulman priests recited prayers from the Koran invoking the protection of Allah upon all true believers engaged in the work. A large number of Turkish notabilities were present; amongst others, the Chief of the Building Commission (Hassip Bey), the Architect to the Administration of Tophane (Oannes Bey), the Engineer of the works (Mr. W. S. McGregor), members of the Council of Tophane, and others. About two years ago, the Imperial Government finally decided to erect new works, and several firms submitted designs. The Government, however, selected the one prepared by their own Engineer. It embraces the construction of complete works capable of producing a million cubic feet of gas per day. The retort-house is 70 feet wide by 130 feet long, and 34 feet high to the wall-plate. It will contain eight settings of \square retorts 22 in. by 16 in. and 20 feet long, set nine in an arch, making altogether 144 mouthpieces. These retorts are brick built, and will be fired on the regenerator system designed and adopted by Mr. J. F. Bell, Assoc.M.Inst.C.E., Gas Engineer of the Stafford Corporation, in whose works these retorts are in use, giving great satisfaction. The annular wrought-iron condensers consist of eight columns 32 ft. 8 in. high over all, and 3 feet in diameter. The exhauster-room is 36 feet by 30 feet, and will contain two pairs of exhausters, each pair coupled up direct to one high-pressure steam-engine. The boiler-house is 24 feet by 30 feet, and will contain three boilers of the Cornish type, 22 feet long and 5 ft. 6 in. diameter. A pump-room 17 ft. by 30 ft. will contain a set of pumps in duplicate for tar, ammoniacal liquor, and water, each pair being complete with an engine on the same bed-plate. The washer will be of the Livesey make, and be capable of passing $1\frac{1}{2}$ million cubic feet of gas per 24 hours. The scrubbers are 8 feet in diameter and 50 feet high. The purifying-house is 130 feet long by 50 feet wide, and will contain four purifiers, each 24 feet square and 6 feet deep. The meter-house is 31 ft. 6 in. square; and attached are laboratory, test-room, and other offices. The ground for the new works is limited in extent for gasholder storage; and, consequently, at present only one two-lift holder of 300,000 cubic feet capacity will be put up, as ground for future storage must be looked for elsewhere. The buildings are being erected by the Building Commission of the Government, from plans and specifications prepared by the Engineer, who has also the superintendence of their erection. The various contracts for the ironwork have been placed with leading firms of gas engineers in England; and the works are being rapidly pushed towards completion.

BRUSSELS MUNICIPAL GAS SUPPLY.

Gas Committee's Report for the Past Year.

The following is an abstract translation of the report of the Gas Committee of the Municipality of Brussels on the working of the gas undertaking during the twelve months ending Dec. 31 last:—

The total quantity of gas produced in the past year was 27,847,210 cubic metres, or about 983 million cubic feet, as compared with 25,903,640 cubic metres, or about 918 million cubic feet, in 1890. It was disposed of as follows:—

	Cubic Metres.
Night gas, at 14c. per cubic metre	16,504,321
Day gas, at 10c.	2,678,620
Municipal establishments, at 10c.. . . .	888,318
Gas-engines, at 10c.	811,872
Industrial purposes, at 10c.. . . .	198,097
Illumination devices, balloons, &c.	154,045
Artisans' dwellings and miscellaneous	59,071
Total sold	21,294,344
Public lighting and illumination	4,124,819
Used on the works, &c.	831,227
Unaccounted for	1,596,820
Total production	27,847,210

The total sales of gas exceeded by 1,414,973 cubic metres, or close upon 50 million cubic feet, those of 1890; but the extra quantity sold was mainly at the lower charge. The working expenses amounted to 3,984,562 frs. (£159,382), which were increased to 4,187,994 frs. (£167,520) by the expenditure of certain sums to order. The principal receipts were as follows: Gas, 2,786,793 frs.; coke, 1,229,020 frs.; tar, 192,791 frs.; ammoniacal products, 123,269 frs.; spent purifying material, 15,061 frs.—other receipts making up a total of 4,731,497 frs. (£189,259). The balance in favour of the Municipality at the close of the year was therefore 543,503 frs.; but as a sum of 257,930 frs., included in the general expenditure, had been spent in increasing the stocks, this amount should be added—making the total profit on the working of the undertaking 801,433 frs. (£32,057), as compared with 1,395,759 frs. (£55,830) in 1890. This was a falling off to the extent of 594,326 frs. (£23,773). This unsatisfactory result is attributable to the reduction of 1c. per cubic metre (about 2·7d. per 1000 cubic feet) in the price of gas; also to the higher price of coal and the reduced value of coke. With regard to manufacturing operations, something like 100,000 tons of coal were carbonized; the cost being 22 frs. 50 c. per ton, as compared with 18 frs. 58 c. in 1890. The contracts entered into for the current year, however, are at a reduction of about 3 frs. on the rate lately paid; and even better terms are anticipated. Coke fetched only 22 frs. 3 c. in 1891; whereas in 1890 it sold for 22 frs. 96 c. Notwithstanding the low price, the stocks were not cleared off; and consequently the yards were rather encumbered with this residual at the end of the year. The retail sales continue to increase; and additional outlets are being sought, so that something like a regular clearance may be effected. At present the tar is disposed of by contract; but a project is on foot to set up a

distillery on the works. The same conditions obtain with respect to ammoniacal liquor, which will probably, before long, be treated on the spot. Spent purifying material fetched 15,061 frs. Something like 12,000 tons of breeze, resulting from the breaking of coke, were utilized, with admixture of pitch, in the manufacture of compressed fuel. The extension of the works continues. The storage capacity is being increased by the erection of a gasholder capable of containing close upon $1\frac{1}{2}$ million cubic feet of gas; and it is expected that the work will be completed by August next year. The amount expended on capital account up to the end of 1890 was 14,455,099 frs.; and the purchase of land last year brought the total up to 14,650,149 frs. (£586,006) at the close. The distributing system has lately been inspected, with the view of discovering the cause of leakage. Out of 351 repairs made, 65 were caused by fracture of the pipes; but no escape was detected from joints made with india-rubber rings. The total length of mains at the end of 1891 was 1,796,896 yards. The number of meters then in use was 14,852, of which 7495 were of the double-index class. As the Council declined to agree to the proposal to abolish differential prices, and sell both day and night gas at the same figure, meters of this class are still put up, although they are found to require much repair. The system of supplying gas to the various floors of tenement houses by means of rising pipes, as in Paris, continues to extend. The number of these pipes in use on Dec. 31 last was 855—an advance of 217 on the number at the close of 1890. Interior fitting is undertaken by the agents of the Municipality. Fittings are put in on hire, at the rate of 5 per cent. per annum; or they are purchasable by eleven annual payments equal to one-tenth of the outlay incurred. On Dec. 31 last there were 1244 sets of fittings on hire, as compared with 766 at the corresponding period of 1890. Another branch of operations is the placing of gas-stoves. This business was started in September, 1890; and by the end of the year 1348 stoves had been put in. They comprised 688 hot-plates, 201 roasters, 9 kitcheners, and 450 heating-stoves. At the end of last year the total was more than doubled—the number being 2965. The 1617 additional stoves comprised 614 hot-plates, 353 roasters, 28 kitcheners, and 622 heating-stoves. This is assuredly evidence of enterprise. With regard to gas employed for motive power, 26 gas-engines were fitted up last year, bringing up the total to 200, or equal to about 667-horse power. The consumption of gas in these engines reached to nearly 30 million cubic feet. In the department of public lighting, there were in use at the close of the past year 5578 gas-lamps, of which 404 were furnished with high-power burners. Of the latter, 401 are extinguished between midnight and one o'clock in the morning, as well as 369 ordinary lamps.

MALTA AND MEDITERRANEAN GAS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Tuesday, at the London Offices, No. 60, Gracechurch Street, E.C.—Mr. J. BIRCH PADDON in the chair.

The SECRETARY (Mr. A. W. Cooper) read the notice convening the meeting; and it was agreed to take as read the Directors' report and accounts for the year ending March 31 last, an epitome of which appeared in our issue of the 17th ult.

The CHAIRMAN said the shareholders would find in the report a formal announcement of the death of Mr. Charles Newton, who was an exceptionally good Director, and who gave the Company the full advantage of his large, special experience. He was a man of the highest principles; he secured the esteem of the whole of his colleagues; and he (the Chairman) was quite sure he would be kindly remembered by all who knew him. The Company and the Board had both been distinctly strengthened by the acquisition, as a Director, of Mr. Stephenson R. Clarke, who was the largest holder of the Company's shares. Apart from these incidents, the past year had been by no means uneventful. The Directors had had to contend with dear coal, a reduction in the price of gas, and competition with the electric light; and these things had given them plenty to do, and caused them some anxiety. On the other hand, they were able to point to an increase of business from all the Company's stations; and this left them a decent balance to the good. The extent of this balance would be shown by a comparison of their accounts with those of some English gas companies, whose working exhibited increased prices, reduced profits, and depleted reserves. Many things had happened in Malta to depress trade, and to check the consumption of gas. There had been a total absence of the usual festivities (at which a good deal of gas was generally used), owing to the death of the Duke of Clarence and some persons of local importance. Then, again, Malta depended very much upon the ships calling there, the number of which had been seriously diminished, in consequence of the Russian famine, and the large decrease in the coal trade. But notwithstanding these adverse circumstances, the Company's rental in Malta showed an increase of 7 per cent.; and as this arose entirely from private consumption, it was all the more satisfactory. In October last, some proposals were made by Mr. Preece, the eminent electrician, for the supply of electricity to the naval and military establishments, and for public lighting. These proposals were favourably considered by the Chief Secretary, and by him laid before the Council, who, however, failed to see that any advantage was to be gained by their adoption. It seemed to them that it was simply the substitution of a dear mode of lighting for a cheap one, and, moreover, it involved the expenditure of all, or nearly all, their accumulated funds, upon which they set great store. Consequently the consideration of the proposals was adjourned; and the Directors were still waiting to hear the result. In connection with this subject, he ought to mention the services rendered to the Company by their General Manager (Mr. J. W. Starkey). The promoters of the electric light were not always very accurate in their statements; and Mr. Starkey managed to deal with the fallacies, as they appeared, in a very satisfactory way—all the misstatements were refuted; and no doubt the electricians were temporarily discomfited by the exertions of Mr. Starkey. During the year there had been some considerable improvements made at Malta—the manufacturing and purifying plant had

been extended, and a new 14-inch main had been laid from the works to the middle of the Valletta district—the result already having been very satisfactory. But the principal work that had been done in the course of the year had been the extension of the mains to Sliema, which was a fashionable adjunct of Valletta. It was on the opposite side of the harbour to Valletta; and, in consequence, they had to take the mains round the end of the harbour, and thereby incur a heavy expense—an expense which was proportionally large to the immediate business. There was no doubt, however, this extension would be a profitable one; and meanwhile the Company had the credit of having complied with an urgent public demand, and had conferred an undoubted public benefit. As to the question of concentrating the manufacturing operations by discontinuing the works at Calcara, and only using those at Valletta, nothing had yet been done; but as the business increased, so the desirability of the alteration increased. As, however, it was entirely governed by financial considerations, and as there was no great urgency, the matter stood in abeyance for the present. At the Sicilian stations, the chief subjects of interest during the year had been the reductions of the price of gas and their effects. It should be understood that the bulk of the Company's rental arose from the public lamps, and that rental was entirely unaffected by the decrease in price. The abatement applied solely to the private consumers; and their response to the reduction (which was a bold one—from 11s. to 7s. 6d. per 1000 cubic feet) was an increase in consumption of 47 per cent. The Directors were, of course, highly pleased with this result; and they had a reasonable expectation of still further increase. At Trapani, they had had to lay additional mains; and at Marsala more retorts and manufacturing plant had had to be put down. At Corfu matters had been unsettled throughout the year. In December last, their contract for lighting the public lamps at this place expired; and since then they had been lighting the lamps under a temporary arrangement. The Municipality had contracted for the supply of electric lighting; but at a price so low that it was presumably for the purpose of advertisement more than anything else. The price charged for the gas supplied to the public lamps there was (in consequence of the rise in the rate of exchange) scarcely remunerative. Therefore the loss to the Company was comparatively unimportant, so far as profit was concerned; and they would have to look for a recoupment in the increased sale of gas to private consumers. The same reduction was made in the price of gas at Corfu as at the Sicilian stations; and the result had been an increase in consumption of 24 per cent. Had the contract for public lighting been renewed, the Company would have had to incur considerable outlay at Corfu in additional manufacturing plant, gasholders, and mains; and, of course, that was not now wanted. Turning to the accounts, the Chairman said, beyond the increase of loan capital, and the expenditure mentioned in the report, there was not much to be said. Their position was this: They had money enough to pay for the extensions already executed, and for all the things to which they were committed. Further extensions, however, would have to be made; and for this capital would have to be raised. As he had already said, there was no urgency in this matter; and before anything was done, a special meeting of the shareholders would be called to obtain their sanction to the raising of further capital. There was one item in the general balance-sheet to which he should call attention. It was that of "Stocks at stations, £11,369," which was £3400 more than in the previous year. The explanation of this was that the Directors thought it desirable that the stocks of coal should be increased—circumstances not being very satisfactory in connection with the coal trade—and the bulk of the £3400 was represented by the additional quantities at the stations. The stock of fittings had also been augmented, in consequence of the larger trade; and the percentages of increase in consumption which he had mentioned justified this. As to the profit and loss account, the first item was that of coal, which was £1178 more than in the previous year; but they used a further 1262 tons, so that the difference was chiefly accounted for by this. The increase in the cost per ton was very little, owing to their having been able to bring forward a considerable stock purchased at the old contract price; but they were now face to face with the full weight of the price of coal. Wages were about £385 more; and this was almost entirely due to the larger make of gas. The charges on street lighting were about £84 less than in the preceding year. The item of maintenance was £897 more; and this was chiefly for the renewal of retorts and mains at Malta. Depreciation of stock was higher by £203. This was in consequence of their having larger stocks; the percentage of depreciation being the same as formerly. The item of exchange had risen by £195. In the preceding year, it averaged 33.6 per cent.; while in the past year it averaged 36.6 per cent.—being an advance of 9 per cent. This 9 per cent. had converted the selling price of gas at Corfu—he would not say into a loss—but it was very near to the cost price. Coming to the working, the Chairman said they had used 11,401 tons of coal; and they had made from this 117,000,000 cubic feet of gas, which was equal to 10,276 feet per ton. They had sold 109,000,000 feet, which was at the rate of 9129 feet per ton. This was an increase upon the sale of the previous year of close upon 10 per cent. The differences between the quantity manufactured and consumed was 13,000,000 feet, which made the percentage of unaccounted-for gas 11.15. This was decidedly more than it ought to be and more than it was last year. There had, however, been a good deal of loss through main laying, of which more had been done in the past year than in any previous year. The process of main laying in their case was a somewhat difficult one, as they had every night to charge with gas the mains laid during the day. The Directors had also thought it necessary to have some experimental lighting at Malta and Corfu; and this helped to increase the unaccounted-for gas. The gas-rental (£27,669) was £878 more than in 1890-1; and considering the large reductions made in the price, he could not help thinking this was most satisfactory. In the next items—coke, tar, and pitch—there was an increase of £393. With the extra quantity of coal used, they would have liked to have seen a larger return than this; but the average price of coke had been somewhat lower. In fittings, they had had an increase of £131; and this all came from the smaller stations. The return on account of fittings was satisfactory from Malta; but it was small, compared with the preceding year,

when they did a very large and quite a special amount of work for the Government. These increases helped them to a profit of £10,678; and although this was £1635 less than it was in the former year, it allowed the payment of the dividends to which they had been accustomed, the full amount to be transferred to the reserve fund (£1500), the full charges for depreciation and interest, and left the satisfactory balance of £2412 to be carried forward. At the first blush, it might reasonably be said, "Why not pay a larger dividend on the ordinary capital?" There was much, however, to be thought of. This year, they were sure to have to meet a large increase in the cost of coal; and they had not yet done with the effect of the reduction in the price of gas. Then there was the Corfu contract; and they could scarcely tell how they would be affected by it. Looking at all these things, he thought it would hardly be becoming on the part of the Directors to recommend the shareholders to appropriate more than the usual sum; and, from experience, the Directors knew the general feeling among the proprietors was a preference for a continuous, rather than a fluctuating, dividend. The Chairman concluded by moving the adoption of the report and accounts.

Colonel JAS. LE GEYT DANIELL seconded the motion, which was at once carried unanimously.

On the proposition of the CHAIRMAN, seconded by Mr. J. ORWELL PHILLIPS, dividends at the rate of 7 per cent. on the first preference shares, of 7½ per cent. on the second preference shares, and of 6 per cent. on the ordinary shares were then declared.

The retiring Director (Colonel Daniell) and the Auditors (Messrs. R. Hesketh Jones and T. Guyatt) were re-elected; and the proceedings terminated with votes of thanks to the Chairman and Directors and officers for the continued interest they took in the affairs of the Company.

BUENOS AYRES (NEW) GAS COMPANY, LIMITED.

The Annual Meeting of this Company was held last Wednesday, at No. 1, East India Avenue, E.C.—Sir WILFORD BRETT, K.C.M.G., in the chair.

The SECRETARY having read the notice convening the meeting, it was agreed to take as read the Directors' report and the accounts, a summary of which was given in the JOURNAL last week.

The CHAIRMAN said this was the seventeenth year it had been his privilege to address the shareholders at their annual meeting; and, with the exception of the first two years, there had been no year in which the Directors had had greater difficulties to encounter than in the past one. It had been a most anxious time indeed for them; but he hoped and believed they had now weathered the storm, and had passed into less troubled waters. He wished to explain to the shareholders the real state of their affairs; so that they might understand the difficulties that had had to be met, and so that they might, notwithstanding those difficulties, recognize that there was a stability and solidity in the Company upon which they might still rely. To carry this out, his best course would be to divide the facts as they really existed into two categories—first, those matters over which the Directors had control; and, second, those over which they had no control at all. Dealing with the first category, which included the volume and results of the working, the number of private meters fixed had increased from 9557 to 10,230. The gross income in currency had advanced from \$2,067,992 to \$2,182,493. This was the largest amount, in dollars, that had ever been earned by the Company since its formation; and it showed that the business continued to satisfactorily increase. They had obtained the assent of the Municipality to an advance of 50 per cent. in the charge for public lighting, and also to a reduction in the number of lamps. This decrease was not only an advantage to the Municipality in their present financial troubles, but it prevented any material increase in their debt to the Company. The Directors had also been successful in raising the price to the private consumers; but they had a great many obstacles to overcome before they were able to accomplish this. The Chairman then proceeded to give some figures from the working returns, which, he remarked, showed that the result of the year's operations was not in any way caused by the manner in which the business had been carried on, but solely by the extraordinary price of paper and gold. The average production of gas per ton of coal was 10,300 cubic feet of 23-candle power, and the yield of coke 17 cwt. To carbonize 100 tons of coal, 18 tons of coke were used as fuel. The unaccounted-for gas amounted to 275,000 feet per mile of main for the whole year; and, considering the difficulties their Manager had to meet, not only in carbonizing but distribution, he was sure that anyone who understood these matters would know that the figures he had given were very satisfactory, and that there were few companies, so far away from the coal-fields as they were, who could show better results. The works, he continued, had been kept in a perfect state of repair; and the local expenditure had been curtailed. No capital outlay had been incurred beyond what was required for a few mains that they were compelled to lay down to meet existing contracts. He ought to have mentioned that the change in the price of both public and private lighting came into operation so late last year that it had not affected very much the accounts now under review; but full benefit would be derived from them in next year's accounts. The great apprehension of the Directors was that, through the financial and political troubles, their customers would fall off, and that the bad debts would increase. Happily their accounts showed just the contrary—their private customers had increased, and the bad debts were not larger than they usually were. He thought, this was owing to a certain extent to the fact that the main-cocks which had been fixed outside the houses enabled them to cut off the supply of gas without going inside, in cases where the consumers did not pay. During the year they laid on 1087 new services, as against 1344 in 1890. Turning to the reverse side of the sheet, there was no doubt the year had been to them, in common with other Companies doing business in Buenos Ayres, one of great uneasiness and loss; and it was really wonderful to him that the depression in their Company was not worse than it had been. The real factor against them, and which had been quite outside the region of their control, had been the price of

paper, which had averaged 275. This had made it difficult not only for them to make any headway but to hold their own at all. However, they were enabled to hold their own; but the Directors were not in a position to pay the shareholders a dividend, and there was no gas company in Buenos Ayres which could pay one. He was pleased to be able to say that there was a brighter light looming in the distance; and they might henceforward look for better things. Why he said so was this: The harvest had been an abundant one; and the Presidential election would soon take place, and then he believed there would be more steadiness and stability in the Government itself. There was also a disposition to curtail the issue of paper money, and if this should have the effect of improving the value of the paper dollar, one of the Company's chief difficulties would be overcome. What he wished to impress upon the shareholders was that the earning power of their property was not one whit less than it had been; but what was worse was that the paper dollars they took as payment were not available for dividend purposes. In the past year, they had lost enormously by the conversion of dollars into gold. At par \$5 were equal to the pound sterling; while at 373—the rate ruling on Dec. 31, the date on which the accounts were made up—it took \$18½ to the pound. Having mentioned that, in order to meet the provisions of a local Act which imposed a tax upon the profits of companies doing business in the Argentine Republic, they had been obliged to change the form of the accounts from the fluctuating currency to a gold basis, the Chairman mentioned that the Directors had lately had the benefit of conferring with their able Manager (Mr. Lewis T. Wright), who had been in England, and added that the prudence and zeal he had shown in conducting the business of the Company was beyond all praise, and they owed to him, the local Committee, and the staff, their very best thanks.

Mr. R. NESHAM, in seconding the motion, remarked that he was the largest shareholder in the Company; and with all the troubles they had gone through during the year, he had never lost hope or confidence in the future.

Mr. S. SPENCER said he saw a short time ago a report relating to a lawsuit in which the Company were concerned; and he should like the Chairman to give the shareholders some information in regard to it. He suggested that it would be more in accordance with the practice of other gas companies if the item of cargoes at Buenos Ayres and afloat (which stood in the accounts on this occasion at £56,132) was set out in detail; so that the shareholders might know what that large sum covered. He should also like a little explanation as to the net revenue account. On the debtor side they had debenture interest £12,000; and on the other side the profit for 1891 was shown as £393. Had they only £393 to pay the debenture interest, or had it been paid?

The CHAIRMAN replied that they had a balance from 1890 of nearly £9000; and, by taking £2800 from the reserve fund, they made up the amount needed for debenture interest.

Mr. CUFF asked whether, now that the Company were keeping their accounts on the gold basis, there was any reason why the Directors could not give the shareholders a proper profit and loss account, instead of the curtailed statement they now had.

Mr. GROVER, referring to the reserve fund of £66,395, inquired if that was calculated on the gold basis. He also asked whether the Company were endeavouring, in conjunction with other companies, to bring the Argentine Government to a proper condition of mind. It was very wrong of them to go on issuing paper, and so depreciating property.

The CHAIRMAN, in reply, said the reserve fund was on the gold basis now. As to Mr. Grover's second remark, he (the Chairman) did not fail to use what influence he might possess on behalf of the Company. He had communicated with the Foreign Secretary, who had taken the matter up, and sent it forward to the English Minister at Buenos Ayres. He had received very kind answers; but it appeared there were difficulties in the way. As to the question regarding the lawsuit, he could not say much about it at the present time, because it did not come into the past year's working, and an appeal had been entered against the decision. [*Ante*, p. 806.] Respecting Mr. Cuff's question, he might say that, with so much competition against them, they did not like to give too many details in the accounts; but shareholders might get all the information they required by applying at the office.

The motion was then unanimously carried.

The retiring Directors (Sir Wilford Brett and Mr. J. Conrad im Thurn) were re-elected; and the appointment of Mr. Ross Pinsent as a member of the Board was confirmed. The Auditors (Messrs. Turquand, Youngs, and Co.) were also re-elected.

On the motion of Mr. R. L. ANDREWS, a vote of thanks was passed to the Chairman and Directors for the diligent attention which they bestowed upon the affairs of the Company.

The Water Supply of Stainland.—The Huddersfield Corporation have agreed to supply the Stainland Local Board with 80,000 gallons of water per week, for a period of twelve months, at 9d. per 1000 gallons. For some time past, the water supply of the township has been insufficient.

The Vyrnwy Water Supply.—The first line of permanent pipes through the Mersey tunnel was completed last Wednesday. The pipes are 12-inch cast-iron ones, and are capable of conveying four million gallons of water a day into Liverpool. The other lines are laid, but not yet connected. When finished, they will be able to carry a total supply of 14 million gallons.

The Pollution of the Water Supply of the Rhondda.—A deputation of the Rhondda Valley Chamber of Trade, appointed to visit the intake of the Ystrad Gas and Water Company, has reported that, on the 1st inst., they found "abundant evidence that dirty waters from the Blaenrhondda colliery levels were flowing into the stream above the intake, and that these were mixed or polluted with human excrement." It is stated that representative ratepayers in the various populous localities throughout the district will wait upon the Sanitary Authority to request them to institute legal proceedings immediately against the Company unless the intake be removed without delay to a place above the mouths of the colliery levels.

TIPTON LOCAL BOARD GAS SUPPLY.

Annual Report.

The report of the Gas Engineer (Mr. Vincent Hughes) on the results of the working of the concern under his care during the year ending March 25 last, was laid before the Tipton Local Board at their recent monthly meeting; and it exhibited substantial progress all round. The manufacturing statement showed that the coal and cannel carbonized amounted to 9133 tons, as against 8428 tons. The quantity of gas produced was 96,778,000 cubic feet, as compared with 86,711,071 feet; the make per ton of coal being 10,596 feet, as against 10,289 feet. The gas sold and used on the works totalled to 86,951,060 feet, in comparison with 78,739,280 feet—the unaccounted-for gas being at the rate of 9·93 per cent., while in the previous year it was 9·21 per cent. The illuminating power averaged 17·72 candles. In commenting upon the report, the Chairman stated that the balance-sheet showed a gross profit of £4266; and a net profit of £169. In his opinion, this was a marvellous result; and he should not have been surprised if a serious deficiency had been reported. They had fallen on very evil times with regard to gas making; and they were not the only Committee who had found it out. If they could have suspended the repayment of loans for the year, they would have had a splendid profit. They had had many difficulties to contend with in the course of the year. They had carbonized 9100 tons of coal; and three years ago the price of coal was 3s. 6d. and 4s. per ton less than it was now. Taking the 3s. 6d. per ton, the rise in price, on 9100 tons, was £1598. Then there was the question of wages, in which there was an increase. In 1889 the whole amount paid was £793; and 7411 tons of coal were carbonized. The cost of wages per ton of coal was 2s. 1½d. per ton. This year the cost of labour was £1435; and 9133 tons of coal were used. The cost of labour per ton of coal was 3s. 1½d., or a rise of exactly 1s. per ton. During the year, they had certainly had an increase in the price of coke; but this was not equal to the advance in coal. They had also a very serious falling off in residuals. Tar, which used to sell at 48s. per ton, had to be sold at 24s.; and there was every prospect of having to dispose of it at 12s. per ton next year, as that was the price quoted in the markets. Then, again, they could get scarcely anything for their spent lime. They had advertised, but all to no purpose; and they were now offering it for 6d. per ton. In spite of all these difficulties, they had succeeded; and he thought it was a matter for congratulation. The report was adopted.

DUKINFIELD LOCAL BOARD GAS SUPPLY.

The Progress of the Gas Undertaking.

The Engineer and Manager of the Dukinfield Local Board Gas-Works (Mr. Harrison Veevers) has lately presented to the Gas Committee his report on the progress of the gas undertaking in the twelve months ending March 25 last, together with the accounts for this period. He states that an increase in the price of tar produced 0·4d. per 1000 cubic feet on the quantity of gas sold; but this was lost by the diminished price of coke and sulphate of ammonia. The market price of the latter was the lowest on record; nor are there any prospects of the prices of either tar or ammonia increasing—in fact, that of the former article will probably diminish. The new purifiers and oxygen plant which it was some time ago decided to put in, and the construction of which has been delayed by many causes, will shortly be in use; and then Mr. Veevers expects to be able to maintain the present illuminating power of the gas (about 18 candles) with the use of a lower proportion of cannel. From the tables accompanying the report (verified, as usual, by Mr. W. Moss, F.C.A.), we find that the net cost of making and distributing gas in the past financial year was 1s. 9·27d. per 1000 cubic feet sold, as compared with 1s. 9·23d. in 1890-91. The former figures were brought up to 2s. 8·79d. by the sums paid for annuities, interest, and the sinking fund; but as the present average price of gas is 2s. 9·02d. per 1000 cubic feet, there is shown a profit of 0·23d., as compared with 1·38d. in 1890-91, when the average price was 2s. 9·99d. The quantity of gas made was 63,244,000 cubic feet, of which 57,741,500 cubic feet were sold; so that 5,502,500 cubic feet, or 8·7 per cent., were unaccounted for. An interesting table gives the items of balance-sheets since the separation of the gas undertaking from Denton and Haughton; and the special features noticeable are the increased sale of gas per ton of coal carbonized, and the reduction in the leakage. The sales show a gradual rise, as follows: 1886, 8104 cubic feet; 1887, 8241 cubic feet; 1888, 8603 cubic feet; 1889, 8919 cubic feet; 1890, 9188 cubic feet; 1891, 9146 cubic feet; 1892, 9137 cubic feet. The figures showing the percentage of leakage go the other way: 20·82, 17·26, 15·84, 13·33, 11·06, 10·46, 8·70. The income from the sale of gas in the seven years was: £7506, £7816, £8050, £6953*, £7546, £7945, and £7943*; the asterisks indicating years in which the price was reduced. Mr. Veevers points out to his Committee that, with ample retort, scrubbing, purifying, and distributing plant, every means should be adopted to increase the sale of gas, and so reduce the proportionate cost of fixed charges, such as annuities and sinking fund. Some years ago he called attention to the large percentage of the inhabitants of Dukinfield who were using other illuminants than gas. Since then, however, prepayment meters have been invented; and he thinks the question of their introduction in the town might be worth consideration.

Llangollen Water Supply.—Mr. T. T. Marks, C.E., of Llandudno, has recently reported upon the water supply of Llangollen. The first portion of the document shows conclusively that the whole system is at present in a bad state, and that it is not advisable to spend more money upon it—the only effectual remedy being to construct entirely new works. Mr. Marks recommends as a new source of supply the Vivod Valley; and he suggests that the following works should be constructed: An impounding reservoir, to contain 2,000,000 gallons; a pressure-relieving tank to hold 100,000 gallons; and the necessary pipelines. The cost of carrying out these works in a substantial manner, including inquiry and law costs, he estimates at about £6700.

THE ELECTRIC LIGHT AT FAREHAM.

From a Correspondent.

Another example of the impracticability of supplying the electric light in small country towns, as a profitable commercial venture, is afforded by the progress of events at Fareham. The Electric Light Company was promoted by a member of the Local Board in this little Hampshire town, under every possible advantage that the local influence could secure, assured of the contract for public lighting, and of some private business besides. The supply of electricity was commenced in September, 1890; and the installation has been inspected by deputations from various places. Yet the result of sixteen months' working up to the end of 1891, is a very heavy loss—amounting to no less than one-half the actual receipts. Passing over the four months of 1890, we find the concern in fair working order at the commencement of 1891, supplying the street lighting, and also 21 consumers, representing 270 lamps. At the end of the year, this had only increased to the extent of seven consumers, leaving 28 customers, with 390 lamps, on Dec. 31, 1891. Such a slow rate of increase seems to show that there is not much prospect of further extension of business at Fareham; but the Directors, in their annual report, "most earnestly impress upon the shareholders the necessity of giving increased support to the Company, both individually, and by using their personal influence to increase the business." Apart from the question of introducing the electric light by means of "personal influence" in a town where the public already have the means of seeing what it can do, it should not be necessary to have to appeal for the individual patronage of shareholders. But perhaps one reason why these gentlemen have not hastened to avail themselves more fully of the advantages afforded by the electric light, is touched upon by the reference in a subsequent paragraph, to "little irregularities that have occurred in the past, which will in future be avoided." Yet shareholders are usually inclined to be lenient towards little irregularities, so far as the public lighting is concerned at any rate. The working for the year 1891 may be accepted as affording some indications of the practical conditions of electric supply. The total income for the year was £832—comprising public lighting, £502; private lighting, £252; and £67 gross profits from installations (from which it appears that the Company not only supply the light, but also do the fittings). But the expenditure for coal, wages, oil and waste, lamps and carbons, amounted to considerably more than this. Including the establishment charges, rents, taxes, &c., it comes to £1169, although no item for repairs or renewals is shown in the account. Giving the concern the benefit of any profit on the lamps, &c., we may put the receipts at £750, and the expenses at £1100. The outlay on capital account approaches towards £6000; and 5 per cent. interest on this would be £300. So that an income of £1400 would be required to afford a fair return for the shareholders; and it is evident that the electric light has been supplied at about half the price that would be necessary in ordinary business working. Coals and wages alone swallow up nearly the whole of the receipts. The private consumers appear to average something over a dozen lamps each, for which they pay about £10 per annum, or 16s. per lamp. With figures like these before us, it is evident that the electric light cannot be supplied in small country towns at anything like prices that would compare with those now paid for gas.

ELECTRIC LIGHTING AT BLACKPOOL.

The Superintendent of the Electric Lighting Department of the Blackpool Corporation (Mr. W. Chew) has just submitted a general report on the electric lighting of the Parade from its commencement, together with an analysis of last year's working cost per Board of Trade unit, and a few general remarks on the subject. The lighting between the two piers was commenced in September, 1879; and the original plant consisted of six arc lights, 60 feet high—two of them being on the extremities of the piers, for the use of which the Companies pay. The lights on the parade were, on an average, 330 yards apart; and the electric plant was put down on the low-tension system by Messrs. Siemens. The original machines and lamps are still at work. In December, 1879, the plant was placed under Mr. W. Chew's care, and has remained so to the present time. After an experience of two years, it was considered advisable to increase the light between the lamps erected; and three more lamps were added—making the average distance 160 yards apart. This, Mr. Chew says, made the lighting eclipse any other public lighting, for brilliancy, that has yet been attempted in this country, and added to the fame of the town. As advances were made in electric lighting, and small arc lights were introduced for street purposes, a reaction set in at Blackpool, and the policy of using such a blaze of light began to be questioned; it being thought that the smaller lights, extended farther, in lieu of the large ones, would answer the purpose as well. It was ultimately agreed to have a public test made by dividing each of the present lights into three. Separate poles and lamps were fixed, and the large and small lights were lit alternately. The unanimous conclusion was that, although it would be much cheaper to run small lights, the effect produced was inferior in all respects to that of the large ones; and Blackpool would not then occupy the first place for brilliant lighting. This decision put a stop to a scheme the Committee had in hand, estimates for which had been prepared, for the lighting of the north and south ends of the Parade by 40 small arc lights on the high-tension system. From that time until very recently, the decision arrived at then has not been assailed. In 1887 two more lights were added at the south end, by a private firm; and a Committee fixed the distance apart at 270 and 214 yards respectively, and 45 feet high. In the following year the bare poles were handed to the Corporation to light, and temporary plant for the purpose was fixed at the gas-works; making No. 2 station. In 1888, the Electric Lighting Act Amendment Act became law; and, as the powers of the Corporation became exhausted, it was considered desirable they should avail themselves of its provisions to enable them to make extensions. For this purpose Mr. Chew

prepared three schemes, embracing both public and private supply; and the Corporation obtained an Order in the session of 1890. By it the Committee were relieved of the responsibility of carrying it out; the duty being relegated to a new Committee, who have still the matter under consideration. Having given this *résumé* of the operations of the Corporation up to the present time, Mr. Chew glances at the progress made in the electrical world in general, and compares the price of gas and electricity at Blackpool. With gas at 2s. 6d. per 1000 cubic feet, and electricity at 8d. per unit, the ratio for equal lights stands as follows: Gas, 2d.; electricity, 8d. With regard to working expenses, last year they exceeded the original estimate by £200. This was caused by the continuation of the light all the year round, instead of during the season only. Reckoned at per Board of Trade unit, they came to 8.7d.; but this included the maintenance and renewal of poles, lamps, and lanterns—an amount equivalent to 2.22d. per unit. Excluding this, we have 6.48d. per unit as the cost, inclusive of heavy repairs to the boiler and engines. Mr. Chew devotes the end of his report to some remarks on the use of electricity for culinary purposes. Taking the case of boiling a pint of water by gas and by electricity, he shows that with the latter agent the cost would be 0.42d., while with the former it would be 0.015d.—the ratio being 30:1 in favour of gas. In conclusion, he points out that the efficiency of the present plant cannot be expected to be maintained, and be equal to that of more modern make, after more than twelve years' working.

THE PURCHASE OF THE IPSWICH WATER-WORKS BY THE CORPORATION.

The Financial Arrangements.

At a Special Meeting of the Ipswich Corporation last Wednesday, the Mayor (Mr. D. Ford Goddard), as Chairman of the Water Committee, presented an important report with reference to the proposed purchase of the water-works. After congratulating the Council upon the fact that the Bill had passed both Houses of Parliament, and was now only awaiting the Royal Assent, the report proceeded: "For the purpose of acquiring the undertaking of the Company, and for defraying the costs and expenses incident to such acquisition (other than the costs of the Act), and for the general purposes of the undertaking, the Corporation are empowered to borrow the sum of £230,000; and with the approval of the Local Government Board, they may also borrow such further moneys as may from time to time be necessary for the purposes of the water-works. They may also borrow such sums as may be requisite to pay for the stock-in-trade, &c., which are by the terms of the contract to be taken by valuation. Money borrowed for the purpose of paying the amount of the valuation is to be repaid within 15 years, and the £230,000 within 60 years from the date of borrowing. The Act empowers the Corporation to raise any amounts which they may hereafter from time to time be authorized to borrow (whether for the purposes of the Act or other purposes) either by mortgage or by the issue of Corporation stock; and it contains all the necessary financial provisions. In submitting the question of the purchase of the water-works to the Council in December last, the Mayor based his calculations upon the money being borrowed at 3½ per cent. interest. Preliminary negotiations have passed between your Committee and several leading banking firms, which fully justify your Committee in concluding that the amount required can be borrowed at a rate not exceeding 3½ per cent." The Mayor, in the course of his remarks, said they would have to borrow for the purchase of the undertaking £200,000. There would be bankers' commission and stamp duty, which he put at £4000. The valuation of the stock-in-trade amounted to £1500; and there would be, in addition, the cost of obtaining the Act. They had already paid about £400 of this through the rates; and he was very much in hope that they would not have to include any portion of the cost in the loan, but would be able to discharge it altogether out of current account. The total of the various sums he had mentioned was £205,000; and the interest on that amount at 3½ per cent. would be £6679. The income which he thought he was right in estimating, for the year commencing in September, 1892, and ending in September, 1893, would be £7400. This was what he believed the water-works would make this year; so that he was adding no increase next year for the growth of the town, and his estimate, therefore, could hardly be excessive. A rate of 1½d. in the pound would bring in £1095; making £8495 to meet the liability of £6679. In other words, they would end the first year with a balance in hand of £1816. The Mayor proceeded to carry his calculations on to the year 1895-6, and concluded by moving a resolution empowering the Committee to complete arrangements for the issue of the necessary stock upon such terms as they might find most advantageous to the Corporation, within the limit of 3½ per cent. interest. Mr. Ridley seconded the motion, which, after a short discussion, was carried—the words "within the limit" being deleted, so as to give the Committee full discretion.

ASHTON-UNDER-LYNE DISTRICT WATER SUPPLY.

One of the principal Water Bills of the present session is that promoted by the Joint Water Committee of the Local Authorities of Ashton-under-Lyne, Stalybridge, and Dukinfield, for the purpose of obtaining an extension of the period for the completion of water-works in the Greenfield and Chew Valleys, at Saddleworth. Owing to the pressure on our space, it has not been possible to record the proceedings on this Bill, which has already passed the House of Lords, and recently came before the Chairman of Ways and Means as an unopposed measure; and therefore the following particulars, which were officially communicated to a local contemporary, may be of interest:—

In addition to the extension of time for the construction of the work in the Greenfield and Chew Valleys, the Joint Water Committee sought for various other powers relating generally to their undertaking. The time

originally asked by the Committee was for an extension of 10 years to complete the Greenfield reservoir, and 15 years to finish the Chew reservoir. At the suggestion of the Chairman of Committees in the House of Lords, the period for the construction of the Greenfield reservoir was reduced to eight years; but in other respects the Bill passed practically as it was introduced by the promoters. A petition was presented in the Lords by the Saddleworth Guardians, acting as a Rural Authority; but they withdrew it at the last moment. When the Bill came down to the House of Commons, it was opposed by both the Saddleworth Guardians and certain owners and ratepayers in Saddleworth, as well as by the County Council for the West Riding of York. Petitions were presented by them against the Bill. Considerable negotiation took place between the Joint Committee and their opponents, and the Committee from time to time made various offers to the Guardians, which, however, were not accepted. Ultimately a conference took place between the parties in London, on the invitation of the Law and Parliamentary Committee of the West Riding County Council, when the promoters were met by the County Council in a far more reasonable manner than they had been by the Saddleworth people; and ultimately terms of settlement were arranged, under which the opponents agreed to withdraw their petitions. These terms practically amount to this: The Joint Committee agree to lay a special pipe from the watercourse connected with the Yeoman Hey reservoir to a point near the Clarence Hotel, Greenfield, in order to improve the supply of water to the Uppermill and Delph district. To do this will cost about £1000; but it is really a part of the work that would in any case have had to be executed when the new Greenfield reservoir was constructed. The whole effect of the opposition which the Joint Committee have had to encounter is consequently to have caused them to incur an expenditure of £1000 a year or two earlier than they otherwise would have had to do. The Joint Committee were prepared, and actually offered, to give to the Saddleworth people far more advantages than those above mentioned; but they were refused. It is the intention of the Joint Committee, and has been all along, to proceed with the construction of the new Greenfield reservoir at an early date; as it will be shortly required for the needs of the whole district of supply. Moreover the Engineers have reported in favour of its construction. In addition to getting an extension of time, the Joint Committee have obtained some very useful powers; amongst others, power to exchange and sell lands, and to purchase by agreement an additional quantity of 100 acres of land for the protection of their water-works undertakings from contamination. They have also secured the insertion of a new and useful clause, providing that, where an owner of a house under the value of £10 is liable by law to pay water-rent, and fails to do so, the tenant may pay it, and deduct the amount from the rent due or to become due to his landlord. There are other powers enabling the Joint Committee, if they think fit, to insist on cisterns being used in cases where there are baths or water-closets. When the Bill was before Mr. Courtney, he only made a few verbal alterations in it; and it was then passed.

Extension of the Water Distribution System at St. Helens.—The Local Government Board have sanctioned an expenditure of £2100 for the extension of the water-supply mains at St. Helens.

The Lamp Manufacturing Company, Limited, of Leonard Street, City Road, have carried out, under the personal superintendence of Mr. Imre Kiralfy, the lighting of the new Venetian Palace Gardens which have just been added to Olympia.

The Gas Workers' Union and the Eight-Hour Day.—At the opening of the proceedings at the third annual conference of the Gas Workers' and General Labourers' Union, which, as stated in the JOURNAL last week, was then being held in Plymouth, the General Secretary (Mr. W. Thorne) read his report, which contained the recommendation that, as the members were entering upon one of those periods of depression in trade with which workers were well acquainted, they should be very judicious in all their movements in treating with employers on matters connected with work and wages, and that, whenever possible without loss of dignity and self-respect, all disputes should be settled in the most quiet and expedient manner. The report also alluded to the fact of the Union being the pioneer of the eight-hour movement, and stated that most of the members were in favour of some legal enactment on the point, as the only way of permanently securing it. The report was adopted.

Batley Corporation Gas Supply.—At the last meeting of the Batley Town Council, the Mayor (Mr. Alderman Brooke) submitted the Gas Committee's minutes for confirmation. In doing so, he drew attention to the satisfactory character of the balance-sheet for the year ending the 25th of March last, which, he said, had been approved. The report from which he quoted showed that the gross profits in the Gas Department for the period mentioned amounted to £10,712; and that, after paying interest and sinking fund charges, &c., there remained a net profit of £4891. Out of this there had been paid, by the approval and sanction of the Council, a sum of £1438 in aid of the debit balance for the district fund account at March 25, 1891. The Committee had also handed over £2000 during the year in aid of the rates, which left a balance of £1453 carried to the contingency fund. From this fund they had paid on account of capital during the last twelve months £1504, which included an item of about £800 for a new washer. The Mayor explained that they were not increasing the capital account, but that anything expended on this account was paid out of the contingency fund. The figures in the balance-sheet had been gone through very carefully; and the Committee were well satisfied with the year's working, especially taking into consideration the fact that the price of gas had been reduced 5d. per 1000 cubic feet, which made a difference of £2046 in the net profits; while in regard to discounts another £292 would have been added—bringing up the net profits to £7223. All things considered, the Council had every reason, he thought, to be satisfied with their Manager (Mr. J. F. Bromley), seeing that when he took charge of the works the average cost of coal was 3s. per ton less than at the present time, and the stokers' wages were 6d. per shift lower. The year's working was in every way satisfactory, and each member of the Corporation had cause to be thankful. The minutes were confirmed.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Bailie M'Kenzie, the Convener of the Gas Committee of the Aberdeen Corporation, has made a show of resigning the convenership, which I presume he will soon see to be a mistake, as it is founded upon too close a consideration for local and sectional opinion, and does not take into account any question as to the position of the gas industry generally. His letter of resignation, which was laid before the Town Council on Monday, stated that he took the step he did "in consequence of an expression of opinion on the part of a majority of the members of the Gas Committee in favour of keeping the gas at the same illuminating power as last year, or lower." He explained to the Council that a year ago they contracted for coal to furnish gas of 24'53-candle power, but had only had gas of an average of 22'80-candle power; and that his view was that they should raise the illuminating power. Accordingly, before the Committee proceeded to open the tenders for coal which had been sent in, he asked them to decide what the illuminating power of the gas they were to supply this year should be. A majority of the members were satisfied with the gas as it had been; and he, feeling that he could not take any part in the purchase of coal to produce a lower quality of gas, could not remain longer Convener of the Committee. They had not been able, he said, to understand the reason for the difference in the illuminating power. Mr. A. Smith, the Gas Manager, told them that Dr. Hay, the City Analyst, did not give a proper report on the gas; but he had himself been present when Dr. Hay was testing the gas, and, so far as he could see, this was done in a fair and upright manner. Mr. Smith had not concealed that his object was to keep down the illuminating power of the gas, in order that it might suit the users of gas-engines and produce more coke. He held that the community required better gas, and that it was the duty of the Corporation to supply them with what they wanted; that the supplying of gas was their first duty, and that afterwards they should consider the question of the bye-products. There was a long discussion upon the subject of the resignation, which, despite the efforts of the Lord Provost to confine it to the question before them, continually ran on to the merits of higher or lower power gas. Ultimately, the Council, by a majority, adopted a proposal by the Lord Provost to allow the Convener's letter to lie upon the table; and Bailie M'Kenzie agreed to remain at his post until the Manager's report upon the quality of the coal offered should come up for consideration. Now, nothing can be said against, but a great deal for, the position taken up by Bailie M'Kenzie. Corporation owners of gas-works are bound to supply the article which the community desires, even more than companies are. It is also true that a high illuminating power is better than a low one. But the Bailie, in adopting the above truisms as his bulwarks, failed to take two very important considerations into account. He said that last winter "there was very great commotion throughout the town" because the gas was of only 22-candle power; and that he believed the people of Aberdeen wanted better gas. He evidently mistakes the outcry of the better classes, and of the grumblers of all classes, for the voice of the people. We have seen elsewhere the moneyed classes clamouring for better gas, and calling out that they did not mind the cost; and then, when the price was necessarily raised, turning round and saying that, because gas was so dear, they would adopt another light. A gas committee must make its garment out of the cloth it finds in the market; and if the community are dissatisfied, they must be educated in the use of that which is appropriate. This brings forward the second thing which Bailie M'Kenzie forgot—that the general situation is found to be that the higher qualities of gas must be given up. If he would take the advice of Mr. Smith upon this point, he would learn that the richer cannel coals are within measurable distance of being exhausted; and, though they can still be got, the price is such that gas produced from them must be sold at an almost prohibitive rate as far as the poorer classes are concerned. It is the duty of the Corporation to supply gas at a price which will, on the one hand, compete with the cheap illuminant oil in the dwellings of the poor; and, on the other hand, while furnishing a satisfactory light for the better classes, will bring home to them that there is a financial advantage in using it in preference to electric lighting. As to the low illuminating power of the gas obtained from the coal which they purchased last year, that is a matter rather for inquiry than for the resignation of the Convener.

The meeting of the Motherwell Police Commission on Tuesday of this week furnishes material for reflection in more ways than one. The Committee which had been appointed to consider whether they should acquire the undertaking of the local Gas Company, gave in their report, in which they stated that they could not see their way to recommend that any offer be made to the Gas Company, but suggested that the Committee should be continued to watch the development of electric lighting and to bring the subject up again when they deemed that the time was ripe. The spirit in which this recommendation was made was well characterized by a speaker when he said "the Committee was appointed to ascertain terms for taking over the gas-works; and it had ended in the Convener becoming an enthusiast for electricity." I am afraid the Committee's meaning must be found by reading between the lines. They are really of opinion that it would be profitable for the burgh to acquire the gas undertaking. But there is little hope of their being able to do so at present; and they wish to hold over the head of the Gas Company the terror of electric lighting, in the expectation that, if it should move a little forward, the Corporation would be able to "put the screw" on the Gas Company and take them over at a low price.

The Barrhead Gaslight Company is one of the best conducted gas companies in Scotland, thanks to the careful management of Mr. J. Carmichael. The shareholders held their annual meeting on Tuesday; and received the gratifying report that the profit for the year admitted of the payment of a dividend at the rate of 7½ per cent., after allowing 2½ per cent. for depreciation. The Company is not a large one; but good work done in a small way is equally creditable with that which is done on a large scale. The profits for the year were £1159, to which was added £350 brought forward; and the sum carried forward this year is £417. The Chairman complimented Mr. Carmichael

on his very efficient management, which was shown by the fact that, notwithstanding dearer coal and lower prices for residuals, he had been able to produce so satisfactory a result. It is pleasing to observe that Mr. Carmichael's reward did not stop short of compliments; but that it was carried into reality by the unanimous resolution to increase his salary by £20 a year. The recognition of merit always pays; and the shareholders of the Company may rest assured that this increase of salary to their Manager will be a good investment.

In connection with the extensions which are in progress at the Dundee Corporation Gas-Works, Messrs. C. and W. Walker have secured the contract for the supplying of sulphate plant; and Messrs. Whyte and Cooper, the contract for supplying exhausters.

The estimates of the Dundee Gas Commission for the year that is now current have been made up. They show an expected output of 505 million cubic feet of gas, or 15 million cubic feet more than was estimated for last year. Of that quantity, it is expected that 5,600,000 cubic feet will be consumed in the works, and that 50½ million cubic feet will be unaccounted for; which will leave 448,900,000 cubic feet for sale. The gas sold in the year which has just closed amounted to 448,245,950 cubic feet; there was consumed in the works 5,633,100 cubic feet, and there was unaccounted for 50,899,550 cubic feet; so that the estimates show little divergence from what was actually realized last year. The estimate is a very moderate one, when the large increases of the past few years are taken into account. Two things may possibly have moved the Commissioners to a policy of caution—that they are about to advance the price of gas by 1d. per 1000 cubic feet, and that during a portion of this year the Commissioners' electric lighting station will in all probability be in operation. It is well to move cautiously, and certainly it is far better to under-estimate than to over-estimate income; but I think that neither of the above reasons need have influenced the Commissioners very much. Two years ago they had the very large increase of 40 million cubic feet in their output, in face of a rise of 2d. per 1000 cubic feet in price. Last year the output exceeded the estimate by nearly 15 million cubic feet; but it has to be borne in mind that the 15 millions was an increase upon a very much advanced estimate. A better way to look at the matter is that in 1889-90, the output of gas was 387,716,000 cubic feet; which, compared with last year, shows an increased output, in three years, of 117 million cubic feet, or an average of 39 million cubic feet a year. Surely an output which has come forward with such leaps and bounds will not be checked now by a rise of 1d. per 1000 cubic feet. As for the electric light, its adoption is altogether a matter for speculation; but if the experience of Dundee be like that of other places, it will not affect the gas industry at all. The revenue from gas and meter rents for the past year was £81,084; which is £1488 over the estimate, and £4500 over the amount realized in the previous year. The estimate for this year is £84,223. Meter-rents are expected to yield £2900—making £87,123 from both sources of revenue; but from that there falls to be deducted £3620 of interest, and £150 is allowed for bad debts, which leaves a revenue of £83,353. The income from residuals, coke, gas-stove rental, &c., is expected to raise the gross income to £93,299. The expenditure is estimated at £93,029; and the apparent surplus is left of £270.

Mr. Foulis, whom the Dunbar Gas Commissioners requested to select a man to succeed Mr. Cuthbert as Gas Manager there, has recommended Mr. John McKechnie, of Glasgow. Mr. McKechnie has received the appointment; but not without a grumble on the part of some of the Commissioners, who objected to the hurry with which the affair had been carried through, and to the new Manager being paid at the rate of £80 a year, instead of £70, as agreed upon. It was explained that Mr. McKechnie was prepared to work with fewer men than Mr. Cuthbert did, and that the £10 extra of salary would be more than saved in that way.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, June 11.

Sulphate of Ammonia.—There has been little passing; and prices hardly indicate any change. Hull and Leith are quoted at £9 15s. Liverpool prices are rather dearer; but the amount of business is scarcely large enough to establish the prices. There is a fair inquiry springing up, however; and as not many parcels are offering, prices will no doubt be maintained. Nitrate is dearer; 8s. being now the lowest price on spot.

LONDON, June 11.

Tar Products.—Buyers seem for the most part to think that the bottom has been touched in the values of benzol, and are more eager to buy, both for prompt and forward, than has recently been the case. Sellers, on the other hand, look for an advance; and but little business has been reported forward. Nineties continue to be more inquired for than fifties. Anthracene is still very dull; and there is no improvement apparent in values, either for spot or forward. Pitch keeps in very good demand at from 27s. to 29s. Carbolic acid is lifeless; and there is no change in the value of crystals. Prices: Tar, 10s. to 12s. Pitch, 27s. to 29s. Benzol, 90's, 1s. 9d.; 50's, 1s. 4½d. Toluol, 1s. 2½d. Solvent naphtha, 1s. 3d. Crude benzol naphtha, 30 per cent., 8d. Creosote, 1d. Naphthalene salts, 20s.; pressed, 45s. Carbolic acid, crude, 60's, 1s. 1d.; 70's, 1s. 4d.; crystals, 5d. Cresol, 8d. Anthracene, 30 per cent., "A" quality, 10½d.; "B" quality, 7½d.

Sulphate of Ammonia is very quiet, at about last week's prices. Gas liquor (10 oz.) is quoted at 5s. to 6s. 6d.

Sales of Shares.—At a sale by auction at Colchester last Wednesday, five new £20 shares in the Colchester Gas Company were sold at £31 5s. each; five £5 fully-paid shares in the Hadleigh Gas Company, Limited, at £3 10s. each; and twenty shares in the Clacton Gas and Water Company, at £4 4s. each.—Among some miscellaneous shares lately sold by public auction at Leeds were four £2 10s. ordinary shares in the Churwell Gas Company, which produced £14 4s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—With the usual stoppage of the collieries throughout this district—extending in the neighbourhood of Manchester over more than the entire week, and in other Lancashire mining centres over at least three or four days—there is necessarily a temporary suspension of business operations in the coal trade here; and there is practically not very much to report. So far as gas coal contracts are concerned, I do not hear of any particularly new feature, except the report that in one or two cases concessions of 3d. to 6d. per ton have been made in special contracts; but generally tenders continue to be based upon the average prices which were obtained last year, and some considerable quantities have been placed on this basis. The Manchester Corporation have settled some of their contracts; and it is stated that a large quantity of gas coal is being supplied from Yorkshire at the price obtained last year. With reference to the remainder of the locomotive fuel contracts, some of the leading firms are determined not to follow the low prices which were accepted by one or two collieries in recent contracts. No doubt this stronger attitude on the part of the coal-owners is due to the fact that there is now little or no prospect of any interference with wages during the present year; and they do not see how they can supply coal at any lower figures, unless they have some corresponding reduction in wages. With regard to other descriptions of round coal, there is so little buying just now that prices are scarcely more than nominal. Generally quoted rates are being maintained; but although it is exceptional where there is any actually announced giving way, where competition has to be faced prices are easier, and concessions upon list rates are made here and there to effect sales. This is particularly the case with regard to common round coals, suitable for steam and forge purposes, for which very low figures have been accepted, where anything like quantities have been concerned. At the pit mouth, best Wigan Arley coal averages 12s.; Pemberton four-feet and second qualities of Arley, 10s. to 10s. 6d.; common house-fire coals, 8s. 6d. to 9s.; and steam and forge coals, 7s. 9d. to 8s. 3d., with as low as 7s. 6d. having been taken in one or two instances. The shipping demand is also very indifferent; and 9s. 3d. to 9s. 6d. represents the full average price for good ordinary qualities of steam coal, delivered at the ports on the Mersey. Engine classes of fuel continue generally steady at late rates—burgundy averaging 6s. 3d. to 6s. 9d.; the better qualities of slack, 4s. 9d. to 5s. 3d.; and common sorts, 3s. 3d. to 3s. 9d. per ton, at the pit mouth.

Northern Coal Trade.—Work being now resumed generally at the Durham collieries, the tendency of the trade is becoming evident. The output of coal is far from being so large as it was before the strike; but it is quite enough to bring down the prices that have been current for three months. Best Northumbrian steam coals may now be quoted 10s. 6d. to 10s. 9d. per ton, f.o.b., and second qualities about 1s. per ton less; but the belief prevails that in a week or two the prices may be lower, as some of the contracts are worked off. Gas coals are rather irregular in price; the contracts of some collieries taking up their diminished output, whilst others have a fair quantity to spare. At present, the range of prices quoted for prompt delivery of good gas coals is from 8s. 9d. to 10s.; but lower prices are looked upon as tolerably certain, for the output will increase considerably after the end of this month—though, of course, the consumption will then begin to tend upwards also. Bunker coals are also lower in price; and from 8s. 6d. to 9s. 3d. per ton f.o.b. is the current quotation, though there are some collieries asking higher prices. Household coals are very dull. Manufacturing coals are quiet. Coke is now in supply from the Durham ovens; and for best blast-furnace coke, about 17s. to 18s. per ton f.o.b. is the rate, but lower prices are soon anticipated. Gas coke is not so plentiful now; the production being very limited, and the stocks having been of late much reduced. The price is unaltered this week.

Scotch Coal Trade.—While activity is still the characteristic of the coal trade, the business continues to be confined to orders for prompt delivery, chiefly for shipping. For forward delivery, buyers are disposed to demand easier prices, on the reliance of Durham coal coming into the market; but against that, coalowners place the fact that six or seven weeks must elapse before the markets can be affected by North of England coal, and that by that time the holidays will be over, and the winter demand will have set in, which will keep up prices. There has consequently, as yet, been no tendency on the part of prices to recede, but rather, for some descriptions, to advance. This is accounted for by the desire on the part of coalmasters to accumulate stocks. They are encouraged in this policy by the fact that the miners are working steadily—which they always do before the holidays—and by the consideration that the holidays this year will probably be more protracted than usual, as no miner will work while a General Election is going on. There has been no advance in the price of gas coal. The rates quoted are: Main, 7s. 9d.; ell, 8s. 6d. to 8s. 9d.; splint, 8s. 3d.; and steam, 10s. to 10s. 3d. per ton. Exports again show a phenomenal increase. For the week they amounted to 191,915 tons; which was 11,072 tons over the previous week, and 67,671 tons more than the corresponding week of last year. The figures for the previous highest week on record were 186,324 tons. For the year to date the total exports have been 3,034,925 tons; an increase over the same period of last year of 421,537 tons.

Gas Workers' Union Officials in Trouble.—Last Sunday evening, William Millman, Assistant Secretary of the Gas Workers' and General Labourers' Union, and William John Anderson, a prominent labour representative, were arrested by the Plymouth police for attempting to hold an open-air meeting in connection with the conference of the Union, in the Bull Ring, on the Hoe, in contravention of the bye-laws of the borough. Application had previously been made for permission to hold meetings; but it was refused. Millman and Anderson were bailed out by a member of the Town Council; and it was understood that they would be brought before the Magistrates yesterday.

Messrs. D. M. Nelson and Sons, late of St. Vincent Street, Glasgow, have removed their offices to No. 68, Bath Street, Glasgow.

The Blackburn Town Council and Electric Lighting.—A Sub-Committee of the Gas Committee of the Blackburn Corporation have had under consideration the best means of utilizing their Electric Lighting Order. To assist them in their deliberations, they issued a circular to occupiers of premises in the centre of the town, to ascertain the probable number of consumers. The favourable replies received were somewhat disappointing to them; but they are of opinion that this result by no means represents the demand if an installation was undertaken. The Sub-Committee also think it would be unwise to allow an electric lighting company to come into the town; so that a move must be made in the matter within the time limited by the Provisional Order—viz., Aug. 4 next. They therefore recommend the Gas Committee to cause "something to be done forthwith."

The Proposed Purchase of the Accrington Gas and Water Works by the Corporation.—We understand that the purchase of the Accrington Gas and Water Company's undertaking by the Corporation is all but an accomplished fact. Terms of purchase have been agreed upon between the Committee of the Town Council and the Directors of the Company; and all that is necessary now is the ratification by the ratepayers and shareholders, and the consent of Parliament. The purchase-money agreed upon is £713,000, made up thus: Annuities equal to maximum dividends, *plus* 10 per cent., which capitalized at 30 years' purchase is equivalent to a sum of £704,000; and compensation to officers and Company's expenses, £9000. Our local correspondent says it is not anticipated that there will be any objection to the scheme from the Accrington people; but the outside districts supplied by the Company may object if the terms do not suit them.

Excursion of Employees of the Glasgow Corporation Gas-Works.—The annual excursion of the employees of the Glasgow Corporation Gas-Works (Dawsholm and Temple stations) took place last Wednesday, when the party, numbering upwards of 600, left Maryhill by special train for Portobello, arriving there at 10.30 a.m. Having dispersed till half-past two, the company again gathered at Joppa Park, where they were met by Mr. and Mrs. Langlands. Here an interesting programme of sports was carried out, during the course of which Mr. A. Wilson (Manager of the above-named stations) announced that Mr. Langlands had intimated his intention of presenting a silver challenge cup to be held annually by the winning team in the tug of war. The events were all well and eveny contested; and at the conclusion the prizes were presented to the successful competitors by Mrs. Wilson. The weather throughout was all that could be desired; and the excursion was thoroughly enjoyed.

Philadelphia Water Supply.—The Philadelphia water supply has been recently reported upon by the Director of the works (Mr. Windrim). He says the Roxborough reservoir, of 148,000,000 gallons capacity, will be finished this year. The city should have reservoirs to contain 10 days' supply; and accordingly additions to the storage capacity are recommended. At present there are the following reservoirs: East Park, 673,874,000 gallons; Wentz Farm, 36,046,000 gallons; Roxborough, 12,838,000 gallons (which will be increased by the new reservoir to 160,838,000 gallons); Belmont, 40,000 gallons; Fairmount, 26,351,000 gallons; Spring Garden, 12,010,000 gallons; Corinthian Avenue, 37,314,000 gallons; Lehigh Avenue, 26,394,000 gallons; and Mount Airy, 4,546,000 gallons. The total capacity probably exceeds 850,000,000 gallons, as the above figures are only approximations. These reservoirs and their distributing mains are so arranged that all sections of the city except three are plentifully supplied. To meet the requirements of the three partially-supplied sections, Mr. Windrim recommends the construction of additional filtering plant, at least two new reservoirs, and increased pumping plant.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.
For Stock Market Intelligence, see ante, p. 1114.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon invest. ment.
£			p. c.					£ s. d.
GAS COMPANIES.								
590,000	10	13 Apr.	10½	Alliance & Dublin 10 p. c.	10	16½-17½	..	6 0 0
100,000	10	"	7½	Do. 7 p. c.	10	11-12	..	6 5 0
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105-107	..	4 13 5
100,000	20	27 May	8	Bahia, Limited	20	10-12*	..	13 6 8
200,000	5	12 May	7½	Bombay, Limited	5	6½-6¾	..	5 11 1
40,000	5	"	7½	Do. New	4	4½-5	..	6 0 0
380,000	Stock.	26 Feb.	12½	Brentford Consolidated . . .	100	212-217	..	5 12 11
150,000	"	"	9½	Do. New	100	162-167	..	5 10 9
220,000	20	11 Mar.	11½	Brighton & Hove Original . .	20	40-42	..	5 9 6
888,500	Stock.	11 Mar.	5	Bristol	100	95-100	..	5 0 0
320,000	20	13 Apr.	11½	British	20	12-14	..	5 2 3
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	10	19-20	..	5 15 0
5,510	10	"	8½	Do. 7 p. c.	10	15-16	..	5 6 3
328,750	10	"	—	Buenos Ayres (New) Limited	10	6½-7½	..	—
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	94-97	..	6 3 9
150,000	20	26 Feb.	8	Cagliari, Limited	20	25-27	..	5 18 6
550,000	Stock.	13 Apr.	13	Commercial, Old Stock . . .	100	229-234	..	5 11 1
165,000	"	"	10	Do. New do.	100	180-185	-2½	5 8 1
130,000	"	30 Dec.	4½	Do. 4½ p. c. Deb. do.	100	118-123	..	3 13 2
800,000	Stock.	30 Dec.	13	Continental Union, Limited .	100	220-225	..	5 15 6
200,000	"	"	10	Do. 7 p. c. Pref.	100	190-195	..	5 2 7
75,000	Stock.	30 Mar.	10	Crystal Palace District . . .	100	185-195	..	5 2 7
486,090	10	29 Jan.	10	European, Limited	10	19-20	..	5 0 0
354,060	10	"	10	Do. Partly paid	7½	13½-14½	..	5 3 11
5,470,820	Stock.	12 Feb.	12	Gaslight & Coke, A, Ordinary	100	208-212	+1	5 13 2
100,000	"	"	4	Do. B, 4 p. c. max.	100	94-98	..	4 1 7
665,000	"	"	10	Do. C, D, & E, 10 p. c. Pf.	100	250-255	..	3 18 5
30,000	"	"	5	Do. F, 5 p. c. Prt.	100	118-123	..	4 1 3
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	169-174	..	4 6 2
1,300,000	"	"	7	Do. H, 7 p. c. max.	100	154-158	..	4 8 7
463,000	"	"	10	Do. J, 10 p. c. Prf.	100	247-252	..	3 19 5
476,000	"	"	—	Do. K, 6 p. c. Prf.	100	148-153	..	3 18 5
1,061,150	"	11 Dec.	4	Do. 4 p. c. Deb. Stk.	100	114-117	..	3 8 5
294,850	"	"	4½	Do. 4½ p. c. do.	100	118-123	..	3 13 2
908,000	"	"	6	Do. 6 p. c. do.	100	165-169	..	3 11 0
3,800,000	Stock.	12 May	12	Imperial Continental	100	211-215	-1	5 11 8
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4-4½	..	6 13 4
560,000	100	1 Apr.	5	Met. of Melbourne, 5 p. c. Deb.	100	108-110	..	4 10 11
541,920	20	27 Nov.	5½	Monte Video, Limited . . .	20	14½-15½	..	6 9 0
150,000	5	27 May	10	Oriental, Limited	5	7½-8½	..	6 1 2
60,000	5	30 Mar.	7	Ottoman, Limited	5	4-5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited	10	2-3	..	—
People's Gas of Chicago—								
420,000	100	3 May	6	1st Mtg. Bds.	100	106-110	+2½	5 9 1
500,000	100	1 June	6	2nd Do.	100	100-103*	..	5 16 7
150,000	10	15 Oct.	10	San Paulo, Limited	10	8-9	..	—
500,000	Stock.	26 Feb.	15½	South Metropolitan, A Stock	100	265-270	-5	5 14 10
1,350,000	"	"	12	Do. B do.	100	217-221	..	5 8 7
200,000	"	"	13	Do. C do.	100	250-240	..	5 8 4
725,000	"	30 Dec.	5	Do. 5 p. c. Deb. Stk.	100	142-146	..	3 8 6
60,000	Stock.	11 Mar.	11½	Tottenham & Edm'ton, "A"	100	225-230	..	5 0 0
WATER COMPANIES.								
729,331	Stock.	30 Dec.	10	Chelsea, Ordinary	100	252-257	..	3 17 9
1,720,252	Stock.	13 Apr.	8	East London, Ordinary . . .	100	195-200	-2	4 0 0
544,440	"	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	138-142	..	3 3 4
700,000	50	11 Dec.	8½	Grand Junction	50	99-103	..	4 2 6
708,000	Stock.	12 Feb.	10½	Kent	100	260-265	..	3 19 3
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max.	100	222-226	+1½	4 4 0
406,200	100	"	7½	Do. 7½ p. c. max.	100	188-193	+1	3 17 9
279,700	Stock.	30 Mar.	4	Do. 4 p. c. Deb. Stk.	100	121-124	..	3 4 6
500,000	100	12 Feb.	12½	New River, New Shares . . .	100	325-335	..	3 12 4
1,000,000	Stock.	29 Jan.	4	Do. 4 p. c. Deb. Stk.	100	126-129	..	3 2 0
902,300	Stock.	30 Dec.	6½	S'thwk & V'xhall, 10 p. c. max.	100	148-153	..	4 4 11
126,500	100	"	6½	Do. D 7½ p. c. do.	100	133-138	..	4 14 3
1,155,066	Stock.	11 Dec.	10	West Middlesex	100	242-246	..	4 1 3

† Next dividend will be at this rate.

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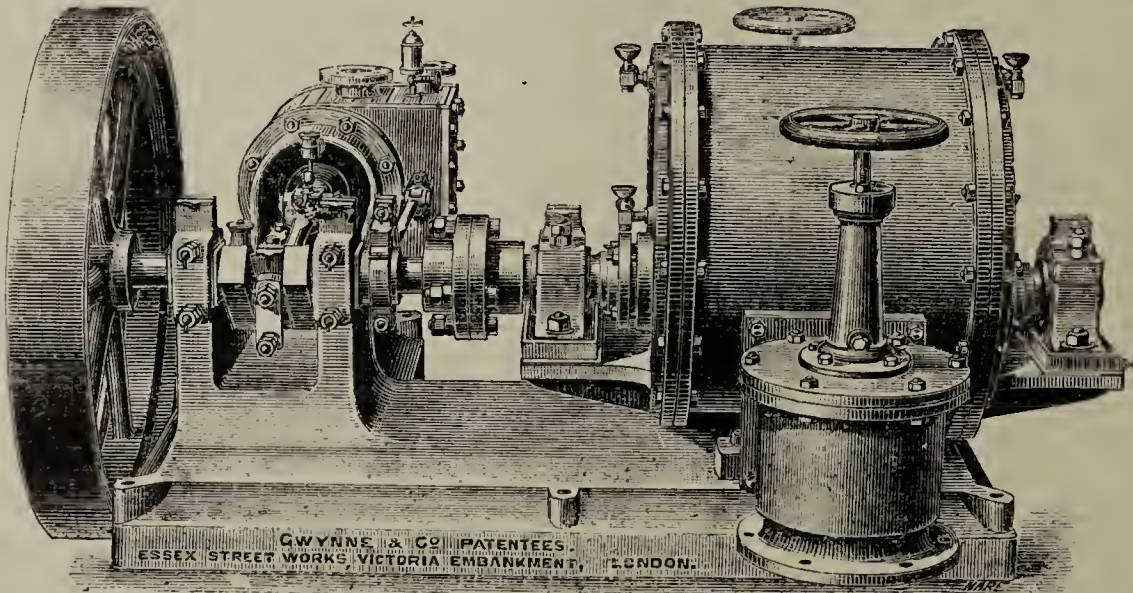
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TO ADVERTISERS.

ADVERTISEMENTS for the next number of the JOURNAL must be received by Monday, 12 o'clock noon, to ensure insertion; but Orders for Alterations in or Stoppages of PERMANENT ADVERTISEMENTS should be received Not Later than the FIRST POST on SATURDAY.

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THE
JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JUNE 21, 1892.

The Gas Institute Meeting.

THE meeting of the Incorporated Gas Institute last week was in every respect an unequivocal success. The President—Mr. W. A. Valon, of Ramsgate and London—did more than was to have been expected of him as his

official contribution to this result; the papers were, on the whole, distinctly good (and with the papers must be included, as a conspicuous part of the transactions, the Murdoch Lecture of Professor Lewes); the pleasure portions of the programme were well conceived and carried out; and, altogether, it is possible to rank the meeting of The Gas Institute for 1892 very high, if not absolutely at the top of all previous performances of the kind. We would not be misunderstood here; and therefore this remark necessitates some explanation. It is too true that the Institute, as an organization representing the British gas industry, no longer stands alone in the field. The wounds inflicted upon it by reckless selfishness, aggravated by unhappy treatment, are still uncicatrized; and it is impossible to say when, if ever, they are to be perfectly healed. But, regarded simply as a meeting of The Gas Institute, and neglecting for this purpose all reference to constitutional questions, we have no hesitation in describing that of last week as among the very best in the history of the organization. Even if the obviously personal efforts of the President are put aside, in order that the meeting should be judged by the conduct of the mass of the members who attended it, we can still characterize the gathering as of exceptional quality. Never were the attendances at the reading of papers so well maintained; and, since the once-notorious besetting weaknesses of the Institute must be referred to, it is with peculiar satisfaction that we are able to report an improvement all along the line which is little short of marvellous. In fact, the Institute appears to have "turned over a new leaf;" and an impartial observer of the late meeting, who could also have recalled previous ones which need not be specified, would hardly have known the association for the same. Common justice demands that this acknowledgment should be made by us, who certainly have never shrunk from writing plainly about the Institute in the past.

Institutions and societies do not improve or degrade themselves, but are reflections of the personal characteristics of their members. The Institute has suffered sorely from circumstances. There has been a serious secession; and where there was once but a single organization of the kind, there are now two. For many reasons, this is deplorable; but a wise man takes things as they are—making the best of them. And so far as experience has gone, an observer who might wish to look on the bright side of this matter would have much reason for declaring that our two national technical organizations have put the members of each upon their mettle. Time alone can prove whether the gas industry is able to support two societies—a point upon which we cannot express an opinion; but it is possible to state that this year, at any rate, both have done very well. We were not prepared for the improvement for the better which has so conspicuously set in, in the case of The Gas Institute. There was the breaking of a gleam of hope for the Institute in the acceptance by Mr. Hepworth of the presidency for 1891; and the hearty way in which he was supported was indicative of the existence, among the majority of the regular supporters of the Institute, of a desire for the prevalence at their headquarters of the spirit of order, tempered with kindness, and attuned to the steady performance of duty, of which the popular Carlisle engineer is the recognized embodiment. Mr. Hepworth had his trials, however, which he was very careful to put behind him, and say nothing about; but he had nevertheless to possess his soul in patience until such time as he should be able to clear the Institute of the worst *remanets* of the period of anarchy through which it had passed before coming into his hands. With Mr. Hepworth worked Mr. Valon in perfect sympathy, which was continued after the positions of the two men in the public eye had been changed by Mr. Valon's succession to the presidency. But whether it was one or the other who happened to be "on deck," the course followed was the same throughout the two years. This continuity of policy has had the happiest results for the Institute; and the appointment of Mr. Hepworth to the post of Honorary Secretary—which will not in his case be a sinecure—is the best guarantee that the policy identified with his name will be persevered in. Consequently, to the two last occupants of the presidential chair of the Institute must be ascribed a great deal of the credit for the change that has come over it. While saying this, we do not seek to ascribe to any one or two men, more than the

rest, the praise for that general turning towards the better way which was so patent in every aspect of last week's doings.

It is evident that the Institute does better in London than in a provincial town. When a large number of men get jumbled up together in a comparatively small place, any evil example that may be present has two deplorable effects—it corrupts some, and disgusts others who cannot keep out of the way. In the big manufacturing towns, moreover, generally affected by the Institute, there is literally no provision for rational recreation; and consequently a week of hotel life tells for the worse upon the weaker vessels among the members. In London, on the other hand, if there is "rowdiness"—which was happily absent last week—it is strictly localized. Why should it ever raise itself into prominence again? The same may be said of touting and treating. We cannot pretend to regard the choice of Belfast for next year's meeting as anything else than a mistake. It was done, mainly by men who had no acquaintance with the place, with the amiable intention of offering a compliment to the President-Elect, Mr. Denny Lane. But there is absolutely no real reason why the reviving strength of the Institute should be strained by holding a meeting in a place so far out of the way as Belfast is for all who do not happen to have easy access to the Lancashire coast. The attendance will not be good; the accommodation is certainly limited; and unless the members who will go to Belfast set themselves resolutely against a recrudescence of the mischief that has arisen upon former similar occasions, there will be danger lest a meeting that is unlikely to be tame in a technical sense may be even more unfortunate in others.

For there is another reflection to be made upon last week's performance. The Institute, having lost its front bench of debaters, and many others, is more dependent than its best friends would like to see it upon outside assistance for enduing its technical transactions with sterling interest. What would this year's book have been like without Professor Lewes and Mr. Walmisley? The members' papers were good average productions, but not very conspicuously above District Association form. The occurrence of Ascot races last week suggests a sporting analogy; and so we will put it that the proceedings of the Institute will not draw good meetings if they are to be all sweepstakes. There must be something added, if good sport is to be secured. Now, the Institute is fairly well off for funds, and London can always be depended upon for a few good professional lecturers and readers of papers. Something will have to be regularly done in this way—for a few years, at any rate—if the reports of the Institute meetings are to be worth reading, or the meetings themselves to be worth attending.

With regard to the important matter of recreation, the conspicuous success of the late meeting in this regard was due to two influences—the generosity and self-devotion of the President and Mrs. Valon, and the fact that the presence of ladies was invited, and even insisted upon as a feature. It is unnecessary to dilate upon the effects of changing the character of any assembly from that of a meeting of single men who are not exactly recluses, to that of a family gathering. In these days it is not needful to expound the right of women to play a more prominent part in most human affairs than was formerly assigned to them; and it appears to be an understanding that ladies are to figure more prominently than has hitherto been the case in connection with the meetings of The Gas Institute. If last week's experience is a reliable guide to a forecast of the consequences that may be looked for from this movement, it will result in nothing but good.

A Lesson from Ilkley.

THE Ilkley Local Board Bill has passed the House of Commons Committee on Police and Sanitary Regulations Bills. This statement may not appear at first sight to be of thrilling interest; and there are perhaps other localities of which it might be said that they take the eyes of Europe more particularly than the pretty district of the Ilkley Local Board. But appearances are deceptive, as more than one philosophical observer has ere now found occasion to remark; and there is a very cogent reason why readers of the JOURNAL, at any rate, should take heed of what has been done for Ilkley by the Commons Committee. The main object of the Bill promoted by

the Local Board was to provide for the compulsory purchase of the undertaking of the Ilkley Gas Company, who for their part did not want to sell. Whenever transactions of this nature are in prospect, the interest widens beyond the parties immediately concerned, and takes in a large circle of those who feel that they may at any time be similarly circumstanced. The Ilkley district, though small, is a rapidly growing one. It is a favourite health-resort; and deservedly so. Consequently, the Local Board, which looks after the sanitary government of the place, realizes the need in its case of what would be called a progressive policy. Having provided various services for the population which they represent—such as water supply, a cemetery, and a cottage hospital—the Local Board cast longing eyes upon the Gas Company's undertaking, and made up their minds that they should like to possess it at its current value; thereby not only bagging the "increment" which the Company would otherwise inherit with the future growth of the district in gas-consuming capacity, but also possibly making a little money that would have been available for helping the rates.

It should be premised that the Company have statutory powers. In these circumstances, it is interesting to see how the Local Authority could make out a case for compelling the proprietors to part with their business. The first thing, of course, was to get up a case against the Company for mismanagement of their affairs and neglect to act up to the statutory requirements imposed upon them for the benefit of the consumers. Mr. Balfour Browne, Q.C., formulated a tremendous indictment against the management of the undertaking, the counts in which covered all the ground from the hours of employment of the lamp-lighters to the extension of the works out of revenue. Most of the local evidence offered by the promoters had reference to the smaller complaints such as could be paralleled in any locality, whether served by a gas company or by a local authority; but the Committee swept all that side of the case away, and devoted their attention to the financial question. This, as it happened, was the weakest point of the Company's position; for there was good ground for the suspicion that the books of the concern had been handled a little too cleverly. The evidence of Mr. T. Newbigging, which was corroborated by that of Mr. C. Gott, of Bradford, was full of strong expressions about the illegality of various payments which the Company had made to their reserve out of profits; and Mr. Newbigging also said that "a considerable amount had been taken out of the pockets of the consumers for the purpose of enlarging and extending the works." This sort of thing weighs heavily with a Committee; and in the case in point, Nemesis has come upon the Directors' sharp practices, in the shape of deprivation of their vested interest in the future gas supply of Ilkley. The Company will be fairly bought out; but the investment will be extinguished. There is a good moral in this story.

Mr. Fletcher's Annual Report.

IN the JOURNAL for the 7th inst., we gave a reproduction of as much of the annual report of the Chief Inspector under the Alkali Works Regulation Act as applies to the class of factories in which our readers are more especially interested. The manufacture of sulphate of ammonia is not a very fluctuating business, because the majority of those who engage in it do so for the sufficient reason that they cannot help themselves. The weight of sulphate coming into the market from factories unconnected with gas-works is growing year by year; but the whole of it is as yet not more than one-third of the output from gas-works proper. It is a curious result of the increasing use of the Claus sulphur-recovery process in ammonia and other factories, that the acidity of the chimney gases appears to be actually intensified thereby. Now, this is something to ponder over; because we so often hear assurances that, by the general adoption of waste-preventing devices, very much of the gaseous pollution of the atmosphere of towns, from which they now suffer so severely in various ways, would be entirely prevented. Well, here there is an economical waste-preventing arrangement, if ever there was one; and the net result is that it makes chimney gases worse than they were before. This follows, of course, because the process is not quite perfect; but experience shows us that it is just this last little objection to a manufacturing process which it is most hopeless to grapple with. A specially interesting portion

of Mr. Fletcher's report, in the estimation of many, will be that in which he discusses the question whether workers in sulphate factories are or are not exempt from attacks of epidemic influenza. It appears from statistics that there is something in the popular belief that men employed in this department of chemical industry are to some extent protected from this insidious malady; but it is always difficult to find exact figures capable of proving the reality of impressions of this kind. If, as is stated to be the case in some quarters, it is still doubtful whether there is anything in vaccination as a prophylactic against small-pox, how can the few statistics which Mr. Fletcher has been able to put together prove anything about the incompatibility between the influenza microbe, or whatever it is, and the air of a sulphate of ammonia factory? At all events, it is good to be assured that sulphate works do not increase the risk of influenza to workmen and dwellers in their vicinity; for so much has at different times been said and written against these factories, that, if Mr. Fletcher's evidence had pointed in a direction contrary to the result which he is able to draw from it, there would have been some danger of their being swept from the face of the land during some spasm of public nervousness.

A Repulse for the Socialistic Labour Party.

THERE will be little else talked about in this country for the next month or so but the General Election, the chances and changes of which will more or less affect every interest and individual in the community. For the time being, we are more particularly inclined to watch the proceedings of the Socialistic Labour Party, who are just now very busily and blatantly asserting their claim to the power of controlling the balance of the election in upwards of a hundred constituencies. Seeing that the result of a general parliamentary election in Great Britain depends upon the way in which a very small proportion of the electorate, computed to be not more than 5 per cent., choose to cast their votes, there is, on the face of it, some arithmetical justification for this boast. The party which can attract to itself this shifting proportion of voters must win. If one might judge by the noise they make, the Socialistic Labour group should constitute at least 5 per cent. of the electorate in many constituencies, and should therefore be able to turn a number of contested elections. The same claim might be made with exactly equal and similar justification, however, for numerous other well-defined groups of the voting community, with the necessary consequence that these independent sections of voters commonly neutralize one another; so that it is impossible for party managers to reckon with confidence upon winning through the support of any one of them. Hence the perplexity of the Socialist Labour leaders, who at one minute proclaim confidence in the effect of their mass meetings, and the next are made to feel that there is absolutely no real guarantee that the voting power which they are able to direct, after a fashion, will have the desired influence at the polls. These reflections strike one with peculiar force upon reading the newspaper reports of the recent remarkable interview between Mr. Gladstone and the leaders of the Socialistic Labour Party, when the latter desired to strike a bargain with the veteran statesman for the inclusion of the eight-hour demand in the Liberal programme, in return for their general support at the approaching elections. When he was first approached upon this point, as we know, Mr. Gladstone refused to even discuss the matter. Being constrained to think better of such a very uncompromising attitude, however, for reasons into which it is unnecessary here to go, Mr. Gladstone so far yielded as to receive a deputation from the London Trades Council, but the result left matters precisely where they were before. It is now as certain as anything connected with current politics can be, that the Eight-Hour Day men will have to deal as best they can with individual candidates for seats in the new Parliament. This of itself is tantamount to a defeat; for it leaves the candidates free to rely for their defence upon those insurmountable difficulties of detail of which nothing would have been said for a while, if the chiefs of either of the great parties had sanctioned the vague idea that the limitation of the hours of adult labour by legislation might be regarded as a point of modern statesmanship. Perhaps after the General Election we shall hear less about the Eight-Hour Legal Day than we have done of late, when it

was at least "on the cards" that the propounders of the craze might find bidders for political support amenable to such offers as they were able to make.

Mr. G. Livesey's Evidence before the Labour Commission.—In the third line of the remarks appended to the table accompanying Mr. G. Livesey's evidence before the Labour Commission, as given in the JOURNAL last week, it should have been stated that the week's holiday with double pay after three years' service, granted to the South Metropolitan Gas Company's workmen in 1872, has been continued down to the present time.

The Automatic Gas-Meter Company, Limited.—By an advertisement which appears elsewhere, our readers will see that a Company has been formed, under the above title, to purchase and work the English patents of Messrs. Thorp, Marsh, and Haynes, relating to patent automatic attachments for application to ordinary gas-meters, to enable consumers to obtain gas in small quantities by the prepayment of a coin. The attachments are suitable alike for both wet and dry meters; and they can be affixed to any of the kinds now in use. We learn that meters constructed in accordance with the patents are giving entire satisfaction in Liverpool, where a number of them have stood the test of more than a year's work. The capital of the Company is £50,000, in £5 shares; the present issue being £20,000. The purchase price of the several patentees' interests is £10,000, payable half in cash and half in shares, or the whole in cash, at the option of the Directors. The subscription list will open to-morrow, and close on the 28th inst.

The Late Mr. G. Shepard Page.—In the course of his Inaugural Address at the meeting of The Gas Institute last week, the President alluded to the late Mr. George Shepard Page, whose sudden death on the 26th of March was recorded in the JOURNAL at the time. In connection with Mr. Valon's remarks, a few particulars as to the career of the deceased, taken from the *American Gaslight Journal*, may not be uninteresting. Mr. Page was born at Readfield (Me.), in 1839; and at the age of eight he was taken by his parents to Chelsea (Mass.), where his father had started works for the distillation of paraffin. In the High School of that town he received his education; graduating there about the year 1857. Subsequently he joined his father in the special industry in which he was engaged, and which rapidly assumed importance. Mr. Page, however, turned his attention to the treatment on a large scale of the tar produced in gas-works; and to this end he went to New York about the year 1860, and established himself in this business. At the close of the War he was a member of the firm of Messrs. Page, Kidder, and Fletcher, which was afterwards converted into a joint-stock undertaking, having the title of the New York Chemical Company. On the occasion of a visit to Europe about twelve years ago, he was much impressed with the practice prevailing here of treating ammoniacal liquor; and he was successful in inducing American gas managers to take up the work. The result has been specially valuable to the gas industry. The late Mr. Page was a member of the American, Western, and Ohio Gas Associations, and also an associate of The Gas Institute.

A New Sand-Washing Apparatus.—In the first number of the JOURNAL for the present year we noticed the sand washing and elevating machine devised by Mr. Greenway, and constructed by Messrs. J. Gibb and Co., of Fenchurch Street. An appliance having a similar object has been brought out by Messrs. Hunter, Fraser, and Goodman, and has been put in operation at the Kew Bridge works of the Grand Junction Water Company, under the supervision of the Engineer (Mr. A. Fraser, M.Inst.C.E.). The new apparatus consists of a receiver, which is placed at the level of the filter-bed, and into which the sand is tipped from barrows. From the receiver the sand, mixed with water, is carried up a tube to the first of a series of hoppers on the bank of the filter-bed by means of an injector supplied with water. The hoppers are of cast iron, and are placed about 7 feet apart. Each hopper is 2ft. 4in. square, and 2ft. 2in. high over all, and is provided with a jet-pipe connected with a main carrying water under pressure, and regulated by a valve. When in operation, the water is turned on, and issues through each jet—forcing water up the delivery-pipes into the hopper; the valves being so regulated as to give a uniform overflow at each hopper. The dirty sand is delivered into the first hopper of the series, and, gravitating to the bottom, is carried forward in a mixed stream of water and sand into the next hopper. This process is repeated in each hopper until the last in the series is reached, which discharges the clean sand into a truck on the filter-bed for relaying there or at any other point where it is wished to deliver it. The dirt is thoroughly separated from the sand, and passes away from the hopper with the overflow water. With a moderate consumption of water, two men can wash and screen 3 cubic yards of sand per hour, no matter how dirty the sand may be. There are two sets of the apparatus at the Kew works, where they have been in satisfactory use for the last six months. One set cleans the whole of the sand of a filter-bed nearly 2 acres in area; while another set is at work cleaning the surface sand of a filter-bed $\frac{3}{4}$ acre in extent. Mr. Fraser states that under the old system the thorough cleansing of the sand of the larger bed cost about £2000; while by the new system it is more quickly effected for about £1000.

WATER AND SANITARY AFFAIRS.

ON resuming their sittings at the commencement of last week, the Metropolitan Water Supply Commissioners plunged into a sea of statistics, with very little prospect of achieving any great practical result. Mr. Binnie, the Chief Engineer of the London County Council, went so far as to say that all the returns made to the Water Examiner by the Companies had been "knowingly incorrect." The President of the Commission very properly interposed with the remark that it was quite likely there might be some misunderstanding in regard to the particulars; but his Lordship signified that the Commissioners desired, if possible, to conduct the inquiry "without any allegations of knowingly false returns." Unless Mr. Binnie exempted the East London Water Company from his censure, it is difficult to understand his subsequent allusion to "his friend Mr. Bryan," who, as the Company's Engineer, would be directly responsible for the return made concerning the quantity of water pumped. With regard to the population, no doubt there is some degree of difficulty in getting an absolutely correct estimate. In the returns made to the Registrar-General by the Water Companies, instead of announcing the "Number of houses, &c., supplied," we now read "Number of services." Of course "houses" may form the basis for estimating the population; but "services" and "houses" may not be quite synonymous. If the Companies have over-estimated the supply, so also they may have over-estimated the population. In the year 1890 they only credited themselves with giving an average daily supply of about 31 gallons per head. Mr. Binnie reckons that they must be supplying more than this. If so, we do not see that it redounds to their discredit. Mr. Binnie is sceptical. With regard to the abstraction of a certain quantity of water from the Thames by the Companies "under agreement," he signified that he was not prepared to believe in the existence of such an agreement until it was produced. The President happily settled this point by saying "the Commission had been furnished with a copy." Mr. Binnie thereupon proceeded to quarrel with the agreement, as giving the Companies power to draw more water than their several Acts of Parliament allowed. On this subject some interesting evidence was afterwards given by Mr. J. H. Gough, the Secretary to the Thames Conservancy; showing, among other particulars, that the Companies were more free than might be supposed, and the Conservators were not restrained in any way by their own Acts from granting an additional supply of water. As the water was wanted, unprejudiced persons will admit that it was well it should be supplied; and the Conservators might be trusted to guard the river from being immoderately drawn upon.

Three half-yearly meetings were held among the London Water Companies last week. In all cases the speeches from the chair were hopeful in tone; confidence being expressed as to the result which might be expected from the inquiry in progress by the Royal Commission. There was also an assurance that Parliament would give the Companies fair terms in any transfer that might take place. The purchase of the Accrington undertaking (noticed in another column) was referred to as a case in which an equitable price had been obtained. At the Grand Junction meeting, the final relinquishment of the Dorney scheme was announced. The history of that affair says little for the wisdom of the House of Commons, which rejected a valuable project without condescending to inquire into its merits. At the Chelsea meeting, Sir W. H. Wyatt congratulated his hearers on the refusal of Parliament to constitute the County Council the Water Authority for the Metropolis. Sir H. E. Knight, at the meeting of the Southwark and Vauxhall Company, in referring to the Royal Commission, evidently had Mr. Binnie in mind, when claiming for the advisers and officials of the Water Companies a more intimate acquaintance with the facts involved in the inquiry than could be arrived at by outsiders, who simply picked up their information from published statistics. Coupled with these encouraging speeches, there was the declaration of satisfactory dividends. The Companies are in full vigour, despite all the attacks that have been made upon them, and are quite prepared to let their case stand upon its merits.

Sir William Harcourt appears anxious to escape the responsibility of having been the chief actor in bringing about the rejection of the Metropolis Water-Works Purchase Bill of 1880. It was not he who did the deed, it was the Corporation of London and the Metropolitan Board; and he charges Mr. A. J. Balfour with "absolute ignorance" in regard to this very matter for having said: "I am a member of the party which attempted, twelve years ago, to give the water supply to London, but was foiled by the machinations of Sir William Harcourt." In a letter sent to Mr. Causton, M.P., on Thursday last, Sir W. Harcourt argues that the terms of purchase proposed by Sir Richard Cross were absolutely and decisively condemned by the Select Committee appointed to inquire into the subject. Of that Committee Sir W. Harcourt was Chairman; and if Mr. E. J. Smith, who negotiated the terms of purchase, were alive, he would be in a position to say something respecting the kind of treatment which he, as the leading witness in support of the scheme, received from the Chairman. Of the determined opposition of Sir William to the provisional agreements which had been entered into, there can be no doubt. The spirit of the most vehement partisanship appeared to govern all his proceedings with respect to this matter; and the same feeling is displayed in the letter to Mr. Causton. We are told of "the reckless and ruinous agreements" which Sir Richard Cross had contracted; and it is asserted that the stipulated payments "would have entailed a heavy loss on the London ratepayers." Perhaps it will not be amiss to refer to a parliamentary return issued in 1885, in which Mr. Allen Stoneham, the Government Auditor, shows that, down to the close of 1884, the excess of earnings by the Companies over the annual interest allowed to them by Mr. Smith was close upon £100,000, in addition to which the balances of cash which were to have been handed over by the Companies amounted to about £300,000. This, again, was independent of any saving in working expenses which would have been effected by the abolition of Directors, the consolidation of the staff, and the more economical disposition of engine power. There can be no doubt that party tactics had much to do with the opposition raised against the scheme. Since that period a calmer judgment has been exercised, and a growing conviction has arisen that in 1880 a grand opportunity was lost for placing the water supply in charge of a public trust. A significant passage in Sir W. Harcourt's present manifesto is that where he says that the possession of authority for the introduction of an independent water supply "is indispensable to dealing with the Companies on reasonable terms." In like manner we find the *Pall Mall Gazette* saying, in reference to the provisions retained in the London Water Bill: "The duty of preparing a scheme for the supply of water to the Metropolis is now thrown upon the London County Council." But what if the Royal Commissioners report by-and-bye that no such scheme is necessary?

Received.—"Everybody's Pocket Cyclopædia" (Saxon and Co., 23, Bouverie Street, E.C.); a useful little collection of "things worth knowing and difficult to remember," which has reached its 510th thousand. Mr. T. Fletcher, F.C.S., has forwarded to us a copy of the fourth edition of his "Coal Gas as a Fuel - A Concise Guide to Fitters and Users." The size of the book has been reduced, so as to allow of its being carried in the pocket.

A Memento of Murdoch.—A few weeks ago we noticed at some length the interesting sketch of the life of William Murdoch which his grandson, Mr. A. Murdoch, of Pollokshields, has published in view of the approaching celebration of the centenary of gas lighting by the North British Association of Gas Managers. A memento of the early days of the industry which Murdoch did so much to create has just come to hand in the shape of a *fac-simile* reprint of a letter he addressed to a Member of Parliament, in vindication of his character and claims, in reply to a publication by the Committee who were conducting through Parliament a Bill for incorporating The Gaslight and Coke Company. Murdoch, it seems, was particularly annoyed at an insinuation that he had been anticipated by one Diller, a Dutch or a German chemist, of whom he had never heard; and he presented a petition against the Bill. He was represented before the Committee by no less a person than Brougham; though he did not, as is generally supposed, give evidence. The Bill was rejected; but another received the Royal Assent in the next session. The letter, which is dated May 4, 1809, is accompanied by a prefatory note by Mr. R. B. Prosser, of 75, Dartmouth Park Road, N.W., to whose enterprise the interesting reprint is due.

THE INCORPORATED GAS INSTITUTE.

PROCEEDINGS AT THE TWENTY-NINTH ANNUAL GENERAL MEETING,

HELD AT THE

INSTITUTION OF CIVIL ENGINEERS, JUNE 14, 15, & 16, 1892.

Mr. W. A. VALON, Assoc.M.Inst.C.E., President.

REVIEW OF PROCEEDINGS.

ALTHOUGH the hour of opening the annual meeting of the Incorporated Gas Institute had been considerably fixed for eleven a.m. on Tuesday last, there was a by no means large attendance of members in the lecture theatre of the Institution of Civil Engineers when, punctual to the minute, Mr. W. A. Valon, of Ramsgate and London, the President for the year, took the chair, and, with praiseworthy despatch, entered at once upon the business of the meeting. The intelligence of the President's arrival, however, quickly permeated through the building and its precincts; and the hall soon showed the full strength of a gathering that, albeit not perhaps among the largest in the history of the Institute, afterwards proved to be one of the most regular in its attendances for the transaction of business.

Mr. Valon was well received; and the meeting soon gave it to be understood that the Chair would be supported in clearing the programme with celerity and good humour. During the pause which, as usual, accentuated the sacrifice of a couple of members in the cause of the scrutineership of the voting-papers, the first "incident" of the meeting occurred in the appearance of Mr. William Carr, late of Johannesburg and some time of Halifax, whose entry was greeted with a welcome that to its subject must have made some amends for a great deal of unpleasant experience of the ways of men and the high-ways of the world.

The reading of the report of the Council by the Secretary (Mr. W. H. Harvey, B.A.) did not call forth any comment, although by this time it must have been borne in upon members that, in order to preserve the Institute in its present position, to say nothing about any expansion of its work in the future, a tight hand will have to be kept upon the revenue. It is well to be able to remark that the mention made in the report of the late Secretary, Mr. W. H. Bennett, was sympathetically greeted. In moving the adoption of the report, the President made a full statement relative to the part taken by the Council, in the name of the Institute, in bringing certain views of subjects connected with the photometry of gas before the Board of Trade Committee on Standards of Light. This matter was afterwards dealt with again; but it will be convenient to conclude our references to it here. It appears that the Council of the Institute have been laudably anxious to do as much as lay in their power to deprecate any action by the Committee that might prejudicially affect the gas industry throughout the country. They have recognized as inevitable not only the disestablishment of the candle as the legal standard for gas testing, but also its substitution by a pentane standard; and while willing, in agreement with the Incorporated Institution of Gas Engineers, to accept a pentane representation of the old candle unit, or some convenient multiple thereof, as satisfactory to the interests which they represent, they are reluctant to consent to any other radical alteration of the methods by which the photometry of gas has hitherto been carried out. The position of the individual members of the Committee of the Council who have had this particular matter in hand was fairly explained on Thursday morning, when an opportunity was afforded to the meeting, by the kindness of Mr. Sugg, of seeing a 10-candle pentane-air standard flame, and of following the considerations that have resulted in the suggestion of this method of applying the principle of Mr. Vernon Harcourt's proposed substitute for candles. No discussion of the action of the Committee of the Council was taken—the business being treated as still in committee; but the members present enjoyed the privilege of being

made better acquainted with the uses and advantages of pentane than could have been done in any other way.

After this semi-confidential business had been disposed of for the time being on Tuesday, the satisfactory intimation was made that the Royal Commission on Labour had accorded permission for the inclusion of the statement relative to the condition of labour in the gas industry, which had been submitted to the Commission by the President (as reported in the JOURNAL a fortnight ago) in the printed Transactions of the Institute for this year. This is an important concession, and one that should result in great good to the industry at large. It cannot be denied that some of Mr. Valon's returns showed the existence in some parts of the Kingdom of room for considerable improvement in the conditions of gas workers; and it is undesirable that the good reputation of the best class of gas-works should suffer from the unfavourable and backward state of others in this regard.

Then came the presentation of the Birmingham Medal to Dr. Perkin, the discoverer of the colouring principle in coal-tar derivatives. The President made the presentation with a graceful speech, briefly recounting the nature of Dr. Perkin's splendid services to modern material civilization; and he followed up this historic incident in the record of the Institute by similarly bestowing the President's Medal for 1891 upon Professor Vivian B. Lewes, F.I.C., F.C.S., who thus, in the most favourable circumstances, made his first appearance at a meeting which before its close was destined to become better acquainted with the new Chief Gas Examiner for the City of London, and to recognize in him one of the most powerful of living agents for the advancement of precise knowledge in the science with which the members are closely identified.

Having thus cleared away all the preliminary work, the President rose at 11.35 to perform his chief public duty to the Institute by reading his Inaugural Address, the text of which we gave in last week's JOURNAL.

The address began with the usual references to the report of the Council, for the purpose of mentioning once more, in the ears of the assembly which knew their forms in the flesh, the names of those once prominent members and friends of the Institute who have "joined the majority" since the last meeting. From this imperative but mournful courtesy to the departed, the President passed to a very lively subject indeed—the Chicago Exhibition of next year; and he took the opportunity of notifying his intention of attending this great industrial gathering on the shore of Lake Michigan. As Mr. Valon remarked, the official representative for exhibition purposes of the gas industry of the United States—Mr. Alex. C. Humphreys—and his colleagues, will be only too pleased to welcome to Chicago any British gas engineers who can make the pilgrimage; and whoever does so will doubtless return with a mind broadened and deepened by the fresh knowledge of men and things which is the peculiar fruit of travel. At the same time it is only right to state, with regard to some of Mr. Valon's observations relating to the part which the American gas industry may be expected to play at the Exhibition, that it is by no means certain as yet that Mr. Humphreys' "Gas Industry Council" will be able to carry out their programme. Their appeal for funds to build a "gas house" and to make a respectable showing for the national gas industry has not been very successful up to the present. Consequently, it will not be surprising if they leave the industry to shift for itself.

Proceeding to discuss the regular presidential topic of the general progress of gas manufacture and utilization, Mr. Valon wisely insisted upon the truth that in an established industry, such as that of gas supply, it is the aggregate of small improvements that constitutes real progress. While it is true in one sense that coal gas is made in much the same way to-day as fifty years ago, it is equally true that a modern gas-works is a factory differing in almost every particular—of design, scale, construction, administration, and working—from anything that went by the same name during the early years of Her Majesty's reign. We have often remarked upon the difficulty of formulating in precise phrases the nature and extent of the improvements in gas manufacture which mark the passing of successive years; and perhaps, for all its vagueness, the test, suggested in the address, of the "feeling that from time to time advancement has been surely made," is as good a guide as we can have.

Descending from the general to the particular, the

President went on to express his views respecting the employment of labour-saving machinery in gas-works. He laid down, in the most uncompromising fashion, the principle that machines for working horizontal retorts, albeit not yet perfect, are now good enough for every gas manager to make use of to the full extent of his needs and opportunities; and he declared that the engineer who neglects to take advantage of this class of machinery incurs a heavy and needless responsibility. As for the revived fashion of sloping retorts, suffice it to say that Mr. Valon regards their advantage as "not proven." With respect to the other retort-house matters dealt with in the address, it appears that the President includes gaseous firing, self-sealing lids, screened foul mains, and liquor seal for the dip-pipes, as contributories to the general advancement of carbonizing practice which has been effected during the last decade or so. Mr. Valon's interest in retort-furnace construction is well known; and it would have been more than human in him if he had refrained from all mention of the success of the style of gas-generator design with which his name is so closely identified. To do him justice, however, he made no vaunt of this, but took the occasion to enunciate some guiding principles for economical furnace arrangement which have been deduced from his own experiences.

Leaving carbonization and treating of purification, Mr. Valon insisted upon the importance of proper treatment of gas before it leaves the washer. He pointed out that while the tar should be removed as quickly as possible from the crude gas, its temperature should be lowered slowly. He also laid great stress upon the necessity of avoiding overwashing the gas, and showed the desirability of allowing it to retain a little ammonia up to its entry into the purifiers. As to purification, the President declared that there are only two systems (by which, of course, he meant good systems, really worth talking about) in the field—one being the Claus ammonia process, and the other the oxygen method of working dry boxes continuously. Some perusers of the address will say that this is a very sweeping way of stating the case. Neither is it quite correct to characterize the use of air in purifier working as an "offshoot" of the pure oxygen method. It would have been more accurate, as well as more conciliatory of objectors and disbelievers who are still a majority, if Mr. Valon had described the oxygen process, which owes so much to himself, as a refinement upon the older air process, and also an improvement in respect of efficiency and economy. For all that Mr. Valon can say, it is certain that only a small fraction of the coal gas made in the United Kingdom (to leave the rest of the world out of the count) is as yet purified by the help of pure oxygen. It may be true, as he would contend, that the misguided individuals who prefer to jog along with 1 per cent or so of air, or with none at all, instead of using oxygen, are guilty of the blunder of making shift with a poor device when they could have a better for the asking. But while they exist in such respectable (if not overwhelming) numbers, they must be reasoned with patiently and gently, if they are to be convinced of the error of their ways. Mr. Valon is of opinion that the apparent cheapness of the air system is illusory, inasmuch as it has to be paid for by a diminished illuminating power. This is true, so far as it goes. Fortunately, or unfortunately, according to the side from which the view is taken, the truth under consideration does not possess the same monetary value everywhere. We do not speak now of prejudice and obstinacy, which only too often resist the entry of true teaching from an unwelcome source. The point is this: Where every grain of sperm in the gas is precious, as it is with the London Gas Companies, or any other makers tested daily up to the extreme illuminating power of the coal at their command, it would be a piece of idiocy to admit even the 1 per cent. of air which would be necessary to do the slightest good with the air process. Where, however, the standard illuminating power required is only 14 candles, whereas the coal used is capable of yielding gas of 15½ candle power, or even more when the carbonic acid is taken care of, it becomes a question with the manager whether he might not just as well sacrifice the extra half candle, and take in as much air as he wants, as lay down oxygen plant. And the residual nitrogen goes through the meters with the rest. We are not pronouncing any opinion upon the controversy between the partisans of the air and oxygen processes of gas purification. Time will

show who is right in these matters; and, in the meanwhile, there cannot be too much discussion respecting the points at issue.

The address next dealt with the disposal of coke, and the influence of smokeless fuel upon the air of towns. Mr. John Aitken's researches upon atmospheric dust were alluded to; and it seemed to be the President's object, in this portion of his oration, to remind his hearers that, while the burning of coke and gaseous fuel in towns afflicted with fogs might be expected to relieve the blackness of these visitations, this expedient would not prevent their formation. It is by no means universally agreed, however, that the sulphur resulting from the combustion of coal, coke, and gas is, as observed in the address, of real anti-septic value. What Mr. Valon had to say about gas-burners was very brief. He remarked of the regenerative principle in this connection that it has done all, or nearly all, that can be expected of it; and he looks to the incandescent principle as offering greater possibilities of improvement in developing the luminous value of gas.

The President evidently intended his references to the question of oil gas, &c., to be a leading feature of his address. Presumably on account of not having himself been able to experiment exhaustively upon water gas and the gasification of oil, Mr. Valon has sounded several American authorities on the subject. It is not to be supposed that Mr. A. C. Humphreys told him all the secret of the extended use of water gas in the United States, which is largely due to artificial causes. But whether he obtained his information from this or from other sources, it is clear that the President has formed a very positive opinion as to the system by which oil gas can best be made in this country, if it is to be made at all. After all, however, the Gas Engineer of the Ramsgate Corporation speaks mainly as a representative of the class of gas managers for whom carburetting methods have only a theoretical interest.

Another, and indeed *the* leading feature of the address, was the President's account of the work undertaken by himself and the Secretary for the Royal Commission on Labour. We have so recently commented upon the evidence tendered before the Commission by Mr. Valon, that it is unnecessary to follow him again through the second edition of the same material which he laid before the members of The Gas Institute. Neither before the Commission nor the Institute did Mr. Valon freely speak his mind respecting all the facts of employment in gas-works elicited by his circular inquiries. Reading between the lines of the presidential remarks upon certain of the returns to his questions, we incline to think that he would like, if he could do so, to recommend to the management of factories that are below the average to "close up" before a worse thing happens to them. When we hear of yard labourers and mechanics working 72 and 84 hours per week, and stokers working up to 90 hours per week, it is enough to explain the vitality of some branches of the Gas Workers' Union. We say here deliberately that if this Union had only attended to these benighted places, instead of wasting its strength in impotent enmity to the most enlightened employers of the age, we should have wished it every success.

Lastly, the President uttered a timely and vigorous protest against the miserable and ruinous way in which some controllers of gas undertakings cut down the standard of remuneration for the discharge of the duties of gas management, and so do their best to drive honest, capable, self-respecting men out of the profession. It is quite true that some gas directors and committees of local authorities expect all the virtues and talents in a gas manager, for a recompense at which a keeper of a beershop would turn up his nose. Of course, they must suffer in the long run; but they have not the wisdom to see this. "Penny wise and pound foolish" is the way with these people; and so it will be to the end of the chapter. Well, since there is no evil without some compensating good, so in this regard, the small remainder of capable men who happen to be appreciated according to their deserts will reap a fine harvest of fees for setting right the blunders of the "cheap-and-nasty" class; and the consumer and the ratepayer will pay for all, and be none the wiser.

The address was particularly well received. Couched throughout in a style which made no pretension to oratorical effect, every sentence it contained was well within the comprehension of the whole audience, who followed

the speaker throughout with that attention which is more gratifying than bursts of applause—which, however, came without stint at its close. It cannot be said that Mr. Valon earned his triumph by seeking to be popular and pleasing at all costs; indeed, he said a good deal that would doubtless have been sharply criticized in the writer of a paper. But his remarks were sincere, and to the point. Long as the address was, it maintained its interest to the end, because it was instinct with individuality, and was absolutely devoid of padding. If we may still further summarize the presidential utterance, it must be to remark that the portions which seemed to make the most distinct impression during the delivery, and to call for more special study afterwards, were those relating to retort-house work, purification, and the position of men and officers in the gas industry. It cannot be gainsaid that the address was a conspicuous and deserved success. And here we would also say that, if Mr. Valon proclaimed his personality with much force in his address, he effaced himself with rare self-denial afterwards; for not in commenting upon any of the papers did he indulge in those official criticisms of an encyclopædic cast to which some occupants of presidential chairs are prone. He did not, in short, assume the professor; but was content to be the businesslike president.

We shall not now attempt to criticize the papers read at the meeting. Suffice it to acknowledge fully and freely that, with small exception, they were all of a good and even of a high class. The meeting was characterized by exemplary industry; and never in the history of the Institute have the morning and afternoon attendances for the three days of solid work been better maintained.

The second day was, to all intents and purposes, a time of triumph for Professor Lewes, whose Murdoch Lecture fairly carried away the meeting, which had had no previous experience of Professor Lewes's masterly style of exposition. Given without a note and without a pause, and illustrated with experiments and diagrams as suggestive as they were informing, the Murdoch Lecture enhanced the brilliant reputation that Professor Lewes gained by his Cantor Lectures. It is unnecessary to say more.

Wednesday night was marked by a most successful Presidential Reception of members and friends of the Institute at the Westminster Town Hall. To Mr. Valon's hospitality the Institute owes one of the most enjoyable social "functions" recorded in its history; and he has the gratification of knowing that his generous effort to add to the pleasure as well as to organize the instruction of the meeting of 1892 was appreciated as fully as it deserved. It would be idle to attempt to conceal the fact that Mr. Valon had set himself the by no means easy task of rehabilitating the Institute in a position which circumstances had made difficult, almost to hopelessness, of re-attainment. But all that infinite pains, unstinted labour, and unobtrusive liberality could do towards affecting this end, was ungrudgingly given by Mr. Valon; and the fitting reward was not withheld. After all that it has gone through, it would indeed be churlish to deny to the last two Presidents of the Institute—Mr. Hepworth and Mr. Valon—an unstinted meed of praise for the public spirit which both have manifested in doing what they conceived to be their duty to the colleagues who put them in the position where they came under the responsibility of saving for good an organization which, we do not hesitate to say, would in any other available hands have been irretrievably lost. Much yet remains to be done before the Institute can be regarded as relieved from all danger; and the record of the latest Presidents will not be without the drawback, inherent in exceptional performance, of throwing a heavy burden on future incumbents of the presidential office. But, bearing in mind the deplorable consequences that personal errors have entailed upon the Institute in the past, we cannot conscientiously refrain from bearing testimony to the good effect of meritorious conduct in its service in the contemporary period which dawned, let us say, at Carlisle, and has culminated in this London gathering.

Thursday, also, was a day of good record, thanks principally to Mr. A. T. Walmisley, who showed what trained engineering and mathematical aptitude can do for the elucidation of some problems of gas-works construction, and whose contribution to the literature of the meeting was a worthy pendant to that of the previous day's doings. We have already mentioned Mr. Sugg's interest-

ing demonstration of the capabilities of pentane for the production of an acceptable photometric standard. To Mr. B. H. Thwaite, also, should be awarded well-deserved praise for an exhibition and description of the most modern improvements in calorimetry and pyrometry.

The election of Mr. Denny Lane as President, and the selection of Belfast as the place of meeting for next year, were very popular. The announcement that Mr. Hepworth would be retained for the service of the Institute, by virtue of his acceptance of the office of Honorary Secretary, was received with enthusiastic approval, as well it might be. It is the very best thing that could have happened for the Institute. The day closed with a visit to the Goswell Road distributing station of The Gaslight and Coke Company, under the direction of Mr. G. F. L. Foulger, newly elected a member of the Council. And so the business portion of the 1892 meeting of The Gas Institute concluded, to the general satisfaction, which was well expressed by the veteran Mr. George Anderson, who, indeed, went to the length of declaring it to have been the most successful in its history. Even if something must be taken off from this statement, to allow for the perfervid *ingenium Scotorum* of the speaker, the response which it evoked showed that it very fairly represented the opinion of the meeting.

The excursion to Windsor and the Upper Thames on Friday was extremely popular, and was completely carried out according to the arrangements made by Mr. Harvey, the painstaking Secretary.

REPORT OF PROCEEDINGS.

The Twenty-ninth Annual General Meeting of The Gas Institute was held on Tuesday, Wednesday, and Thursday of last week, at the Institution of Civil Engineers, Great George Street, Westminster, under the presidency of Mr. W. A. VALON, Assoc.M.Inst.C.E.

The minutes of the last annual meeting were taken as read.

APPOINTMENT OF SCRUTINEERS.

Mr. J. W. GLOVER (Chelsea) and Mr. J. WHYTE (Seaham Harbour) were appointed Scrutineers of the ballot papers.

ANNUAL REPORT—STANDARDS OF LIGHT.

The SECRETARY (Mr. W. H. Harvey, B.A.) then read the annual report of the Council, the principal portions of which were given in the JOURNAL last week.

The PRESIDENT, in moving the adoption of the report, said: There is another matter on which I ought to say a few words, in order to make the account of the year's work complete. It has occurred too recently to be referred to in the report now before the meeting; and therefore a few supplementary remarks are perhaps advisable and necessary. As you are all aware, a Committee on Photometric Standards, under the chairmanship of Dr. Odling, has lately been appointed by the Board of Trade, for the purpose of collecting evidence, and, I presume, of making recommendations, respecting that matter so important to the gas industry—the standards of light. On the 10th of May last, the Committee invited the Council of the Institute to select two or three representatives to appear before them on the 2nd of June; and they suggested that they should confer beforehand with three representatives of the Incorporated Institution of Gas Engineers, who were also to attend on that date, in order to decide on the form the recommendation should take. Although the notice given was very short, the importance of the matter was felt to be so great as to warrant a prompt effort being made to meet the wishes of the Committee. The views of the Council having been ascertained by circular, three of their members—Mr. John West (Vice-President), Mr. Norton H. Humphrys (ordinary member of the Council), and myself—were selected as representatives to confer with the representatives of the Incorporated Institution of Gas Engineers, and to appear before the Standards of Light Committee. On the 2nd of June, your Council's representatives met, and agreed upon the following two general resolutions:—

- (1) That the opinion be strongly impressed on the Committee on Photometric Standards that no standard will be acceptable to the gas industry generally unless based upon, and of the same relative value as, the existing parliamentary standard candle or unit of light.

- (2) The representatives of the Incorporated Gas Institute would also urge on the Committee the necessity that the present obligations on gas suppliers should in no respect be injuriously affected.

After passing these resolutions, a joint consultation of your Council's representatives and those of the Incorporated Institution of Gas Engineers was held; the representatives of the latter body being Mr. Charles Hunt (Birmingham), Mr. John Methven (Beckton), and Mr. R. O. Paterson (Cheltenham). The foregoing two resolutions passed by the Council's representatives were read and approved; and it was resolved to submit them to the Committee on behalf of both Institutions, together with the following more detailed recommendations:—

- (1) That attention be drawn to Mr. Methven's experiments, showing the influence of the hygrometric condition of the atmosphere on the pentane unit of light; corrections for that source of error appearing to be necessary to enable the pentane candle to be used for standardizing.
- (2) That air carburetted with pentane be used for testing purposes.
- (3) That a multiple of the standard candle equal to ten candles be produced for testing purposes by the application of a screen to an Argand burner; and that all tests be performed with an open bar photometer not less than 60 inches in length.
- (4) That the rate of consumption of the gas to be tested be adjusted as nearly as practicable to the maximum efficiency of the various standard burners.

The joint consultation then terminated. In the afternoon of the same day (June 2), the representatives of the Councils of the two Institutions appeared before the Committee on Photometric Standards at their meeting at No. 8, Richmond Terrace, Whitehall, and submitted the above resolutions and recommendations; expressing also the joint hope that, if possible, some information might be made public as to the work done and proposed to be done by the Committee. I may add that we could get no information from the Committee on the work they had already done *in camera*. We were anxious, if we could, to ascertain something of their views, so that we might be able to save their time and our own, and also as a guide to what we might say. However, no information was forthcoming. It is the intention of the Council, with the permission of the members, if time should permit on Thursday, to discuss the question of photometric standards; and we shall be very glad if those who have views of any kind, will be good enough to express them, so that they may be collected together and form a guide to the Council should any consultation take place in the future, and also be put on record, and be seen by those whom we are most anxious should become acquainted with them. I beg now formally to move the adoption of the report.

Mr. J. WEST (Manchester), in seconding the motion, said all would agree that good work had been done during the past year, especially by the President before the Royal Commission on Labour. No one knew the amount of work imposed upon him; and those who had read his evidence would agree that he had well represented the views of the Institute generally. Most valuable evidence was given; and the members would all be glad to learn that permission to publish it had now been granted, and that it would be embodied in the Transactions of the Institute.

The motion was put and carried unanimously.

The statement of accounts, which had been circulated amongst the members, was then formally presented; and, on the motion of the PRESIDENT, it was at once adopted.

THE BIRMINGHAM MEDAL.

The PRESIDENT next presented the Birmingham Medal to Dr. Perkin. In doing so, he said: Dr. Perkin, the gas industry, as well as the textile colouring world, owe to you a debt of gratitude which we, as the body representative of the former, wish to acknowledge, but cannot repay. Hence, I have the pleasure and honour, as President of this Institute, of conveying to you the Birmingham Gold Medal, which is the highest honour we have in our power to confer on any individual, however eminent. On the face of the medallion you will find stamped, among others, the representation of your own features. Your genius has furnished employment for thousands of workmen, as well as a remunerative outlet for millions of capital; and your discoveries have added to the beauty of our homes and the pleasure of our lives. Such a record needs no commendation but its own achievements. As the mouthpiece of this assembly, representing as it does the gas industry of the United Kingdom, I heartily congratulate you, and express

to you our earnest desires for many years' further satisfactory enjoyment of your well-earned reputation.

Dr. PERKIN, in reply, said: I have to thank you, Sir, very much for the kind remarks you have made, and for presenting me with the medal; and also the Institute for the honour they have done me in awarding the medal. I am very glad that my labours with reference to coal-tar colours have had some little influence on the development of the great industry which you represent.

PREMIUMS FOR PAPERS.

The PRESIDENT, in presenting the President's Medal to Professor Vivian B. Lewes, said: It is with great personal pleasure that I hand to you the President's Medal for the year 1891, for your excellent paper, read in your absence by the Secretary, last year at Carlisle, and further as a general acknowledgment of the original work you are doing in very intimate connection with what we are all interested in. You have already succeeded in making clear many points hitherto clouded in doubt; and we are all, during the course of this meeting, in expectation of hearing more from you. On behalf of the Institute, accept my congratulations, and allow me to express our strong desire that we may long have the benefit of your powerful intellect as an assistance in the elucidation of principles, and in furthering their proper practical application.

Professor LEWES, in response, said: Mr. President and Gentlemen,—I thank you very heartily for the great honour you have done me. My work, I can assure you, has been a labour of love; and I only hope that in the future I shall justify the honour you have bestowed upon me this morning.

Mr. A. T. Walmisley, to whom had been awarded the second premium, not being present,

The PRESIDENT presented the third prize to Mr. W. R. Chester, for his paper on "Bye-Products and their Utilization." In doing so, he said: The Council, I am sure, will only be endorsing the unanimous opinion of the members that some recognition should be given of the original way in which you dealt with your subject. Your general work is well before us all; and I find that you are now about to lay us under further obligation to your patience and industry by publishing what will be one of the most useful books of the day—viz., your "Bibliography of Coal Gas." I hope that your book will be well received, and your efforts be thus crowned with success; and that we shall have your presence amongst us to enlighten us further for many years to come.

Mr. CHESTER briefly returned thanks.

The PRESIDENT, in presenting the next premium to Mr. J. T. Ritson, of Jersey, for his paper on "The Disposal of Sulphate of Ammonia Locally," congratulated him on having treated, in an original and attractive manner, a subject on which many thought it was impossible to say anything new.

Mr. RITSON thanked the Council for the honour awarded him, and also for permitting him to reprint and publish the paper, which he was glad to say had proved very successful.

PRESIDENT'S ADDRESS.

The PRESIDENT then delivered his Inaugural Address, which was given in the JOURNAL last week (p. 1105).

Mr. J. HEPWORTH (Carlisle) proposed a vote of thanks to the President for his excellent address. It would, he said, be out of place to discuss it; but he could not refrain from remarking how excellently the President had focussed the leading questions of the day in connection with the gas industry, and how ably he had dealt with them. If Mr. Valon had expressed views which some members would be inclined, on further consideration, to controvert, he would be the last man to quarrel with them on that account; and he was certainly deserving of their warmest thanks.

Mr. G. ANDERSON (London) seconded the motion. He said he did not think those who had been in the habit of attending the meetings of the Institute for some years past would be of opinion that there was any sign of decadence in the President's address. It was eminently practical, and contained a great deal of information which would repay further study. He had evidently spent a great deal of time in investigating the more intricate parts of the profession, especially the purification of gas, which was not so well understood when the Institute was founded as it now was. Many years ago, he (Mr. Anderson) promulgated certain views which were then considered doubtful, but were now generally accepted, one of which

was the washing of gas, though he never went so far as to recommend using 50 gallons of water to a ton of coal. He thought 10 or 12 gallons might be used advantageously without detriment to the illuminating power of the gas.

The motion was put by Mr. Hepworth, and carried unanimously.

The PRESIDENT said if any efforts of his had been of value to the Institute, he was amply repaid for the trouble he had taken.

The meeting then adjourned for luncheon.

READING OF PAPERS.

On the resumption of the proceedings in the afternoon, the reading of papers was commenced, and was continued on the next and the succeeding day. They were taken in the following order:—

Tuesday.—(1) "Steam Applied as an Aid to the Revivification of Oxide of Iron *in Situ*." By F. G. DEXTER, of Winchester. (2) "Some Analyses and Lighting Values of English Coal Gas, made during the Year 1891." By W. FOSTER, M.A., Professor of Chemistry at the Middlesex Hospital.

Wednesday.—(3) "Difficulties in Tank Construction" [Second Paper]. By THOMAS NEWBIGGING, of Manchester. (4) "The Structural Capacity and Cost of Gas-Works." By W. R. CHESTER, of Nottingham. (5) "Notes on the Carburetting of Gases." By VIVIAN B. LEWES, F.I.C., F.C.S., Professor of Chemistry at the Royal Naval College, Greenwich.

Thursday.—(6) "The External Vertical Standards of Gasholder Framework." By A. T. WALMSLEY, M.Inst.C.E., of London. (7) "Cantilevers and Cantilever Gasholders." By W. GADD, of Manchester.

The first three papers, together with the Murdoch Memorial Lecture, by Professor Lewes, entitled "A Century of Work on the Development of Light from Coal Gas," will be found in another part of the JOURNAL to-day. The remainder, with the report of the discussions, will be given in subsequent issues.

On the re-assembling of the members on Thursday morning, the first business was a discussion on the question of

PHOTOMETRIC STANDARDS.

The PRESIDENT said Mr. Sugg had kindly brought some apparatus to illustrate a standard for testing the illuminating power of gas. It was very ingenious, and could be used away from a gasholder or illuminating power meter—a small steam-engine being used to drive a fan for sending the air through the pentane. After Mr. Sugg had given a description of the appliance, he should be glad for gentlemen present to express their opinions on the matter.

Mr. SUGG said the credit of the application of pentane air gas for the purpose of supplying a standard light belonged to Mr. Vernon Harcourt, one of the Metropolitan Gas Referees. Pentane was the fifth product of the distillation of petroleum, and was a very light volatile spirit—so light, in fact, that if any of it were placed in a cup or glass, the whole of it would immediately evaporate. Its great advantage was its being so volatile that it made very little difference whether the temperature was at freezing-point or at 50° or 60° Fahr. Of course, the temperature of the rooms in which the testing of gas was carried out was never down to freezing-point, or the meters would be frozen up, and the gas would not pass through them. Any temperature below 50°, therefore, need not be considered; and pentane was perfectly volatile at this temperature. The method first proposed by Mr. Vernon Harcourt was to make the gas by putting 3 cubic feet of air into a holder with 9 inches of pentane, which made about 4 cubic feet of the gas. The first thing that occurred to anyone was, Would the gas always be the same? If 9 inches of pentane were dropped into a gasholder, so that none was lost, practically there would be the same quality of gas every time. He tried pentane when it was first brought out ten years ago, and found that any ordinary workman could produce it always of about the same quality; so that a fairly regular quality might be relied upon when made by this method. Since then Mr. Dibdin, the Chemist to the late Metropolitan Board of Works, and now to the London County Council, found that if atmospheric air were passed over the surface of pentane, it would take up a certain quantity; and that practically

the same effect could be obtained as if the gas were made in a holder. At first sight, this appeared to be doubtful, because it might be said that, under different conditions of the atmosphere, different quantities would be taken up, and a richer or poorer gas be produced. This, no doubt, was so; but it was corrected in a very simple way, which really amounted to the same thing as if the gas were mixed in a holder. This gas was of very heavy specific gravity; and, when issuing from the burner, it would rather run out of the bottom of the glass than go up. The apparatus before the meeting, therefore consisted of a little steam-engine driving a small fan, which blew the air of the room through the carburetter, in going through which it passed over the surface in the spiral passage, so as to obtain a large surface contact, issued from the centre, and was then conveyed to the burner. Any difference in quality was regulated by turning the tap, so as to get the flame down to the height of 3 inches; and then practically always the same quality of gas was obtained. The height of the flame was due to the quantity of carbon in the gas. If, therefore, the flame were richer, the tap was turned down; if poorer, it was turned up. Thus there was always the same quality of gas with the same height of flame. Even if one did not get quite the same height, the screen cut off the top, and gave the same illuminating power; because if the flame were turned higher, the quantity of air supplied would not be sufficient for perfect combustion, and the illuminating power would be reduced. In the same way, if the flame were not turned up high enough, the illuminating power would be lowered. The value of the standard of light could not be altered except to diminish it—one could not increase it. Cutting off the flame at the top ensured getting the same amount of light from it. He hoped he had made it clear that passing air in this way over a carburetter amounted to the same thing as mixing the gas in a holder; and there was this advantage about it, that the air could be taken from the room without getting any extra moisture in it from the water in a gasholder. Then the question would at once occur, Would there be a possibility of any stratification of the gas in the holder, so that one part might contain gas of one illuminating power, and another part a different quality of gas? If the gas were left for three hours, it would undoubtedly become thoroughly mixed. But supposing even it were not so, and more pentane (the lighter) went to the top, and less to the bottom, this would be found out by the flame being lowered; and if this were done, one had only to turn up the cock so as to get it again to the height of 3 inches. So that practically with this apparatus, when the pentane fluid reached its proper level, from 0.9 to 1 cubic foot of air could be used for passing over the pentane to supply gas for the burner. As the material exhausted itself, there was a greater distance between the surface of the liquid in the top of the carburetter; and consequently the air did not come into so intimate contact with the pentane as at first. It therefore required more air—perhaps 3 cubic feet instead of 1 cubic foot; and yet the illuminating power of the flame would be still the same, because this would be compensated for by turning up the flame to the standard height. He had devised the apparatus to show the working of the process. Of course, with a blower like that before the meeting, the flame was not quite so steady as it would be if worked from a gasholder, or if a small holder were put between to keep the pressure perfectly steady. But the principal cause of the shaking of the flame which might be noticed was not so much the blower as the movement of the air in the room. There were, of course, a number of currents in a place like that in which they were assembled, which would not be found in the air of a photometer-room; and where the flame was perfectly steady, one could read off its height very exactly. He next wished to draw attention to a point which had been mentioned with regard to the facility with which so large a standard could be read on a photometer scale. It had been said that, with such a standard, the distance over which it could be moved to indicate a candle would be so small that one might move it over a candle or two without noticing it; but a little reflection would show that this was not so. He produced a 100-inch photometer scale to illustrate this point; and he pointed out that, if used with an 8-candle standard (so that 2 candles would represent 16-candle gas), the movement between 8 or 7 candles was about 1 inch. When they came to 10 candles, the distance would be

fully 1 inch for the rise of another candle. It became a little smaller between 12 and 13 candles. But the differences between 14, 15, and 16 candles were represented by divisions as wide as nearly $\frac{3}{4}$ inch, and more than $\frac{1}{2}$ inch; and one could not move the disc 0.1 inch without seeing it. So that 0.1 candle would easily be read off from such a bar. This disposed of the argument that a 10 or a 16 candle standard would be more difficult to read than the 2-candle standard. Mr. Harcourt's first proposition was that the candle should be represented by a flame very much like that of the ordinary standard candle; and when he first brought it out, he must by some means have been deceived in the calculation of the jet, because he had in use a 10-candle standard which was, as nearly as possible, the same as the one now shown, with the exception that the holes were larger. This was used with ordinary gas; and so long as it did not alter more than about a candle, the variations of the standard were so slight that they might be disregarded. He had used this for the last 15 years for the purpose of keeping standard candles in something like proper order, so that the materials should not be changed, and the illuminating power of the candles used by different gas companies should be as nearly as possible constant. It would be perfectly impossible to make candles absolutely identical; but if one had them as nearly as practicable the same, having similar materials and wicks, the amount of light per grain of spermaceti consumed was to all intents and purposes the same. He made use of this; and the application of the pentane to this burner, with the variation suited to the pentane air gas, had made the standard perfectly steady; and it did not require any correction at all for temperature or barometric pressure—it corrected itself. Professor Lewes, in his lecture, had set him (Mr. Sugg) thinking about the way in which that standard adjusted itself; and he confessed that he had had some difficulty in understanding it. When the temperature, for example, was high and the barometer low, there would, no doubt, be a difference in the quantity of gas issuing from the burner, because there would not be so much pressure on the top. But at the same time the oxygen of the atmosphere would be attenuated; and there would be less of it close to the burner—the blue would go up a little higher to correct it. This was how he supposed the burner had hitherto corrected itself. If they cast off the blue from the bottom, it did not correct itself, and did not give the same result—it was variable; but if they left the blue in, and cut off the top, they had a standard which was invariable. Multiples of this could now be made up from the 10 candles—in fact, they could make a 5, 10, 16, or up to a 30 candle standard. He did not understand that there would be any difficulty in making a 20 or a 30-candle Argand burner; it would have to be made in the same way. It might be noticed that there was a certain "bellying-out" of the flame. They had tried to make it straight; but, if this was done, it did not correct itself in the same way as the slightly bellied flame did. He would not attempt to give the reason for this, because really he did not know it. He had thought that it was owing to the way in which the oxygen reached the flame; but Professor Lewes had materially altered his (Mr. Sugg's) views with regard to some things which occurred in these standard burners. In looking over the recommendations sent to the Committee on Photometric Standards, he noticed that the first was that the standard should be based on, and be of the same value as, the existing parliamentary standard. There had been some considerable discussion about this matter; and it had been suggested that the candles had deteriorated, so that they gave less light per grain of spermaceti than they ought to do. But he could state distinctly that this was not the case. He could prove that the candles had not altered by the standard with which he had always been accustomed to work. The number of strands in the wick had not been changed, neither had the admixture of wax with the spermaceti; and he believed they remained exactly the same as they were in 1881. The difficulty to be surmounted, which he thought had now been accomplished, was to know what a parliamentary candle was. Taking the unit of light as Mr. Harcourt's one candle, it was evident, from the beginning, that this was more than a candle; but how much more, was not perhaps exactly known. It was certainly within 0.05 or 0.06 more than a candle. He believed a decision had been arrived at by

splitting the difference, and it was now reckoned as 0.25 of a candle; and the unit had been reduced, so that the light now shown had been standardized accordingly. It was not very far out; but it might be slightly different to what it would be when standardized. Another recommendation was that all tests should be made upon an open bar photometer of not less than 60 inches in length. He thought it would be better, if an open bar photometer were used, that the room in which it was placed should also be defined; because it was quite clear that there was a chance of the reflection of the gas getting on to the ceiling or on to the wall, and coming back again, which must help the candle. This he knew was so in some instances; because they had recently met with a case where two instruments, standardized by the Standards Departments of the Board of Trade, did not give exactly the same result—one being fixed in one room, and the other in another room. Both instruments were precisely alike, and when put together in one room, they gave exactly the same result. He had prepared the apparatus roughly, in order that he might test it by the standard of light, so that they might find a difference between the two photometers, and ascertain the cause. He only mentioned this incidentally, because some experiments which had been made had led to the retardation of the adoption of this system. He believed they had been made with an open photometer, and did not always give exactly the same results. If it were properly screened, so that the shadows did not fall on the disc at any point, they would produce the same effects as a closed photometer.

The PRESIDENT said the members were much obliged to Mr. Sugg for the very clear and lucid manner in which he had introduced the subject.

Mr. N. H. HUMPHRYS (Salisbury) said, as one of the representatives who waited on the Committee on Photometric Standards, he thought it only right to explain to the members of the Institute the position in which they stood. They were invited to appear before the Committee at somewhat short notice; and they were quite unable to have the advantage of consulting with some other members. Perhaps, in several ways, it would have been better if they could have met the Committee after the discussion now being held; but when he was requested to form one of the Committee, he considered it very desirable that the Institute should go before the Standards Committee, and show them that, while they did not seek any advantage to themselves from the introduction of a standard which would enable them to diminish the quality of gas in any way, on the other hand, representing (as they did) a very large interest—the quantity of gas sold under existing parliamentary obligations amounting to several millions sterling—it was important that the standard should not be raised even by a decimal point, but that the existing standard or unit should be maintained. No doubt, if there had been more time, they could have discussed several other details. But he did not attach very much importance to them; and no doubt the Committee would thoroughly thrash them out. The important point was to keep exactly as they were. They were fighting a hard battle, with rising prices for coal and labour; and they did not want to be burdened in the slightest degree more than they were now.

Mr. JOHN WEST (Manchester), also as one of the representatives selected to appear before the Standards Committee, said it might be as well for him to give his views. Being called together very hurriedly, as Mr. Humphrys had stated, there was not much time for consideration; and they had to fall back upon past experience. No doubt the Committee had been appointed in consequence of the unsatisfactory way in which the testing of gas was carried out in London and surrounding districts. The Gas Companies and the official testers of the County Council found very great divergence and disagreement in their results. This arose from various causes; but it appeared to be mostly attributed to the defectiveness of the candles. For his own part, he thought the candles, although they were not the right thing, had had more complaints made against them than were thoroughly justified; and he had a belief that, if everyone were in earnest, and made very careful experiments, much better results could be obtained from them than was sometimes found to be the case. Then the photometers had been altered again and again, until gas companies scarcely knew where they were. It appeared to him that all the changes made in photometers had been in the direction opposed to the interests of gas companies; and therefore managers were anxious that

some more definite standard of light should be authorized. He should like to have seen the Methven standard adopted, because it was very largely used in the Manchester district, and was a very good one, though not perhaps so perfect as it might be; but it was known how it could be improved and made a perfect standard. He believed, however, that this method would not be entertained, because the Committee were averse to testing gas against gas; and the probability was that the standard eventually adopted would be the pentane one of Mr. Vernon Harcourt. Some little time was spent in framing the resolutions. The gas companies and corporations did not wish to gain any advantage by a change of standard; but they knew that whatever was settled as best for the London Gas Companies would affect the whole country when they went to Parliament for renewed powers. Many years ago, he made a hobby of testing gas and burners; and, in connection with the late Mr. F. W. Hartley, he had made a great many tests. He remembered at once, when this question cropped up, that what was called the Vernon Harcourt pentane standard candle many years ago gave more light when consuming $\frac{1}{2}$ cubic foot per hour than the ordinary standard sperm candle; and they were desirous that this should not be adopted, because, if that were so, gas companies and corporations would be handicapped to that extent. For this reason they had put forward the recommendation that any standard adopted should have the same relative value as the existing parliamentary unit. Experiment showed that the Vernon Harcourt standard gave about 4 per cent. more light than the standard sperm candle. Mr. Sugg said 5 per cent.; but he (Mr. West) put it very moderately at 4 per cent. They had, since they saw the Standards of Light Committee, heard that the gas companies, in order to have the matter settled in some way, rather than go on with the old candle, had agreed to compromise the matter, and accept it as giving $2\frac{1}{2}$ per cent. additional light over the old sperm candle. In doing this, he did not hesitate to say they were giving something away—perhaps 1 or $1\frac{1}{2}$ per cent. He rather objected to this standard, because there was the making of the pentane, which was somewhat difficult, though Mr. Sugg had said it was not so now. In days gone by, they used to find it troublesome; and all he could say, on behalf of managers of moderate-sized works, was that he did not want to see them encumbered with any more difficulties than they had to contend with at present. Presuming that this would be the standard, the next question was what multiple it should be—2, 5, or 10 candles. He himself was in favour of the 10-candle standard, such as Mr. Sugg had described; and he thought this would work very well with all kinds of gas, either 16, 20, or even 30 candle. He believed the President did not quite agree with him on this point, and would rather have a burner made specially for every quality of gas supplied. After the resolutions had been passed, the representatives of the Institute met the representatives of the Institution of Gas Engineers—Messrs. Hunt, Methven, and Paterson—and framed another set of recommendations. The first and second were agreed to unanimously; but upon the third they were not quite unanimous. He certainly agreed with it, and wished they had done as Mr. Sugg had suggested, and recommended the size of the experimental room; but it would take up too much time to go fully into the matter. The fourth resolution might require a little explanation. Some of the members might have seen, in the *JOURNAL OF GAS LIGHTING*,* an account of Mr. Hunt's experiments. His idea was that the gas should be tested with a chimney full of flame, regardless of quantity. He showed that, when he had only a moderate light in the burner, the gas would give a light equal to 10 candles; but when he filled the chimney, after making corrections in every way, he had more than 14 candles. So that there was an advantage in burning the gas as he considered properly, irrespective of the quantity of gas consumed. He believed the President dissented from this view. With regard to the burner, his own idea was that they should not have burners for every kind of gas, but there might perhaps be three sizes—one, the "London" Argand burner, for gas of 14 to 16 candle power; another for richer gas, such as they supplied in Manchester and Birmingham, of 17 to 21 candle power; and another for gas of from 25 to 30 candle power, which might do for Scotland. He

thought three burners of this kind, arranged by someone who understood the matter, and certified by the Board of Trade, would be quite sufficient; and they should all be Argands. Some who supplied rich gas were under the difficulty that they could not test it properly with the "London" Argand. In Manchester they tested with the flat-flame burner on this account. The 10-candle burner was not a new notion—in fact, it had been in use for some 15 years for standardizing the candles. [Mr. Sugg: Only in my private laboratory for that time.] He had no doubt that the Standards Committee were anxious to do what was right and proper to all parties.

The PRESIDENT said it was perfectly true that he was not quite in accord with one or two of the resolutions which had been put forward; but he wished now, if possible, to say nothing about the Standards Committee, but simply to mention that the first and second resolutions, which were passed by themselves and accepted by the Institution of Gas Engineers, represented exactly his views. With regard to the subsequent resolutions propounded, his objection was to having any fixed standard; believing, as he did, that the standard should be a multiple of the unit, whatever it was. For instance, if they went to Parliament with a Bill undertaking to supply 14-candle gas, he thought that there should be a 14-candle gas at one end of the bar, and a 14 candle standard at the other end. The same with 16, 18, and other candle gas. There should always be a standard burner representing the obligations under which they were. His objection was not so great to the exact quantity of light being at the one end of the bar as at the other; and he should be prepared to accept the 10-candle standard, because the variation would not be very great; it was a very fair division of the bar, a very convenient light to have, and the calculations could easily be made. On the other hand, he could not accept the proposition that the rate of 5 cubic feet per hour should be done away with, and that they should simply test with a chimney full of flame, so as to get the best result out of the gas, and then calculate back for the consumption. Everyone who had used a photometer knew the result of this. Gas which would give an illuminating power of about 10 candles when burning the rigid 5 cubic feet per hour, would, under the conditions named, show something more than 14 candles. This improvement gradually diminished as the gas increased in power. If they reached 16, $16\frac{1}{2}$, or 17 candles, they obtained a balance; and the 17-candle gas would show 17 candles, and no more. Immediately they tried to burn a richer gas than this in the same chimney, an opposite effect was produced; and instead of getting a better result, they had a worse one. It seemed to him, therefore, that any method by which they burnt gas under the condition that a poor gas would show a better result and a rich gas a poorer one, could not be adopted as a standard. The resolutions which had been printed and circulated showed what the majority of the joint deputations of the two Gas Institutions agreed to; but he thought it necessary to make this statement, so that he might, in his individual capacity, be free in the future to discuss the points he had mentioned.

THE SECOND PREMIUM.

The PRESIDENT presented the second premium to Mr. A. T. Walmisley, who was unable to be in attendance on Tuesday to receive it. In doing so, he said: Your painstaking paper, read last year, on "The Effects of Wind Pressure on Retort-House Roofs and Gasholders," has been adjudged to rank next in place to the one receiving the President's Medal. It contained information on what to us is an important matter—much of it new. It will stand in our Transactions as a paper of reference for all those requiring guidance on a subject not too well understood; and you will have the satisfaction of knowing that your labours are appreciated by the profession. It is therefore with great pleasure I hand you this cheque.

Mr. WALMISLEY expressed his appreciation of the honour which had been conferred upon him in awarding him the premium, which, he said, was quite unexpected. He had gone into the matter as being one that was interesting to himself, and desiring to arrive at the truth; and if his labours were appreciated by a body of gentlemen who were intimately acquainted with the practice of wind pressure upon gasholders, it showed that they had not been thrown away.

* See Vol. LVII., p. 1006.

REPORT OF THE SCRUTINEERS.

The result of the election of office-bearers for the ensuing year was as follows:—

President.—Denny Lane, of Cork.

Vice-Presidents.—John West, of Manchester; R. Mitchell, of Edinburgh.

New Members of Council.—G. F. L. Foulger, of London; T. H. Martin, of New Barnet; S. R. Ogden, of Blackburn; and H. Wilmhurst, of Sleaford.

Auditors.—T. W. R. White, of Sherborne; S. W. Durkin, of Southampton.

Honorary Secretary.—J. Hepworth, of Carlisle.

The Council explained, on the balloting-paper, that, in accordance with Rule 41, they had appointed Mr. Norton H. Humphrys, of Salisbury, as an ordinary member of the Council, to fill the vacancy caused by the resignation of Mr. A. Mead.

NEW MEMBERS.

The SECRETARY read the following list of new members and associates, and of those transferred to the class of Members:—

Members.—Adlington, E. L., Worcester; Andrews, J., Langley Mill and Heanor; Beynon, R. W. C., Torquay; Francis, A., Tavistock; Hawkins, J. E., Invercargill (N.Z.); Lawton, H., Carnforth; Ogden, S. R., jun., Maryport; Rust, J. L., Chepstow; Taylor, W., Glossop; Wilkinson, H., Harrogate; Weller, F., Southtown, Great Yarmouth.

Associate Members.—Dann, T., Bedford; Pooley, H., Birkenhead; Robinson, C. J., Ilkeston.

Associates.—Creeke, R. W. B., Leven (Fife); Ellice-Clark, E. B., London; Lewes, V. B., Greenwich; Sheldrake, J. H., London.

Transferences.—Associate Members to Members: Jowett, T., East Grinstead; Sutcliffe, V. J., Bradford. Associates to Members: Lass, Alfred, F.C.A., London; Tallentire, W., Lurgan.

The SECRETARY said that several applications for membership had been received too late. He therefore wished to remind gentlemen that all such applications should be forwarded before the 31st of March in each year. Those he had received too late would be held over until next year. He then, in accordance with the rules, read the list of the members who were two years in arrear with their subscriptions.

AN HONORARY MEMBER.

The PRESIDENT said he had the pleasure of nominating the President of the French Technical Institute (M. Mallé) as an honorary member. The Société Technique du Gaz en France had always made the Presidents of The Gas Institute honorary members of their Society; and the Institute had reciprocated by making their Presidents honorary members. He felt it a great honour when it was conferred upon him; and he had much pleasure, therefore, in submitting the resolution.

The proposition was carried unanimously.

PLACE OF NEXT MEETING.

The PRESIDENT said Mr. Denny Lane had been elected for the second time President of the Institute. He was a man whom they all held in very high esteem, as was shown by the unanimous vote in his favour; and he felt sure that, under his presidency, they would have a very successful year. Then came the question of deciding on the place of meeting. Mr. Denny Lane had written a letter expressing his regret at not being able to be present, owing to ill-health, which rendered it unadvisable for him to take so long a journey. He (the President) saw him a few weeks ago, when he fully expected to be able to attend on this occasion. He proposed that they should fix upon either London or Belfast for the next meeting. It was to be urged in favour of Belfast that it was on Irish ground, and they had an Irish President; but it was not his own town. If, however, they went to Cork, he understood some trouble would be experienced in finding accommodation. He believed there might also be difficulty of the same character at Belfast. With regard to London, there had been a strong recommendation to the Council to hold the next meeting in the Metropolis; a large number of members thinking that, as all roads led to London, this was a good place to meet in as often as possible. It was, of course, for the members to decide.

Mr. D. M. NELSON (Glasgow) said he believed, though there was no very great amount of accommodation in Belfast, there were several very pleasant little places just outside the town, which were easily accessible, where it could be found.

Mr. T. TRAVERS (Cork) did not think there was that want of accommodation which seemed to be anticipated. It was certainly the first time he had ever heard such a suggestion. He thought gentlemen would find that Belfast would afford as good accommodation, considering it was a town of 100,000 inhabitants, as a great many of the places they had visited. He might fairly say that the natural beauties of the place would amply compensate for any shortcomings there might be.

Mr. P. SIMPSON (Rugby) said he would move that the next meeting-place be Belfast. They could not do better than keep to the old custom of one year in London and one year out. He had not the least fear of the accommodation being deficient.

Mr. H. WILMHURST (Sleaford) seconded the motion.

Mr. SIMPSON remarked that they had a great many members from Ireland, and they had only been there once before; and on that occasion they were very courteously treated.

There being no amendment, the PRESIDENT put the resolution, and it was carried unanimously.

VOTES OF THANKS.

The PRESIDENT said his next duty was to propose a vote of thanks to the President and Council of the Institution of Civil Engineers for their kindness in according the use of that very splendid room for the meeting. It was not by any means the first time they had received this hospitality; but they did not appreciate it any the less on this account. The courtesy and kindness they met with from everyone connected with the place was very pleasant to each individual member of the Institute.

The resolution was carried by acclamation.

The PRESIDENT next proposed a vote of thanks to Mr. Foulger for his kindness in giving the members day by day an opportunity of visiting the Goswell Road station and inspecting the method of distributing the gas from the stations of The Gaslight and Coke Company. Mr. Foulger had now been elected a member of the Council; and he (the President) was quite sure he would be a valuable member, considering the way in which he had taken the work in hand, even before he was appointed.

The resolution having been carried unanimously,

Mr. FOULGER thanked the members for the manner in which the resolution had been received.

Mr. HEPWORTH then proposed a hearty vote of thanks to those gentlemen who had read papers. He said it was always somewhat invidious to make comparisons, not only of paper with paper, but of session with session; but it might be fairly said that the papers contributed this year had not been surpassed on any previous occasion, and there were two at least which would stand out prominently to be perused for many years to come.

Mr. T. H. MARTIN (New Barnet) seconded the motion; and it was carried unanimously.

Mr. SIMPSON then moved a vote of thanks to the Scrutineers.

Mr. W. R. COOPER (Banbury) seconded the motion; and it was carried unanimously.

Mr. A. DOUGALL (Tunbridge Wells) said they were now drawing to the close of a very enjoyable and instructive session, and their thanks were eminently due to those who had arranged the business as well as the pleasures of the meeting. He therefore proposed a hearty vote of thanks to the Council of the Institute, for the time and attention they had given to the business.

Mr. W. A. PADFIELD (Exeter) seconded the proposition, which was cordially adopted.

On the motion of Mr. W. SMITH (Hyde), seconded by Mr. D. VASS (Portobello), a vote of thanks was passed to the Auditors—Messrs. White and Martin.

Mr. HEPWORTH next moved that the hearty thanks of the Institute be presented to the President, for his able services during the past twelve months. It had, he said, been his privilege to see the President's work during the whole of the year, having been very closely associated with him; and whatever former Presidents might have done, no one could have exceeded, if they had equalled, the work Mr. Valon had performed for the benefit of the

Institute. It was a matter of regret to him that there was not some way of asking the President to take office for a second year. He saw behind him the names of honoured engineers who had filled that office in connection with the Institution of Civil Engineers for two years in succession; and he thought they might do worse than copy that plan when they had such a man as Mr. Valon to occupy the chair. It was mentioned a few days previously that the work of collecting evidence for the Labour Commission had fallen specially on him; and he (Mr. Hepworth) did not think any words could exaggerate the magnitude and importance of the work Mr. Valon did, and did so ably and willingly, while that matter was under discussion. It unfortunately happened that they were not all prompt and businesslike; and he knew, as a matter of fact, that a great many gentlemen who replied to the communications from the office in connection with the Labour Commission might have done so a great deal sooner than they did. But probably they thought that it was a big question, and required considerable time to deal with. At all events, whether the labour had been much or little, no one could question the willingness as well as the ability of the President to undertake it. Before sitting down, it was only right to say they were indebted to Mr. Valon, as they had been to no other President before, for his kindly hospitality at the Westminster Town Hall. It was not every President who could do what Mr. and Mrs. Valon did so gracefully on the previous evening. But without discussing this phase of the question, everyone must have thoroughly appreciated what they did, and must feel grateful to them for initiating such a pleasant feature in their meetings.

Mr. R. MITCHELL (Edinburgh) said that he had great pleasure in seconding the motion so ably proposed by Mr. Hepworth. He would not detract from the force of that gentleman's observations by attempting to add anything to them. The only way they had of showing their appreciation of the great kindness of Mr. Valon was to pass him the heartiest vote of thanks possible for his services during his term of office.

Mr. G. ANDERSON (London) said he had been a member of the Institute for some 24 or 25 years; and he must say he thought this the most successful meeting they had ever had. He had, he thought, never seen larger attendances; but there was one special feature about this meeting, that they seemed to have got rid of everything approaching the slightest semblance of disorder. In proof of this, they had carried unanimously the resolution fixing the place for the next meeting; and he never remembered that this had been done before. No doubt a great deal of the success was due to the President; and the only reason he (Mr. Anderson) objected to Mr. Hepworth's suggestion about electing him for a second term was that which Mr. Hepworth had himself adduced—viz., the great amount of labour which had been thrown upon him during the past year. He would only suggest that they should give him a rest, and then bring him forward again.

The resolution having been carried by acclamation,

The PRESIDENT, in responding, thanked Mr. Hepworth very much for the kind words he had used, and the whole of the members for the consideration they had shown him since he had been President. Wherever he had gone, in all parts of the country, he had had the same reception from every member, and also at the meetings of the District Associations. If his efforts had been successful in cementing and holding the Institute together, the object he had in view would have been accomplished. While they could have meetings like the present one, and like those they had had before, where earnest business men with business intentions were intent to teach and intent to learn, they could not do better than continue on their present lines. He certainly thought that in an Institute like this, which met annually, they should, as far as possible, have a judicious mixture of pleasure and amusement as well as serious business which occupied them in the daytime. They ought to have an opportunity of speaking to each other untrammelled by any kind of form; and he was quite sure the means they adopted of social intercourse added a great deal to the value of the Institute. Most of them were isolated. It was very true that he and a few others had an opportunity of meeting their fellows more frequently than some; but the bulk of the Institute went away, and perhaps did not see each other until they met again in another twelve months. He hoped, therefore,

they would always continue on the same lines of common sense on which they were now; that the Institute would do as it was doing—grow from day to day. Speaking with the responsibility of his position, and knowing the inside work of the Institute, he could say most truthfully that there was not the slightest sign of decay of vitality in any possible way, but quite the contrary. He urged them all, therefore, to bring suitable members to the Institute. They wanted them, because they wanted numbers in order to enable the thing to be worked as it should be, and to make it, as it had been, an Institute representative of themselves and of the great gas industry. If any efforts of his during the last year had tended to this end, and if any services he could render in the future would further this object, he was amply rewarded. He thanked the members very sincerely for the great kindness they had shown him on all occasions during his tenure of office. Continuing, he proposed a vote of thanks to the Secretary, for the way in which he had discharged his duties during the past year. No one, he said, knew so well as the President how irritating and how tiresome some of the Secretary's duties were. During the last three or four weeks, it had been nearly night and day work; and therefore he was fully entitled to a hearty vote of thanks.

Mr. S. W. DURKIN (Southampton) said he had been on the Council under three Presidents, and had had some experience of the Secretary's arduous duties; and he fully concurred in what the President had said with regard to the assiduity with which Mr. Harvey discharged them.

The motion having been carried,

Mr. HARVEY, in responding, said that he was very glad indeed if any efforts he had made to do the work of the Institute thoroughly and well had met with the appreciation of the members; and he could assure them that, as long as he occupied his present position, he should hope to give equal satisfaction.

The proceedings then closed.

PAPERS READ AT THE MEETING.

STEAM APPLIED AS AN AID TO THE REVIVIFICATION OF OXIDE OF IRON "IN SITU."

By FREDERICK G. DEXTER, of Winchester.

The purification of gas in closed vessels is not by any means a new subject. It has received close attention (more particularly of late years) at the hands of many able men, and under varying circumstances. The "Claus" process and the "Oxygen" process representing modern attempts, probably owe their birth to the attention drawn to possible results by the introduction to the purifiers of a small percentage of air with the crude gas.

It is not the writer's intention to take up the time of the meeting by recapitulating the many theories, opinions, and facts which have been given from time to time in support of, or in opposition to, the air process, as ordinarily tried or saddled with the cost of carburetting. They are, more or less, all well known to you. One paper in particular by Mr. Valon, our President, given in the Institute "Transactions for 1889," summed up the debateable question very shortly. He, having tried the effect of air purification, and found it (at any rate under his circumstances) objectionable, had immediately set about trials with oxygen pure and simple, with the truly beautiful results already recorded. That paper, in effect, seemed to tell us that both opponents and exponents of air revivification were wrong—the only true solution being oxygen undiluted. In the subsequent discussion, Mr. N. H. Humphrys found himself unable to reconcile the statement that $\frac{1}{2}$ per cent. of free oxygen mixed with $99\frac{1}{2}$ per cent. of crude gas—or rather a mixture of crude gases—could differ in active properties from $\frac{1}{2}$ per cent. of oxygen mixed with a similar quantity of crude gases, because the said $99\frac{1}{2}$ per cent. of mixture in the second case had 2 per cent. of nitrogen with it, passed in with the oxygen as air. There can be no doubt that the incredulity then expressed, found an echo in many other minds. But it appeared to me, after the reading of that paper, and in spite of the very interesting results brought to light in the "History of a Heap of Oxide" given by Mr. Humphrys,* that the days of air revivification were numbered, if the facts there recorded were substantiated in other quarters,

* See JOURNAL, Vol. LIV., p. 50.

and no better results were possible. During the same discussion, Dr. Thorne, in endeavouring to throw some light upon the discrepancy between results obtained with air and oxygen (the percentages of oxygen being identical), said: "But the chemical world was startled some few years ago, by experiments made by Professor Harold B. Dixon and others, in which it was shown that if the oxygen were perfectly dry—in a state of dryness, such as, until that time, had been quite unknown—then the power of the oxygen to support combustion was enormously *decreased*. One might heat sulphur in *dry* oxygen to such a point that it sublimed, without its burning; and one might heat a piece of charcoal in oxygen to a bright-red heat, take the flame away, and it would go back again without any visible burning. But the moment the merest trace of moisture was introduced, the effect was quite different; the carbon, or sulphur, or phosphorus, or whatever it might be, immediately burst into flame." These remarks, and others of a similar nature, had considerable weight in my own mind; and although I had often thought upon the "*Air versus Oxygen*" question before, without arriving at any satisfactory solution, the conviction then flashed upon me that in this quality of dryness lay the secret—not, however, in the form of accounting for oxygen being so far superior to air, but as explaining why air had not been made to more closely approach oxygen under conditions suitable to its use.

Moisture plays a most important part in Nature; its combinations are inconceivably numerous, and but few chemical reactions are possible without its aid. The instances given by Dr. Thorne might be multiplied many times over. To give one which immediately occurred to my mind—the simple process of rust formation on iron. Here there is a chemical combination—practically combustion, evolving a certain degree of heat. It is the union of oxygen and iron with that all-important aid, moisture. Does rust, or oxide of iron, form in a current of perfectly dry air, however much prolonged? The ferric hydrates, or natural bog ores, contain in their natural state as much as 50 per cent. of water. Even if treated with dry sawdust before use, they will frequently contain (as used in the purifiers) 25 to 30 per cent. of moisture. Artificial oxides also are of necessity "*watered*" before use; and it is hardly needful for me to remind members of the practice of "*watering*" oxide when spread upon the revivifying floor, and even of the practice, as I once heard, of raising a purifier lid to water the contents, as an aid to greater efficiency.

Having, I trust, drawn your attention to the fact that damp oxide is of recognized importance, and that when oxide has been allowed to get thoroughly dry its efficiency in the box is seriously curtailed, I wish to point out that the air process as ordinarily applied is directly responsible for, and rapidly brings about, this very evil—the drying of the oxide; while, as far as I am aware, not only have no efforts been made to counteract this evil, but apparently the matter has altogether escaped the attention it deserves. A few months since, I had the honour of presenting to the South-West Association of Gas Managers a paper dealing with the "*Revivifying of Oxide of Iron in Closed Boxes*,"* by means of a blast of air, derived from a pressure-blower; the box being disconnected from the working series during the operation. The same idea, carried out, however, in a different way, had previously been attempted, but abandoned owing to the extreme difficulty experienced with the hardening or caking together of the oxide. This obstacle, I felt convinced, could be overcome by the use of suitable opening material, and proper attention to the humidity of the oxide. The subject is here introduced only to show the effect produced in a case analogous to the subject of the present paper. I found that the heat produced during the chemical reactions or revivification of the oxide was quite sufficient to drive off, in the form of vapour, the water liberated by the reactions, as well as any mechanically mixed with the material. It was, in effect, simply baking out the moisture; and if the meeting will recall for a moment the caking together and hardening effect in the case of the drying-up of common mould, mud, clay, or any similar material, it will not be found difficult to account for.

To satisfy myself thoroughly upon this point, I had arrangements made to condense the moisture blown off

with the air and gases at the plug of the purifier; and I carefully compared samples of the same material immediately before applying the air-blast and after. The result showed me that considerable quantities of water were driven off by the agency of the heat of the reaction; and the difference between the condition of the oxide before and after treatment with air was most marked. In fact, if the air was not well controlled, it was quite possible to so harden or dry off the layer first affected as to render it impervious to the air current for all practical purposes. Here, then, appeared to me an explanation of a common difficulty, and sometimes entire want of success experienced by users of the ordinary air process.

The chemical reactions effected within an oxide purifier treated with a small percentage of air are of precisely the same character as occur with the same oxide removed to the revivifying floor, or to a spent box treated by a blast in the way just referred to. But while the reactions are similar, the conditions are very different. Oxide revived upon an open floor has this advantage—the heat disengaged can get away quite freely, without necessarily raising its temperature to any great extent. It is, if dry, in a position to absorb moisture from the atmosphere; and, further, should the material not be in a sufficiently damp state, its condition would undoubtedly be noticed, and the necessary moisture added by watering before it was replaced in the box. In applying the air process, however, what occurs? The heat formerly allowed to escape is pent up; it is allowed to become intensified to such an extent, at times, as to cause the oxide and sulphur to fire, and the grids to burn. This catastrophe, while admittedly due to mismanagement, as it shows want of attention to the correct proportioning of the air supply, still serves the purpose of illustrating the intensity of the reactions produced. It is simply a question of degree, the amount of heat liberated in a given time depending entirely on the rapidity of the air supply in conjunction with the condition of the oxide. The quantity of heat is at all times more than sufficient—especially well within the layers—to cause the rapid evaporation of moisture, the presence of which is one of the most important conditions of success.

It is to be noted that the abstraction of moisture acts detrimentally in two ways—mechanically and chemically. (1) Mechanically, by the drying up, hardening, or caking together of the oxide, which causes greater resistance to the passage of the gas. (2) Chemically, by impairing the active properties of the oxide. Of the former effect, many have in the past given their experience; and several instances could be given of boxes shut off, long before properly spent, through sheer inability to get the gas through the material, which has even required the use of pickaxes to disengage. Of the latter, or chemical aspect, I do not think the last word has yet been said. In fact, I am coming to the conclusion that, if the mechanical difficulty did not first assert itself, and put an end on this score alone to further work, the oxide could be so deprived of moisture as to put an almost entire stop to revivification. I hope, before concluding these remarks, to give such evidence on this point as will clearly indicate the necessity of attention in this direction.

In jotting down information in connection with Mr. Valon's and Dr. Thorne's remarks on the oxygen process, as given in the paper before referred to, and in connection with the various experiences recorded with the air process, as well as my own experiments, I had the following notes:

- (1) A given percentage of free oxygen admitted to purifiers appeared to have far higher revivifying effect than exactly the same percentage of oxygen admitted in conjunction with 2 per cent. of nitrogen as air.
- (2) The presence of moisture is of primary importance in most chemical reactions. It is known to have an extraordinary influence upon the combination or activity of the particular element under consideration—*i.e.*, oxygen.
- (3) The absence of moisture in oxide used for purification has an injurious effect; special steps being always taken under ordinary circumstances to ensure its presence.
- (4) The production of hydrated ferric oxide in the active form absolutely depends upon water for its constitution, whether the reaction from sulphide takes place on the revivifying floor or inside a purifier.

* See JOURNAL, Vol. LVII., p. 643.

- (5) That, while the conditions of revivification on an open floor favour the assimilation of moisture either naturally or artificially, the conditions of the closed box not only directly preclude this, but, by means of the heat produced, aid the abstraction of moisture, driving forward along with the gas whatever might be liberated chemically or exist mechanically mixed.
- (6) That the difficulty of back-pressure caused by caking, was again directly traceable to the removal of moisture.
- (7) That, in revivifying purifiers by an air-blast taken in at the bottom, and the current removed at the top, revivification always proceeded in the reverse direction to the blast—*i.e.*, from the top downwards. But, while the top material with less air became damp from moisture driven forward from lower layers, the bottom, which took longer to revivify, though in contact with more air, remained very dry.

The enumeration and study of these points led to but one conclusion. The air process tended to become self-destructive by the removal of the necessary moisture; and although at some works a greater measure of success would be experienced than at others—due to the varying amount of moisture present in the oxide originally, or in the gas, or the proportion of air used—yet there appeared very good ground to believe that no results were so good but that they could be greatly improved. The present uncertainty as to the possible life of any box could be reduced to definite lines, if the important question of humidity received the necessary attention.

While collecting these notes, and trying the effect of the ordinary air process with the admission of varying quantities up to a little over 2 per cent., a circumstance occurred which seemed to me to put all doubt at rest. The ordinary process had been working for some time, with results apparently as satisfactory as were obtained elsewhere. Speaking generally, the boxes, while gradually increasing in back-pressure, did not give exceptional trouble, necessitating shutting off, except in a few instances, or towards what appeared to be the limit of their life by ordinary tests. Having occasion to change over to a separate section of retort-house, attention was called within two days to the impossibility of getting the gas through the purifiers. A new box having been added only four days before, I could not for awhile account for this extraordinary behaviour; the back-pressure on the first of the series having risen in this short time from 4 to 18 inches. On shutting this box off, and making the second box the first, a similar increased resistance arose within the next 30 hours, and again a repetition with the third box. This was a very serious matter; and upon investigating into the cause, I found that each box became decidedly warm in comparison with the temperature usually found. I at once came to the conclusion that the mischief arose through an increased quantity of air being drawn in owing to some fault in the new retort section which was put to work. This surmise proved correct; and the oxide, having been removed, broken up, and freshly damped, was again used in turn with no further difficulty. This experience convinced me that, if means were devised to prevent moisture leaving the oxide under revivification, or, if it did do so, to replace it continuously, the greatest possible benefit would result.

I saw that, according to "King's Treatise on Coal Gas" (Vol. I., p. 377), Mr. Cleland, in applying a jet of steam for scrubbing purposes, claimed a saving of one-third in labour and material (oxide) in the purifiers, by reason of the complete removal of ammonia and arrestation of tar oil and *water* before the gas reached the oxide or lime purifier. This indicates that one of the conditions of success was that the moisture or steam should be prevented from entering the purifiers; and probably at that time, without the altered conditions of air revivification, the object was so far right. Under the conditions here discussed, however, the reverse is true. Moisture is urgently needed. Mr. George Anderson on the subject of "Gas Purifiers,"* in his paper read in 1889, said: "He formed the opinion that to purify gas there must be humidity; and the more humidity there was without doing damage, the better." *Exhaust* steam having necessarily the greater part of its heat removed, appeared to me one of the best possible means of introducing moisture—being itself nothing

but warm water vapour, in the finest possible state of division, and therefore readily adaptable to bring about complete admixture with the gas, and consequently in the most favourable state and condition to come into contact with the oxide.

On thinking over the details for the proposed trial, it occurred to me that the gas itself would probably exercise an affinity for, and take up a certain proportion of, moisture, if allowed to come into contact a sufficient time—added to which it would be necessary to adopt some means of control in case the amount of exhaust steam admitted should prove too great, or the reverse, as my idea was to turn to account the exhaust from the exhaust engine. Having at my disposal an annular condenser, I applied the exhaust steam by means of two jets—one above and one below the gas inlet; and the path of the steam being at right angles to that of the gas, thorough admixture was obtained. To still further break up and intermix gas and steam, I fitted the annular spaces with wood and pine shavings supported upon rings at intervals, in a very similar manner to Cleland's scrubber. This arrangement prevents undue compression of the material at the lower layers. Each of the tubes was fitted with shower-rings, by which a stream of water could be made to descend upon the material; and provision was also left to enable the steam to be applied at different points, so as to carry forward, or prevent the passage of, any proportion of steam required.

I am pleased to be able to say that the results have been quite successful. Extended trial over many months with comparatively small and large air percentages, both with and without steam, leave no room to doubt the marked superiority resulting from its use. Careful records were kept of the effect of air alone during nearly twelve months' working; and during last season in applying steam, I kept, as nearly as circumstances would permit, to the same percentages at similar times of the year, in order to ensure parallel conditions.

The average results obtained are as follows:—

- (1) During the summer months, with 2 per cent. of air and no steam, the gas purified per box averaged 3,000,000 cubic feet.
- (2) Under similar conditions of make in summer, with 2 per cent. of air *and steam*, the average quantity purified per box was 7,000,000 cubic feet.
- (3) During the winter months, with 0·8 per cent. of air only and no steam, the average life per box was 2,400,000 cubic feet.
- (4) With steam added and 0·8 per cent. of air (under conditions otherwise the same), the life per box rose to 7,200,000 cubic feet.

I may mention that the oxide used in these trials contained from 36 to 40 per cent. of sulphur; and the gas on entering the purifiers while under steam was at a temperature of from 90° to 100° Fahr. The efficiency of the oxide in each box was raised by the help of steam from twice to three times its normal value—the greatest increase of efficiency being obtained in winter, when ordinarily, by reason of increased flow and low temperatures, the efficiency is generally lowest.

The specific points and advantages arising from the addition of moisture in this way may be briefly enumerated as follows:—

- (1) The steam supplies the necessary moisture to preserve the activity of the oxide.
- (2) The oxygen of the air supply seems, as Dr. Thorne suggested, to possess far more active properties under the influence of moisture. At any rate, a comparison of statements 1 and 2 or 3 and 4 singularly confirms this.
- (3) Back-pressure from hardening or caking is absolutely stopped. This I attribute to the prevention of the drying-up effect, and also to the undoubted fact that the sawdust and woody fibre in the oxide swells considerably, thus tending strongly to disintegrate the mass, rather than allow it to bind.
- (4) The high temperature of the ingoing gas, particularly in a humid condition, is distinctly favourable to oxidation, and to the chemical reactions generally.
- (5) The addition of heat in this way is of great importance in winter, counteracting most satisfactorily the inert action of the oxide under severe cold, prolonging the life of the box, and enabling far greater dependence to be placed on the purifying operations.

* See JOURNAL, Vol. LIV., p. 116.

I am quite aware that, to render this paper more complete and worthy of your acceptance, I should embrace within it extended statistical reference to the exact analysis of the oxide and of the gas, before and after operations, together with information as to the actual amount of water used, the purifying area, and similar details. But I am placed at some disadvantage in being called upon to supply a paper at very short notice; and I am consequently unable to deal so fully with the matter as could be wished. This detailed statistical work is not yet ready; and as my trials are still progressing, I think, perhaps, it would be better to include the details in some future paper—that is, if the subject is thought worthy of a further hearing—though I am quite willing to give to the meeting now any information in my possession likely to be of assistance.

By giving the results under exactly parallel conditions, and at similar times of the year, one is placed in a better position for judging of the value of my contention. I believe that, when rightly administered and rightly understood, air applied in small proportions will be found of more value than the larger doses now are, which are often administered under unfavourable conditions. With careful attention, we may, perhaps, remove to some extent the discrepancy between air and oxygen.

SOME ANALYSES AND LIGHTING VALUES
OF ENGLISH COAL GAS MADE DURING
THE YEAR 1891.

By WILLIAM FOSTER, M.A., Professor of Chemistry at
the Middlesex Hospital, London.

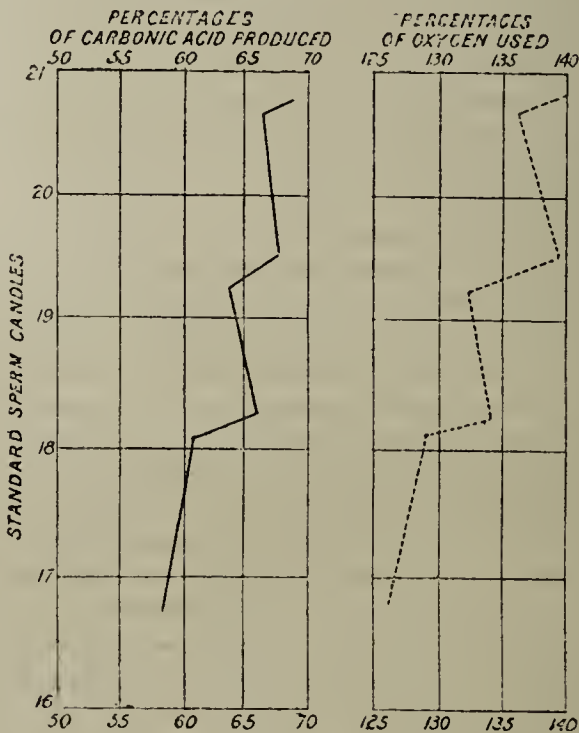
Through the courtesy of several gas engineers, I have been enabled, during 1891, to take samples of coal gas manufactured by them in different parts of England. The lighting value of each of the samples taken was determined at the time by a trained, experienced, and distinct operator. The conditions under which the samples were tested were also precisely similar. An open-bar photometer of the same length was employed; the burner was the standard Board of Trade Argand; the standard of light was sperm candles used in each case in the same way. The only exception is a sample of gas taken from the supply to my own laboratory. This was tested in an open-bar photometer by means of a Methven screen, instead of sperm candles. All the lighting values, expressed in sperm candles, have been corrected for deviations of the gas from standard conditions of temperature and pressure.

The methods of analysis adopted have been, in all essential particulars, those used and described by Dr. Percy Frankland, in his paper read before the Chemical Society in 1884.* Herewith are appended tables of the results

* See JOURNAL, Vol. XLIV., p. 17.

obtained. In addition to an account of the proximate constituents of the samples, I have furnished a statement of the average molecular composition of the heavy hydrocarbons—the hydrocarbons removeable by the action of fuming sulphuric acid. There is also a statement of the volume of oxygen needed for the complete combustion of a given volume of each gas; and the volume of carbonic anhydride resulting from such combustion. Four of the seven samples which are the subject of this communication contain sensible quantities of nitrogen; and it is to certain considerations arising from the presence of this nitrogen that I first desire to direct attention.

Dr. Frankland and others have shown that, within the limits reached by the figures of my experiments, nitrogen, in a mixture of coal gas and nitrogen, reduces the lighting value of the coal gas in simple proportion to its volume in the mixture. On this basis, I have calculated what the lighting value, the amount of oxygen consumed, and the carbonic anhydride produced would be, were the gas freed of its nitrogen. The numerical results are given in Table II. On expressing the same figures diagrammatically, where lighting values are represented by abscissæ, and percentages of oxygen and carbonic anhydride by ordinates, the curves obtained are characteristic. It will at



once be seen that, for a given lighting value, more carbon vapour is needed in cases where nitrogen was originally present than when absent. Irrespective of the condition in which the carbon exists in the gas, the presence of the nitrogen is associated with a lower specific illuminating value per unit of carbon. From an inspection of the figures

TABLE I.

Reference Number of Sample.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.
Carbonic acid gas. . . . .	..	0.47	0.32	0.53	..	..	..
Carbonic oxide	7.00	6.58	7.58	7.40	6.01	6.51	5.60
Heavy hydrocarbons (C ₁₁ H ₁₀)	4.35	5.84	4.62	5.93	5.69	6.33	7.88
Marsh gas	35.12	35.93	36.33	33.32	37.80	37.66	37.74
Hydrogen	50.18	41.11	43.65	38.38	40.06	49.10	46.55
Oxygen	0.61	0.36	0.40	0.57	0.44	..	..
Nitrogen	2.52	9.71	7.10	13.89	10.50	0.40	4.00
	99.78	100.00	100.00	100.02	100.50	100.00	101.77
Carbon density of heavy hydrocarbons	3.20	3.00	2.53	2.80	3.26	3.14	2.57
Hydrogen density of heavy hydrocarbons	5.80	5.40	6.80	6.10	4.40	5.38	4.30
Oxygen needed for complete combustion of 100 volumes original gas	122.32	122.35	120.05	120.19	124.60	132.10	131.90
Carbonic acid produced by combustion of 100 volumes of original gas.	56.88	59.82	56.35	58.50	61.60	63.92	64.38
Lighting value per 5 cubic feet per hour in standard sperm candles.	16.30	16.60	16.80	16.84	18.50	19.10	20.00

TABLE II.

The following figures have been obtained by calculation from the foregoing. They furnish the carbonic anhydride, oxygen, and lighting value, on the assumption that no nitrogen is present in the individual sample.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.
Oxygen needed for 100 volumes of nitrogen-free gas.	125.98	134.48	129.41	139.42	139.55	132.60	136.12
Carbonic acid produced by 100 volumes of nitrogen-free gas	58.58	65.80	60.51	67.86	69.00	64.20	66.44
Lighting value per 5 cubic feet per hour in standard sperm candles of nitrogen-free gas.	16.80	18.26	18.05	19.53	20.72	19.20	20.68

of the analyses, I am unable to account for this reduction in the lighting value of the carbon.

The experiments which have been made by other workers on the reduction in lighting value of coal gas when diluted with nitrogen, have been made with purified gas; and, therefore, any reasoning based on such experiments can only be applied in a qualified way when considering the effects of nitrogen introduced as atmospheric air during the process of manufacture or purification. For my present purpose, the introduction of air may be considered under four heads—

- 1.—As air drawn into the retort through undue “exhaust.”
- 2.—As air intentionally introduced while the crude gas is hot, and containing hydrocarbon and tarry vapours.
- 3.—As air introduced after cooling and “scrubbing,” but prior to purification proper.
- 4.—As air accidentally introduced during the change of purifying material.

The samples are practically free from oxygen; and therefore no air has been accidentally introduced (4). Air is not used for purification in the works from whence these samples came. Hence origin under heads (2) and (3) can be neglected. I therefore infer that air has been drawn into the retort.

For some time I have maintained, on general considerations, that the influence of nitrogen on the lighting value of coal gas would most probably vary with the point at which air is introduced in the manufacture—say, in the four supposed cases already given. I was prepared to find an increase in the amount of carbonic oxide when air enters the retort; but that is certainly not shown in these analyses, even when allowance is made for the diluting effect of a given volume of nitrogen. I ought, perhaps, to point out that the quantities of carbonic oxide in all the samples is considerably greater than those given in several recently published analyses of coal gas.

Several attempts have been made to assess the lighting value of combustible gas by chemical and physical processes, apart from the use of a photometer. The specific gravity of the gas is a rough guide to the lighting value, if one knows the way in which the sample has been manufactured and purified. The diminution in volume caused by the action of bromine furnishes useful information. The determination of the volume and character of the heavy hydrocarbons is a third method; but, for strictly accurate purposes, all such methods are subordinate to that of the direct measurement of the light by a photometer. However, they have their uses.

An inspection of the diagram showing the relation between lighting value, oxygen consumed, and carbonic anhydride produced, will, I venture to think, lead to the conviction that a knowledge of the two latter factors, in the case of an analysis of illuminating gas, will enable one to assess the lighting value more accurately than any of the chemical or physical processes previously referred to—that is, when the lighting value comes within reasonable limits. Further data are, of course, necessary.

I draw the following inferences from these experiments:—

- 1.—That the ingress of air at the retort in gas manufacture lowers the specific lighting value of the carbon.
- 2.—That a consideration of the quantity of oxygen consumed, and the quantity of carbonic anhydride produced by an ordinary sample of coal gas, is a valuable guide to its approximate lighting value.
- 3.—That the quantity of carbonic oxide in these samples is much in excess of that attributed to similar gas by recent workers.

Addendum.—Since the foregoing paper was written, I have had occasion to employ coal gas for quantitative heat experiments where means for testing its lighting value were not available. A sample taken from bulk in a test holder gave on analysis the following data:—

Carbonic anhydride = 56·70 per cent.
Oxygen consumed = 120·00 ”
Nitrogen in the original gas = 2·38 ”

I put the lighting value at about 16·3 candles. The official testing-place was closed on the occasion of my experiments; but the engineer of the works supplying the

district informs me that tests made by the company's officials on that occasion went up to 16·5 candles.

It will be in the recollection of some of my hearers, that in the autumn of 1889, I made an examination, both chemically and photometrically, of coal gas manufactured by the Dinsmore process at Widnes. Some of the points brought out in that inquiry were certainly novel. The lighting values were determined by the Sugg “G” Argand—not the London Argand, such as has been used in the experiments described herewith. Fortunately the chemical analyses were made with all the care and experience I could command; and I can refer to them with confidence. There were three samples, two being so-called Dinsmore gas, and the third a mixture of ordinary and Dinsmore gas. The data obtained were as follows:—

Description of Gas.	Percentage of Carbonic Acid produced.	Percentage of Oxygen used.	Percentage of Nitrogen in Original Gas.	Lighting Value in Candles by the “G” Argand.
Dinsmore I.	63·12 ..	130·6 ..	·60 ..	21·8
” II.	68·44 ..	136·5 ..	·59 ..	22·3
Mixture (town gas)	58·70 ..	120·3 ..	1·10 ..	18·6

According to the diagram before you, the lighting values of these gases with the London Argand would be about as follows: No. I., 19 candles; No. II., 21 candles; Town gas, 16·8 candles.

At the time of publication of the Widnes experiments, the extraordinary low specific gravity of the Dinsmore gas was a matter of public comment. I then called attention to possibilities in the *quality* of the carbon molecules affecting the result. Last year I gave the Institute an account of experiments connected with this part of the subject. I am now enabled to put before the Institute evidence of a different order—namely, that there was in the gas the quantity of carbon vapour necessary to constitute a gas of high lighting value—higher, in fact, than can be explained by the previously accepted data based on a mere consideration of the specific gravity.

Disputes between gas companies and their supervising authorities on the subject of the lighting value of the gas of the district, are not unknown. There was some evidence recently given before a Parliamentary Committee on the lighting value of the gas supply of a well-known borough. The variations in the lighting value were alleged to amount to several candles—say, from 14 to 18. My contention is that such alleged variations cannot occur without a chemical analysis, on the lines indicated in this paper, disclosing the real character of the gas supplied, and its approximate lighting value. Tests of gas supplied on a particular date cannot be verified; but samples of gas used at the time can always be reserved in sealed glass tubes, and the character of the gas subsequently ascertained. Much misunderstanding would, I venture to think, be avoided by such a course of procedure. In any case my proposition makes it possible for an independent observer to revise the autocratic dictum of a gas examiner by fresh experiment; and, in these days of constitutional government, that is worth something.

DIFFICULTIES IN TANK CONSTRUCTION.

[*Second Paper*]

By THOMAS NEWBIGGING, of Manchester.

Two years ago I contributed to the “Proceedings” of the Institute a paper with a title similar to the present one, in which the difficulties of bad ground—of soft, yielding and sliding clay, sand, and silt—were dealt with. In the paper which I have the honour to present to you to-day, I propose to take up the question of the water difficulty—the difficulties attendant on the presence of water in the excavated ground, and also some of the effects of extraneous water.

The first thing to be done, in determining the site of a tank, is to sink a well or shaft in the vicinity, or to make a number of borings on or near to the site, in order to ascertain the character of the strata in which the excavation for the proposed tank has to be made. If the ground in the immediate neighbourhood is clear of other tanks or buildings, it is not a matter of serious concern to find that a bed of sand, full of water, has to be encountered. To overcome a difficulty of that kind in such circumstances, is chiefly a question of pumping power. Piling also might be resorted to, and the free use of concrete, in case there was a possibility of the water being removed by pumping from underneath the tank at any future time.

But, on the other hand, if there are adjacent structures which it is unwise to run the risk of damaging, then it is well to be chary about pumping the water from the underlying sand and gravel. In such event, it is almost a matter of certainty that the removal of the water, accompanied also by the removal of a large proportion of the sand along with it, will cause subsidence of the ground in the vicinity, with consequent and possibly irreparable damage to the structures upon it. The safer and more prudent thing to do in such a case is either to abandon the site for another, or, if that cannot well be done, to construct the tank either wholly or partially above-ground, and of cast or wrought iron plates.

Assuming that the site for a gasholder tank has been finally settled; that it has been decided the tank shall be constructed of masonry (which term includes stone, brick, and concrete, or a combination of these); that it has been ascertained by boring that water is present in objectionable abundance in the substrata to be pierced—the first thing to be done is to sink a well or sump, 3 feet to 4 feet in diameter, at a convenient distance from the circumference of the proposed excavation. This should be lined with open unmortared brickwork (technically called "steining"), to allow of the free percolation of the water into the sump or well through the joints of the lining. Into this, when the sinker has reached the water-bearing strata, he conveys the suction-pipe of the pump, puts the latter in operation, and clears out the inflowing water to enable him to proceed with his work. This well is carried down to a depth of 3 feet to 5 feet (depending on the volume of water present), below the bottom of the intended excavation, and is then paved with bricks set in cement. If the strata are of uniformly open character—consisting, say, of a mixture of gravel and sand—one sump will be sufficient to clear the ground of water; otherwise, if it is not uniform, but barred by intervening clayey deposits (not an unusual thing), and even by solid-bedded sand—for this sometimes is almost as impervious as clay—it may be necessary to drain the water to the sump, or even to put down two or more sumps outside the ground operated on. Duplicate pumps should be provided where the inflow of water is very great. With these arrangements completed, the work of excavating and building can be proceeded with unhindered by the presence of any undue amount of water.

In the course of my practice, the excavation for a tank of which I was Engineer was chiefly through hard sand-stone rock, the layers of which had been tilted up into almost the vertical position. This was fissured and cracked in all directions; and through the crannies, water bubbled up in numberless springs. Although one side of the adjacent ground was at a lower level than the tank bottom, it was impossible, by any reasonable expedient, to draw off the water from the outside. Possibly, by sinking a shaft to a considerable depth, it might have been accomplished. But considering the nature of the strata, that would have been costly; so I resorted to other means to overcome the difficulty. It is not an easy thing—in many cases it may be pronounced to be impossible—to choke out water from a tank from the inside. In puddling the bottom of the tank in question, and covering the puddle with a bed or layer of concrete, the springs were by no means closed; and though they were reduced in number, the flow of water was still quite as plentiful as before. Assuming that the pressure in these springs was sufficiently great to have overcome the pressure of the head of water in the tank when the latter was full, there would have been no objection to leaving them to flow at their own sweet will. But that was a risk which it was not prudent to run. The head of water in the tank would probably have more than counterbalanced the pressure of the springs; and where water can enter, it can as easily make its exit. The plan which in this case I adopted for making the tank water-tight, was to train or drain the different streams of inflowing water to one point by cutting a trench round the side of the bottom where the springs occurred, and laying therein strong 3-inch drain pipes, which in turn were carefully protected by a covering of strong concrete. The springs usually occur at, or near to, the base of the mound or dumping left in the tank bottom; so that it is easy to gather them together by a drain and convey the water all to one convenient point. I had now got only one stream of inflowing water to deal with; and at this point I placed a 3-inch cast-iron stand-pipe, 3 feet in length,

closed by a valve at its upper end, and the flanged foot secured by four Lewis bolts let into a base-stone 18 inches square and 9 inches thick, through the centre of which a hole was drilled. This stone was let into the floor slightly below the level of the concrete surface; and a cavity was left underneath it. From this stand-pipe, the inflowing water was pumped to relieve the pressure on the bottom till the cement in which the stone was bedded had set hard. I ought to mention that, in the side of the stand-pipe, at distances of 9 inches apart, I had three $\frac{3}{4}$ inch holes drilled. These were left open, to allow the water to issue from them without rising to the top. As the filling of the tank proceeded, these holes were each carefully plugged as the water rose above them; then the valve on the upper end of the stand-pipe being closed, the filling with water was completed—the tank proving to be perfectly water-tight.

Another method sometimes adopted, instead of using a stand-pipe as described, is to carry the drain right through the tank wall at its base, thus making an outside exit for the water. I prefer the stand-pipe, however, as being more self-contained and certain in its action. It sometimes happens that, without previous indication of its presence, the pressure of surrounding water will, in the course of construction, blow a hole or holes in the tank bottom. If so, the best thing is to let it blow; let it have free vent until all is completed and the tank ready for water, then apply the stand-pipe as described.

In another instance in my own practice, I had to construct a tank the line of circumference of which came close up to the side of a retaining wall bounding a considerable stream. In this case, the excavation having to be carried close up to the wall, the latter was laid bare for about 30 feet of its length; and as the cutting had to be taken about 6 feet below the level of the water in the stream, the rush of water through the interstices of the wall would have been fatal to the operations. Accordingly, to shut out the water, I constructed a wall of wooden sheet piling—made a cofferdam, in fact—60 feet in length; and the wooden piles forming one side of it were shod with iron, and driven (most of them) 12 feet into the bed of the stream. They were then bound together at their upper ends by a horizontal beam bolted thereto, and anchored at distances 10 feet apart with long bolts passing through the retaining wall. The space between the piling and the stone wall was 2 feet in width, and was hand-dredged to a depth of 10 feet below the water level. This space I had carefully filled in to above the stream level with stiff clay puddle, well rammed down. The work was eminently successful; and it was found an easy matter to cope with any water from the stream that reached the excavation, either from beneath or from beyond the two ends of the cofferdam.

The presence of water in an excavation is not always objectionable, unless it be excessive in volume. For example, in excavating through stiff clay, it renders the work of the labourer much easier than if the ground is dry and hard. Those who have had experience in shifting boulder clay, will readily endorse this view. Strata of this character are often so hard and parched and intractable as to require blasting to facilitate removal.

Avoid puddling a tank-bottom in wet weather, especially if the bottom is in the form of a mound or cone. Uniformity of consistence in the puddle is of more importance here than against the outside of the walls, for the obvious reason that the bottom has to bear the pressure of the water when the tank is filled. If one portion is well consolidated and firm and another soft and yielding, the concrete covering is liable to crack and split open, owing to the unequal sustenance. It is almost impossible to preserve this necessary uniformity with water coursing down the slope of the mound; the puddle becoming sodden and sloppy. And here I may remark that the fact that equal sustenance is of such importance, also proves the necessity of having the clay covering on the bottom of one uniform thickness all over. Even the deeper excavation made to receive the horizontal portions of the inlet and outlet pipes should have a solid concrete filling, allowing for just a like thickness of puddle above them as over the other parts of the apron and cone.

I do not think it is a wise thing to test the tightness of a tank with water immediately on completion. Better wait till the holder is finished, in order to give the puddle and cement time to set before subjecting them to the heavy pressure of water. I have known several instances of the

splitting of tanks due to this premature filling with water. Further, before filling a tank with water for the first time, the puddle and backing behind the wall should be carefully watered—by means of a hose-pipe, if possible—for several days before the filling is begun, and also during its progress. This promotes consolidation of the backing.

Finally, I have spoken of “difficulties,” so called. But there are really no difficulties at all; or if there are, they are not insurmountable. They are all to be overcome by skilful resource, coupled with judgment, determination, perseverance, and suitable appliances.

THE MURDOCH MEMORIAL LECTURE.

A CENTURY OF WORK ON THE DEVELOPMENT OF LIGHT FROM COAL GAS.

By VIVIAN B. LEWES, F.I.C., F.C.S.,

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The hundred years which have elapsed since Murdoch made his greatest discovery, and illuminated his house at Redruth with coal gas made in an iron kettle, have taught us many lessons; and by no means the least important chapter in the history of this century is the rapid growth in our methods, not only of making gas, but of burning it. In spite of all that has been learnt, however, we are only on the outskirts of a real knowledge of the changes which give us our great gaseous illuminant; and although a century of experiment has taught our gas managers the best coal to use, and the best methods and temperatures for producing gas from it, we are still ignorant of the exact nature of the hydrocarbons present in the coal, which, under the influence of destructive distillation, yields the gas, and also of the changes which result in the complex residue we know as tar, and the gaseous mixture which, forms the coal gas itself. The questions still to be answered with regard to coal gas will take long years of research for their elucidation; and I propose to-day to devote myself to a discussion of the methods we employ for the generation of the light from the gas, and to the facts we have learnt as to the causes of luminosity in flames, rather than to trespass upon a subject which still contains so many unknown factors.

When Murdoch, in 1792, first made coal gas in his Cornish home, he burnt it as it escaped from the open end of a pipe; but, quickly perceiving that a spreading of the flame gave a better light with a decrease in consumption, he fitted a thimble over the end of his tube, and, by boring small holes in the thimble-head, caused the gas to burn in several small jets. But as his experiments progressed, the form of his burner was modified, until in 1807, when fitting up the works of Messrs. Phillips and Lee, in Manchester, he used two forms of burner—the one a rough Argand, and the other “a small curved tube with a conical end, having three circular apertures or perforations, about a thirtieth of an inch in diameter, one at the point of the cone, and two lateral ones through which the gas issued, forming three divergent jets of flame somewhat like a fleur-de-lys.”* This latter burner, which, from the shape of the jet, received the name of the “cockspur” burner, gave a light equal to $2\frac{1}{4}$ mould candles of six to the pound; while the Argands used developed a light equal to four candles of the same description. The Argand burner had been in use for the consumption of oils for some years before the introduction of coal gas; and in its early form consisted simply of two concentric tubes fixed at the required distance apart; the coal gas being fed in between them. Soon, however, the idea arose of closing the open circular slot by a metal ring pierced with holes so as to give a circle of small jets; and even prior to 1816 the main principles of our present Argands were to be found in the burners in use. It was about 1816 also that the cockspur burner became converted into the cockscomb, and then the batwing—thus marking a distinct advance in the method of burning the gas, as by spreading the flame out into a thin sheet, instead of having it in a solid mass as in the jet burner, the air was more uniformly and readily supplied to the burning gas, and the increased temperature of the

flame due to the more perfect combustion increased the light-giving power of the burner to nearly that of the Argands then in use.

In 1820, Neilson of Glasgow, whose name will always be remembered as the discoverer of the hot blast in iron smelting, found that, by allowing two flames to impinge upon each other, an increase in luminosity was obtained; and, after several preliminary stages, the union-jet or fish-tail burner was produced, in which two holes bored at the necessary angle in the same nipple caused two jets of gas to impinge upon one another, so that they mutually splayed themselves out into a flat flame. The shape of the batwing flame was a very wide flame of but little height, while the fishtail flame was much higher and narrower; and although the service yielded by the batwing for each foot of gas consumed was no better than, if it was as good as, that given by the batwing, yet its shape, which made it less affected by draughts, and enabled a globe to be used with it, ensured a greater meed of success for it than the batwing burner had secured.

The next twenty years was a period of improvement and gradual perfecting of the Argand and flat-flame burners—the influence of pressure and regulation of the flow of gas to the burner being gradually realized and arranged for; whilst other structural improvements were introduced later by Sugg, Bray, and others.

In the year 1854 a new and important departure was made by the Rev. W. R. Bowditch, who conceived the idea of utilizing heat, which otherwise would have been lost, to raise the temperature of the air supply, by enclosing an Argand burner by a double glass cylinder so arranged that the air had to pass down between the glasses and in its passage became highly heated. The burner itself was never a commercial success, as the high temperature so rapidly acted upon the inner glass as to render its frequent renewal necessary; but it marks an important era in the history of lighting by gas, as in it we find the inception of the regenerative lamps which during the last thirteen years have revolutionized the methods for the production of high illuminating values from gas. The first successful application of the principle was by Mr. F. Siemens, in 1879. The results he achieved were so far in advance of any previously obtained, that others followed in his footsteps; and Clark, Grimston, Bower, and Thorp all contributed burners in which the same principles received slightly different application. These in turn have given rise to the host of others which not only add to our power of illumination, but also threaten to increase business in the Law Courts.

About the same time that the regenerative burner was struggling into prominence, Mr. Lewis brought out a burner in which the coal gas was consumed mixed with air, as in a Bunsen burner; and the flame was then urged, by an artificial blast, against a cone of fine platinum wire, which being heated to incandescence gave a very high candle power per cubic foot of gas consumed, and was thus the forerunner of the Welsbach, Clamond, and other incandescent lights.

Having traced the gradual genesis of our present burners, we must now glance at the theories which have been from time to time advanced as to the causes that endow a flame containing those compounds which we know as hydrocarbons with the properties of emitting light; for, until we have some conception of the causes which give rise to luminosity in a flame, it is impossible to arrive at any idea of how far further improvements may be expected to go, and in what direction to look for them. While this century was still in its “teens,” Sir Humphry Davy undertook that great research which culminated in the invention of the Davy safety-lamp; and during this work he made some observations which caused him to enter upon further researches as to the cause of luminosity in flames. These were embodied in his historical papers published in the Transactions of the Royal Society for 1817. These researches led him to the conclusion that the luminosity of flames is due “to the decomposition of part of the gas towards the interior of the flame, where the air is in smallest quantity, and the deposition of solid carbon, which, first by its ignition and then by its combustion, increases in a high degree the intensity of the light.” Davy’s explanation remained unquestioned until 1868, when Dr. Frankland showed that flames such as that of hydrogen in oxygen could be rendered luminous by compressing the oxygen, and that such a flame contained no

* Murdoch’s Royal Society Paper, 1808.

solid particles, as required by Davy's theory; also that the intense light emitted by phosphorus burning in oxygen, or arsenic in oxygen, could not be due to this cause, as the temperature of the flame was higher than the volatilizing points of the products—phosphorus pentoxide and arsenious trioxide. The combustion of phosphorus in oxygen, for instance, gives a temperature of over 1300°C .; while the oxide that is formed volatilizes at between 800° and 900°C .

Dr. Frankland's research showed beyond doubt that a flame containing dense vapours might be luminous; but he failed in proving, as he claimed, that the luminosity of a coal-gas flame was due to dense hydrocarbon vapours heated to incandescence, and not, as Davy had stated, to separated carbon particles at a high temperature. This paper gave rise to a large number of other researches and communications on the subject, which greatly increased our knowledge of the actions going on in flames and the various causes which affect them. Dr. Frankland not only showed that flames might be luminous without containing solid particles, but advanced the theory that the luminosity in the flame of a burning gaseous hydrocarbon was due to dense hydrocarbon vapours; and he further pointed out that the soot deposited upon any cool substance held in such a flame contained hydrogen. To this W. Stein replied, showing that the deposited soot contained less than 1 per cent. of hydrogen, which was therefore probably only occluded by the carbon; and also that, if it had been present as a vapour in the flame, it ought, on being heated to the same temperature as the flame, to be once again volatile, which it undoubtedly is not. In the year 1874, Soret attempted to show that the cause of luminosity in flame really does depend upon the presence of solid particles, by focussing the sun's rays upon a luminous flame, and examining the reflected light by means of a Nicol prism. Rather later, Burch pursued the same line of research, but he employed the spectroscope for his examination of the reflected light; while quite lately, Professor Stokes, following the same line of research, has confirmed their results, all of which point conclusively to the presence of solid particles in those flames which owe their luminosity to the combustion of hydrocarbons. Heumann also, in 1876, pointed out that hydrocarbon flames gave a distinct shadow, which is only the case when solid particles are present.

It is impossible to gainsay or refute the mass of evidence which has been adduced upon this point; and we must accept as proved beyond doubt that the luminous portion of hydrocarbon flames contains solid particles of practically pure carbon, which, partly by their own combustion and partly by the combustion of the other gases present, are heated to incandescence, and contribute at any rate a very large proportion of the luminosity of the flame. In the present state of our knowledge, I should be sorry to say that the luminous portion of a flame does not contain some extremely heavy hydrocarbon vapours, and that these may not, under the influence of intense heat, add to the general effect. But at present I have been unable to detect their presence, while the presence of solid particles has been abundantly proved. Several attempts have been made to trace the chemical changes going on during the combustion of the flame gases. Hilgard, Blochmann, and Landolt did this by withdrawing portions of the gases from different parts of the flame, and analyzing them; but no definite conclusion was arrived at as to the actions which culminated in the liberation of the all-important carbon particles. For some time past I have devoted attention to this point, and, with the aid of my assistants, have, I think, found the key to the actions which are going on within a luminous flame—actions far more complicated than were imagined or provided for by the older theories, and yet in themselves beautifully simple.

In our coal gas, we have a mixture of hydrocarbon gases and vapours diluted with hydrogen and small quantities of carbon monoxide; while such unwelcome impurities as carbon dioxide, nitrogen, and oxygen also exist in traces as small as the gas manager's skill can make them. The composition of coal gas varies considerably with the temperature at which the retorting of the coal takes place; and the gas made by one company may vary from time to time within fairly wide limits. The composition of the London gas at the present time is a study of considerable interest, as it reveals occasionally signs of the

methods of enrichment which are being tried at some of the principal works:—

South Metropolitan Gas.

	1890	1892
Hydrogen	57.08	52.22
Unsaturated hydrocarbons	4.38	3.47
Saturated hydrocarbons	33.99	33.76
Carbon monoxide	2.63	6.23
Carbon dioxide	0.79	0.60
Nitrogen	0.96	3.23
Oxygen	0.15	0.49
	100.00	100.00

In all our gas-flames we can trace by the eye two principal zones, and at least one subsidiary one. There is the non-luminous zone just above the burner, and above it again is the all-important area of luminosity which gives the value to the flame; and between this and the air comes a thin non-luminous mantle which marks the confines of the flame. The inner non-luminous zone of the flame has always been looked upon as the zone of non-combustion, and but little attention has been paid to it by the chemist; while the gas engineer has often yearned to decrease its size, and so increase the zone of luminosity, but has so far found that regeneration is the only practical method of doing so. If we are to increase the amount of light which it is possible to obtain from a gas-flame, it is manifest that this portion of the flame offers us the most promising field for research. My experiments upon flame gases show that as the coal gas comes from the burner into the air, the hydrogen, on account of its lightness and diffusive power, finds its way to the exterior of the issuing gas, and burns first; combining with the oxygen of the air to form water vapour. Next in order of rapidity of burning is the methane, or marsh gas, which is also the lightest gas, next to hydrogen, present. The hydrogen in the marsh gas burns to water, while the carbon burns partly to carbon dioxide and partly to carbon monoxide, according as the marsh gas molecule at the moment of combustion is in an excess or deficiency of air. The carbon monoxide is generated in the flame, partly by incomplete combustion and partly by the action of water vapour on some of the heavy hydrocarbons, so much more quickly than it is burnt, that it increases in quantity up to the top of the non-luminous zone, although itself a combustible constituent of the gas.

The combustion of these two gases on the exterior of the lower portion of the escaping coal gas creates intense heat, and bakes the remaining portions of the gas in the non-luminous zone; and this causes important changes to take place in the heavier saturated and unsaturated hydrocarbons present. These consist chiefly of ethylene, benzene, propylene, butylene, and crotonylene, as representatives of the unsaturated hydrocarbons; methane, ethane, propane, and probably butane, as representatives of the saturated. With the exception of the methane, these hydrocarbons are all of considerable density; and the denser they are, the smaller is their tendency to find their way to the exterior of the flame. Only the straggling molecules from their ranks do this; so these bodies decrease far more slowly in the earlier portion of the flame than the lighter gases with which they are mixed. These hydrocarbons, however, are gradually altered by the heat to which they are subjected; and they all show a tendency to break up into acetylene at a temperature a little over 1000°C . (2120°Fahr .), so that by the time the top of the non-luminous zone is reached, 81 per cent. of the still existing hydrocarbons have been converted into this body, and the luminosity of the flame commences immediately afterwards. Acetylene is a clear, colourless gas, with a strong and disagreeable odour. It consists of 24 parts by weight of carbon, combined with 2 parts by weight of hydrogen. It is one of those bodies which during their formation take in heat instead of giving it out; and it is therefore called an "endothermic" compound. Such substances are especially liable to decomposition, as this is accompanied by a rise in temperature instead of, as is the case with most decompositions, an absorption of heat. Acetylene is decomposed at between 1100° and 1200°C . into carbon and hydrogen, together with traces of higher hydrocarbons; while Berthelot has shown it to be so unstable that it can be broken up into carbon and hydrogen by detonating a percussion cap in it.

The next step in elucidating the cause of luminosity was to determine the temperature existing in the various parts of a flame; and as a flat flame offers a more convenient

surface for research than any other, the flame from a No. 7 Bray burner was chosen, and the temperature of the various portions was determined by a Le Chatelier thermo-couple. This consists of a piece of platinum wire, the end of which is twisted with the end of a wire made of platinum with 10 per cent. of rhodium. On heating this, a galvanic current is generated, which is made to pass through a reflecting galvanometer of special construction, and this deflects the needle. A ray of light falls upon a mirror attached to the needle, and is reflected on to a scale; so that, as the needle moves, a spot of light travels along the scale. The scale is graduated into degrees by plunging the thermo-couple into various media the temperature of which is known; and as the current generated is practically proportional to the temperature, it makes a very convenient arrangement for measuring high temperatures. Using this instrument, it was found that the temperature half-an-inch above the burner was 500°C . (932°F .), and steadily increased to 1200°C . (2192°F .) at the top of the non-luminous zone, luminosity commencing at 1200°C . (2192°F .). The highest temperature was found to be near the top of the luminous zone, where it reached 1368°C . (2462°F .). In no case is the temperature of the luminous portion of the flame less than from 1100° to 1200°C .

Taking the evidence which I have now laid before you, we may, I think, fairly fully explain the actions that take place in the flame, and lead to luminosity. As the gas leaves the jet, the hydrogen rapidly diffuses to the outer edge of the flame, and burns; the methane doing the same, but rather more slowly. The combustion of these gases raises the temperature 500°C . in the first half inch; while before another half inch has been traversed 1000°C . is reached, and the chemical changes in the hydrocarbons are progressing rapidly—the unsaturated hydrocarbons and higher members of the saturated hydrocarbons being rapidly converted into acetylene. If the temperature of the flame were not allowed to rise above 1000°C ., this acetylene would be nearly all polymerized into benzene, naphthalene, and other more complex bodies, which would be slowly burnt up without liberation of carbon, and a non-luminous flame would result. This may be shown by holding a platinum dish against a luminous flat flame, when luminosity disappears; but it may be reproduced by heating the interior of the dish. In the case of a gas-flame, however, instead of remaining at 1000°C ., the temperature rapidly rises to 1200°C ., with the result that, instead of polymerizing into more complex bodies, the acetylene formed at once splits up into carbon and hydrogen, and the former, heated to incandescence by combustion, gives the luminosity. It is the attainment of this temperature that marks the limit of the non-luminous zone. If this were the only action, however, the luminous zone would be very short. But the bodies formed from the acetylene before 1200°C . was reached, and the methane, of which some still remains unburnt, are converted into acetylene at a still higher temperature—*i.e.*, 1300°C .; and this being reached near the top of the luminous zone, yields a fresh supply of carbon, and so increases the height of the light-yielding portion of the flame.

In producing the luminous flame, therefore, there are two main factors to be observed—first, to use such compounds as shall be most easily converted into acetylene; and, secondly, to attain as quickly as possible as high a temperature as practicable. The moment we have reached this point in our theory, we naturally think how this can be best done; and we find to our disgust that theory has only just caught up practice, as long experience has taught our gas managers that the olefines and unsaturated hydrocarbons are the most valuable illuminants in the gas, while our burner makers have slowly and by laborious steps found that by regeneration they can obtain the best results per cubic foot of gas consumed.

Some of my hearers will go beyond this point, however; and it may flash through their minds to ask: "If acetylene is the key to luminosity, and if this gas is formed by the action of high temperatures on the gas, why is it that retorting at high temperatures gives but a trace of acetylene, and ruins the illuminating power of the gas?" Simply because the heat which forms the acetylene also polymerizes that body into benzene, and still more largely into naphthalene, especially in the presence of carbon; and you know better than I do that high temperatures result in an

increased yield of this body, or else, having formed acetylene, breaks it down to carbon and hydrogen, and that any attempts to increase the luminosity by superheating the gas must end in failure, as the action taking place in the flame is probably the only method by which this body can be so formed as to yield the desired results. In the flame it is formed and at once decomposed by the heat of combustion; in the retort it is formed at high heats, and yields but traces of benzene and naphthalene, which largely go into the tar, or condense where they are least wanted. Even if it were possible to charge gas with acetylene, it would be useless for practical purposes, as it is soluble in water and all other media, such as glycerine, which could be used in gasholders and meters. So that once more we come back to the fact that, in our gas-flame, Nature has provided the best methods for the carrying on of the actions which culminate in luminosity, and that the most likely field for improvement is in our mechanical treatment of the flame itself. This is also shown by the fact that in an ordinary gas-flame the luminosity is caused by something like 1.5 per cent. of acetylene liberated at the right spot; whereas double this quantity, mixed with a non-luminous gas like hydrogen, yields hardly any light-giving power to the flame, because by the time the temperature necessary for the splitting up of the acetylene is reached, it is nearly all burnt up without any liberation of carbon.

Regeneration, as has been before pointed out, increases to a very great extent the light yielded per cubic foot of gas. This is due to two causes. In the first place, by increasing the temperature, the decompositions necessary to form acetylene and liberate carbon from it are hastened, and so the non-luminous zone is decreased in size, and a larger proportion of the gaseous hydrocarbons are converted into acetylene; and, secondly, by heating the inert nitrogen of the air supply, it prevents the withdrawal of so much heat, and raises the carbon particles, when liberated, to a brighter incandescence, and so yields a higher service. Through the kindness of Mr. Siemens, I have been enabled to determine the effect of regeneration on a flat flame, both as regards the diminution in size of the inner zone and the increase in luminosity. The flame, when cold, had a total area of 11 square inches, of which the luminous zone occupied 7.8 square inches, and the non-luminous 3.2 square inches. On regenerating this flame, the total area decreased to 10.2 square inches; but the luminous zone occupied 7.9 square inches, and the non-luminous zone 2.3 square inches of the space; while the illuminating power was increased 100 per cent.

The regenerative gas-burner, however, is by no means the most widely-used one; and initial cost and domestic inertia are such all-powerful factors, that the flat-flame burner is still the burner of the people. But great as have been the improvements effected in this class by our leading makers, the use of the flat-flame burner means several millions wasted annually—not to the profit of the gas manager, but simply in loss of light to the consumer; and as anything which could be done to increase the light-giving power of the flat flame would be an inestimable boon, you will pardon my spending a few moments in pointing out a direction in which, I think, attempts might be made to do this. In the passage of the heavy hydrocarbons up the non-luminous zone of the flame, a certain percentage must of necessity be lost by wandering into the part of the flame where combustion is taking place, and where they get burnt up without decomposition, and so are lost as far as any luminosity is concerned. The larger the inner zone, the greater will this loss be; so that if the inner zone can be by any means reduced in size, not only do we gain an increase in luminous surface, but a larger supply of carbon particles to yield light.

Some five-and-twenty years ago, a device for increasing the luminosity of a flat-flame, called "Scholl's platinum light perfecter," created a considerable amount of interest; and undoubtedly, while the perfecter was new, it caused a considerable increase in the amount of light emitted by the flame. The perfecter consisted of a thin slip of platinum fixed across the burner, and between the orifices of the jet, so that the two streams of gas impinged upon it, and afterwards mingled in the flame. The explanation always given of its action was that, in the far from perfect burner then in use, it perfected the combustion of the flame by breaking the rush of the gas; and that, had it been applied to a properly regulated burner

no gain would have resulted. This view is, to a great extent, supported by the effects of pressure upon the gain in light obtained by its use, as Mr. Rowden and Captain Webber found that the increase in light given by it varied from 30 per cent. with a pressure of 0.46 of an inch, to upwards of 200 per cent. with a small burner and a pressure of 0.84 of an inch. But although this was an important factor, a still more important one remained; and that this was so is shown by the fact that, after being used for a considerable time, the perfecter lost its power to a very great extent, which would not have been the case had its action been purely mechanical.

Platinum is a metal which possesses the property of condensing gases upon its surface, and rendering them chemically more active than when in their normal condition; so that if the condensed gases have a tendency to enter into chemical combination, the presence of the metal, especially when heated to a certain extent, will set up chemical action. That this is the case is clearly shown by heating a piece of platinum foil to redness, allowing it to cool until it ceases to be visibly hot, and then holding it in a current of mixed coal gas and air, when the metal at once becomes red hot, and often reaches a temperature at which the gas is ignited. This is due to its compressing the oxygen of the air and the hydrogen of the coal gas upon its surface, and bringing about their combination—an action which evolves great heat, and raises the platinum to incandescence, although the actual temperature necessary to ignite the gas may not be reached, as the heat required to do this is very great. In the perfecter, the strip of metal, besides regulating the force with which the two streams of gas impinged upon each other, was raised by this action to incandescence in a portion of the flame which otherwise would have been several hundred degrees cooler, and thus converted the hydrocarbons into acetylene, and by its superheating action reduced the size of the non-luminous zone. After a time, however, the platinum became attacked by the hydrocarbons of the gas, and the carbide of platinum formed ceased to have this regenerating action, and the perfecter lost its potency. It was this deteriorating action of the coal gas on platinum which I believe seriously militated against the success of the Lewis incandescent lamp, which was undoubtedly the most promising of its class, but which, for the reason I have given, soon lost its power.

By placing a platinum wire in the non-luminous zone of a flat flame, we can, if care is taken not to distort the flame, draw down the luminous zone to a considerable extent; and if a fine platinum gauze screen be placed on each side of the lower portion of the non-luminous zone, it acts in the same way as regeneration does, and gives a considerable increase in luminous surface. Another way in which the non-luminous and non-effective portion of the flame may be reduced is by increasing the rate of combustion at the bottom of the flame. Ten years ago, Sir James Douglass introduced his multiple Argand, in which a number of circular flames burnt one within the other, while a series of deflectors caused a sharp current of air to impinge upon the outer flames at their base; causing a very great increase in the illuminating effect produced per cubic foot of gas consumed. In this burner the outer layers of flame were sacrificed to create an intensity of temperature which should perfect the light-giving power of the interior layers; and by setting up this intense combustion at the base of the flame, the service of the burner was raised to 6 candles per cubic foot of 16-candle gas. A still better example, because more widely known, of the same thing is to be found in Mr. Sugg's "London" Argand, in which the metal cone round the burner plays the same part as the deflectors in the Douglass burner, although to a smaller degree, while the cluster burners also benefit to a certain extent by the increase of temperature which their arrangement brings about; and I cannot help thinking that if our burner makers will attack the question of improving the flat flame by thickening the flame a little, and introducing a suitable form of deflector to bring a current of air against the base of the flame, we shall soon be able to squeeze a couple of candles more service out of these trusty old servants, and thus add an iota more cheerfulness to our gas-lit cities.

The question of how far it may be possible to go in the extraction of light from gas, is a question so complex that I hesitate to even mention it; but I think that many things point to the best forms of regenerative burner having

nearly reached the limits of practical possibilities. So that, in conclusion, it may be well to see in what other direction the development of light from coal gas may yet extend. The 4 per cent., or thereabouts, of heavy hydrocarbons, which in the ordinary combustion of coal gas yield the acetylene necessary for the liberation of the carbon particles which are essential for the production of luminosity, are so small in quantity, as compared with the constituents which in the burning of flame merely generate heat, that the idea naturally arose of the incandescent burner, in which, by admixture of air with the coal gas before combustion, a non-luminous but hotter flame could be produced and utilized for heating various refractory materials up to incandescence, so that they, and not the carbon, should emit the light. In burning coal gas from an open tube, the highest temperature attained is about 1100° C. (2012° Fahr.); while in the more perfect combustion taking place in a flat flame, 1368° C. (2462° Fahr.) is attained. But by mixing air with the gas before combustion, as in the ordinary Bunsen burner, until the mixture burns with a quiet and non-luminous flame, a temperature of 1500° C. (2732° Fahr.) is reached; while by increasing the quantity of air until the flame is on the point of flashing down in the tube, the temperature rises to 1630° C. (2966° Fahr.), or nearly 300° C. hotter than the luminous flat-flame. It is this high temperature which is taken advantage of to raise the various materials used in incandescent burners to the point at which they emit the required light.

In order to gain a relative idea of the service obtained per 5 cubic feet of 16-candle gas from the various classes of burner, choosing the best of each kind for comparison, we may take it (roughly) as being as follows:—

Service yielded by Various Burners per 5 Cubic Feet of Gas per Hour.

Flat-flame	12.5
Argand, ordinary	14.0
London Argand	16.0
Regenerative	52.5
Incandescent	70.0

A colleague of mine at the Royal Naval College—Professor Lambert—has been for some time past experimenting in his own house as to the cost of various forms of illuminating on a domestic scale; and his results, for actual working over a considerable period, he has kindly placed at my disposal. They are as follows:—

Annual Cost of Maintaining a Light of 48-Candle Power (say, 2000 Hours' Burning).

RESULTS OF TESTS UNDER PRACTICAL CONDITIONS.
GAS.

Argand Burners.	
Three 16-candle lamps, each consuming 5 cubic feet of gas per hour	30,000 c. ft. of gas at 3s. per 1000 c. ft. 90s. Renewals of chimneys 3s. — 93s.
Regenerative Burner.	
One small lamp, consuming 6 cubic feet of gas per hour	12,000 c. ft. of gas 36s. Repair of lamp, &c. 5s. — 41s.
Alco-Carbon Burners.	
Two No. 2 Bray burners, each consuming 3½ cubic feet of gas per hour, carburetted with naphthalene	14,000 c. ft. of gas 42s. 52 lbs. of naphthalene, at 3d. 13s. — 55s.
Incandescent Burner.	
One new large mantle, 48-candle power, burning 3½ cubic feet per hour	7000 c. ft. of gas 21s. 0d. Renewal of mantles, 3 at 2s. 6d. 7s. 6d. Renewal of chimneys. 1s. 6d. — 30s.

PETROLEUM.

Large Lamp.	
One 48-candle lamp, burning 1 gallon of oil in 28 hours	Oil consumed, at 7d. per gallon, 41s. 8d. Chimneys, wicks, &c. 2s. 4d. — 44s.
Small Lamps.	
Four 12-candle lamps, each burning one gallon of oil in 84 hours	Oil consumed 55s. 6d. Chimneys, wicks, &c. 2s. 6d. — 58s.

ELECTRIC.

Incandescent Lamps.	
Three 16-candle lamps, each absorbing 56 Watts	Cost of current at 8d. per unit { 224s. (1000 Watt-hours) Lamp renewals, six at 3s. 6d. 21s. — 245s.

The only remark which I have to add to this particularly interesting and useful table is that Professor Lambert has been extremely fortunate with his incandescent mantles and chimneys; while the regenerative lamp employed is manifestly too small to give anything approaching its maximum results. My own experiments would lead me to say that the incandescent and regenerative burners,

taking everything into consideration, are as nearly as possible equal in cost; each of them yielding the above amount of light for an expenditure of about 35s.

In the search, moreover, for the best method of generating light from coal gas, we must not overlook the quality of the light emitted. We should remember that the yellow light given out in the ordinary consumption of coal gas is eminently adapted for resting the eye, wearied by the actinic rays of the daylight; and that, although an intense white or bluish-white light is admirably adapted for picture galleries, and other situations where it is necessary to bring out delicate shades of colour, yet that in the living and working room such a light must in time affect the eyesight more or less. Incandescent lighting is still in its infancy; and it has yet to be discovered how to make a mantle or cone which will not deteriorate in use, and shall not be too brittle to withstand the jars of every-day work.

I have, in this lecture, attempted to place before you a general outline of the wonderful growth of our present methods for developing light from coal gas; and we may well be proud of the results of the work done in the past century. But is there no reverse to this picture? Has everything been done which might have been done to encourage and increase the demand for gas? The gas engineers and managers of this country may have been a little tardy in recognizing new principles; but their record is a noble one, and the one great mistake of the century does not rest upon their shoulders. For coal gas to take its proper place, it must be supplied at the cheapest possible rate; and all statistics show that the increase in consumption when the price of gas is low is very large indeed. The one thing which has more than anything else kept back the gas industry has been the fixing of the illuminating value at too high a figure. If a 14 instead of a 16 candle standard had been adopted here in London, an almost unbearable burden would have been taken off the gas manager's shoulders. Not one consumer in a thousand would have noticed any difference in the light—indeed, a little trouble on the part of the Companies in advising consumers as to the best forms of burner to use, would probably have resulted in an absolute gain; while the reduction in price consequent on the doing away with the need of enrichment, would have given an enormous impetus to the employment of gas as a domestic fuel.

At the close of the lecture, which was very warmly applauded,

Mr. HEPWORTH said it was impossible for anyone to do justice, in the time at the disposal of the meeting, to the brilliant lecture to which the members had just listened. He would, however, ask all present, more especially those members of the Institute who were old enough to remember the former lectures, whether in any previous experience they had had the pleasure of listening to one so lucid, so singularly clear, and so instructive as this had been. Professor Lewes had laid not only the Institute, but the whole gas profession under the deepest obligation; and he (Mr. Hepworth) had much pleasure in proposing a hearty vote of thanks to him.

Mr. J. M'GILCHRIST (Dumbarton) expressed his great pleasure in seconding the vote of thanks. He said he had never listened to a more excellent lecture, and had certainly never heard a better speaker. It was so excellent, in fact, that he did not think it would improve matters by saying anything more about it. They could only accord to Professor Lewes a very hearty vote of thanks; and he considered the Council should also be thanked for providing so able a lecturer.

Mr. W. SUGG said he did not rise to discuss the lecture, but only to support the motion. He had been carried back to the first meeting of the Institute; for the voice of Professor Lewes had certain intonations in it which recalled to his mind the voice he used to hear many years ago, when the progress of making gas was to a very great extent assisted by the lectures which were given annually. He thought it was a good augury for the success of the Institute in future that the Committee should have found a means of renewing this communication between them and the highly scientific body of chemists; and he hoped this experiment would be continued for many years. As Professor Lewes had said, they had been struggling for years in practice, and had not had anybody, up to the present, to tell them where theory and practice combined. He (Mr. Sugg) had worked for many years on this matter;

and he acknowledged that, until he saw the lecturer's experiments with regard to acetylene, he never thoroughly understood the causes of the luminosity of a gas-flame. They had the same sort of general idea that Sir Humphry Davy had with regard to solid particles; but they did not know until that morning how those solid particles were converted into light. There was an idea about keeping the flame hot, or, as he used to contend, keeping the gas cool. It was a very difficult thing to do the one without the other; and certainly his opinion was that the gas, being kept cool before it reached the point of ignition, gave a very decided increase of illuminating power. But he afterwards found that the improvement arose from keeping the flame hot by substituting a non-conducting for a conducting material, so that the heat should be concentrated in the flame; and now they had heard the reason why this was so. He should like to have gone at some length into the points raised by the lecturer, though his criticism would have been entirely of a friendly character. But he would only say that this was a practical and theoretical lecture combined; and he hoped the results would not be lost to the gas industry.

Mr. D. BRUCE PEEBLES (Edinburgh) desired to express his special thanks to Professor Lewes for one single point he had put forward. At present, in Edinburgh, they were very eagerly contesting the question as to the maintenance of 28-candle gas; and Mr. M'Gilchrist was one of the strongest opponents of reducing the quality in Scotland. He (Mr. Peebles) hoped this lecture would have brought him to a different opinion; for it seemed that the future of Scotch gas managers depended on the lowering of the illuminating power. They were having electricity introduced in all shapes and forms; but the lecture they had just heard would prove most incontestably that gas had a great future before it. Electricity had been the friend of gas. It had promoted the improvement of burners; and wherever it was introduced gas had flourished.

The PRESIDENT, in putting the resolution said he should only like to say for himself that the combined theory and practice of Professor Lewes had opened their eyes to facts which they only saw dimly before, and many had not seen at all. If they carefully considered what had been said, many mistaken opinions, which had been passed off as having something in them, would be cleared away.

The resolution was carried by acclamation.

Professor LEWES thanked the members of the Institute for the kind way in which they had received the lecture. He could assure them that his labour on the subject was one of love; and he hoped before his working days were over that he should have been able to do some good, at any rate, to the gas industry.

The PRESIDENT then announced that Mr. R. B. Prosser had kindly placed at the disposal of the members some *fac-simile* copies of a letter written by William Murdoch in vindication of his character and claims. He believed it was Murdoch's only literary production, with the exception of his paper in the "Philosophical Transactions." A copy was given to Mr. Prosser by one of Murdoch's grandsons; and one was found amongst the papers belonging to the old firm of Boulton and Watt. He believed that Mr. Richard Tangye, of Birmingham, had another. But, apart from these, there were no others known to exist. The members were under a great obligation to Mr. Prosser for having placed these copies at their disposal; and he begged to propose that a vote of thanks be accorded to him.

The proposition was carried unanimously.

Masonic.—Those of our readers who were present at the Emergency meeting of the Evening Star Lodge, on Monday evening last week, for the reception of the masonic members of The Gas Institute by the President (W. Bro. Valon), will be interested to learn that a full report of the proceedings will appear in the *Freemason* and also in the *Freemason's Chronicle* on Saturday next.

The Use of Gas in Lighthouses.—A few evenings ago, an interesting experiment was made at Howth (Dublin) to test the powers of Mr. J. R. Wigham's new gas-burner for lighthouse purposes. It was exhibited through the "giant" lens, about which a paper was read at the Royal Dublin Society a few weeks since, as mentioned in the JOURNAL at the time. The lens was fixed in the experiment house near the Bailey Lighthouse; and the light in the latter was at full fog power, in order that a comparison might be made between it and the new light. The latter shone very clear, and the flashes were extremely bright and distinct. The Commissioners of Irish Lights witnessed the exhibition.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1197.)

AFFAIRS in the Stock Exchange during the past week have been extremely devoid of interest. The chief business was the settlement; and, when that was got through, matters became very quiet indeed. Ascot races proved a powerful counter-attraction, and thus tended to reduce the attendance; while the closing of the Exchange on Saturday further curtailed the hours of business. Beyond this, there seems to be a considerable disposition to remain quiet until after the General Election. In result, prices have, on the whole, not varied much during the week, except in markets which have been influenced by some special circumstances—e.g., American rails. High-class securities, of course, are kept up by the demand for investments; the Money Market continuing in the state of plethora which has characterized it now for so long. The Gas Market was very quiet again—indeed, it could scarcely have been quieter on some days. There have been few changes in quotations, beyond those arising from *ex div.* alterations. But they are for the most part favourable; and they also indicate the continued demand for the secured issues by way of investments. Of the Gaslights, the "A" have varied by a fraction only; being lowered $\frac{1}{2}$ at the start. So little was subsequently done in them as scarcely to afford any indication of a marked tendency; but the closing bargain at 210 was the best of the week. Much more was done in the secured issues, with a buoyant tendency; and all the debenture stocks show a moderate improvement. Very little business was done in South Metropolitan, and prices were only poor; the "B" falling $1\frac{1}{2}$. Nothing at all was marked in Commercial; and quotations were steady. The only alteration among the Suburban and Provincial undertakings is a further advance of $1\frac{1}{2}$ in Brentford new. The Continental Companies have moved somewhat irregularly; Imperial remaining with a flat tendency, while Union and European show an advance in value. None of the rest of the Foreign division have made any particular sign. Water continues to rise steadily; and several stocks show moderate improvements—ranging from 1 to 3 per cent.

The daily operations were: Extreme quietude was the rule on Monday, and but few issues were touched. Brentford new rose $1\frac{1}{2}$. But Imperial Continental receded 1; and Gaslight "A," $\frac{1}{2}$. Prices were better on Tuesday, except for Imperial Continental. South Metropolitan "B" fell $1\frac{1}{2}$. Water was firm. Southwark ordinary and "D" shares and both Lambeth issues rose 2; and New River debenture, 1. Gas remained quiet and unchanged on Wednesday; and the only move in Water was a further rise of $1\frac{1}{2}$ in Southwark "D." Thursday produced no new feature in Gas; and the sole change was a rise of $\frac{1}{2}$ in European part paid. Chelsea Water rose 1. Friday closed a quiet week, without further alteration than an advance of 1 in Gaslight 4 per cent. debenture.

ELECTRIC LIGHTING MEMORANDA.

The Newcastle Electric Lighting Undertaking—The Work of the Electrical Trades Section of the London Chamber of Commerce—An American Electrician on the Electrical Industries of London.

A PAPER on the Newcastle-on-Tyne Electric Supply Company's undertaking was recently read before the Institution of Electrical Engineers; and the authors—Mr. A. W. Heaviside and Mr. R. C. Jackson—naturally did their best to make a good showing for the interesting venture. For us perhaps the most material consideration in regard to electric lighting at Newcastle is the fact that the local gas supply is one of the very cheapest—perhaps actually the cheapest—in the world; and it is therefore interesting to see how an electric lighting company can face the competition of gas sold at 1s. 10d. per 1000 cubic feet, with 10 per cent. discount. To begin with, the Electric Supply Company recognized the necessity of putting the lowest possible price upon their light; and they accordingly fixed their rate at $4\frac{1}{2}$ d. per unit, with 5 per cent. discount. Thus, in addition to having the cheapest gas, Newcastle has the advantage of the cheapest public electric supply in the world. The station was equipped with Brush electric plant and Robey steam-engines; the system of supply being that of the high-pressure alternating current, with transformers of the Elwell-Parker type. The Company can buy their steam coal for 5s. 10d. per ton; and three 200-horse engines represent the generating power. Unlike every other concern of the kind that we ever heard of, the capital account is stated to be closed; so it may be concluded that the Directors are sensible enough to try what their business prospects really are before launching out upon more than the 26,000 lamps of 8-candle power which constitute the actual working capacity of the station. It is stated that the "load factor" of the installation is only 8.16 per cent. The electricity as delivered costs about $2\frac{1}{2}$ d. per unit for running expenses; but a good deal seems to be omitted from the calculation of which this figure is the result. The capital outlay upon the station has been low, working out to about 30s. per lamp installed, or £50 per unit. In discussing the paper, Mr. Crompton, of course, endeavoured to show that the Company would have been wiser had they elected to use the low-pressure

continuous system; but it was pointed out that, if slightly less working expenses could be claimed for this system, the capital expenditure would have been much higher. The revenue derived from the Newcastle electric lighting seems to be about the average of other places—between 8s. and 9s. per 8-candle lamp per annum, which may be roughly translated, for easy memorizing, into an average of 1s. per candle power per annum.

The London Chamber of Commerce has an Electrical Trade Section; but this organization, from which great things were once expected, seems to be but a dead-and-alive affair. The Section lately held its annual general meeting, when Major Flood Page was elected to the chair, in succession to Mr. R. E. Crompton. Steps are being taken, under the auspices of the Section, to consider what should be done for the representation of the British Electrical Trades at the Chicago Exhibition. The cause of electrical traction is exercising the minds of so many people connected with the electrical trades, that the Section has appointed a Standing Committee to consider and deal with this class of questions, reporting to the Section from time to time. It is understood that, but for this action of the Section, it was within the range of possibility that yet another Association of Electricians would have been formed for the comfort and convenience of such as occupy themselves with matters electrical that do not particularly interest the telegraph and lighting men who constitute the majority in the existing technical societies. One would imagine, however, that electricians of all varieties have already all the accommodation they need for talking to each other, and bringing their prophecies and expectations before the outer world.

An American electrician has been giving his friends at home an account of his impressions of the condition and prospects of the electrical industries of London. He appears to have been struck by many things, and remarks of the inhabitants of London that they "spend so little money for heat, that they can afford to waste some on light; and they pay almost twice as much for an incandescent lamp as we do in New York, in spite of the fact that the price of coal is about the same in both cities." This is one way of looking at the matter; but it does not recommend itself as a very practical or instructive method. The American critic was not without a sense of humour, however; for he remarks that he "visited most of the central stations, and learned from the resident engineer of each that his plant was the most economical of all." This is probably the experience of most of the members of those municipal deputations which have made the same round in the vain effort to ascertain, by inspection and comparison of works in operation, what is the best system for adoption in their own particular case. Again, the gentleman from the States observed that with us "the consulting engineer asserts himself in a way that is unheard of in New York;" and he declared that it "did his heart good to see so many people living on one job." Perhaps this circumstance accounts more satisfactorily than the first hypothesis for the comparative dearness of electric lighting in London. It is some gratification to find that, in American eyes, the electrical industries of England appear to be at least respectably carried on. We may have an Old-World preference for what is good over what is cheap; but this is a drawback, from the point of view of the "hustling" electrician, which cannot be helped.

FRENCH RULES FOR LIGHTING.

(Concluded from p. 1115.)

WHEN it is a question of arranging for the lighting of a large hall, architectural and other necessities will determine the height and character of the lustres or centres; and their number will also often be fixed by the same conditions. The illuminating power of these centres or lustres may then be determined with a view to securing a minimum intensity of lighting in the horizontal plane situated at a given height (1 metre, for example) above the floor.

If the positions of the sources of light are imposed by architectural necessities, it often follows that the distribution of the light will not be so uniform as might be desired. (This cannot be helped.) From the practical point of view, the reflecting action of a ceiling can be replaced by the illuminating power of an imaginary luminous source, placed vertically over the actual one, the illuminating power of which is taken to be a certain fraction k of that of the latter. M. Wybauw has made some experiments to determine k in a hall of moderate dimensions; and he has found that we can admit, without much error, $k = 0.5$. The introduction of this imaginary light-source into the calculations enables the problem to be treated mathematically; thus giving certain results. But the looseness of the coefficient k prevents the assignment of any great value to the results of calculations of this class. We are therefore driven back upon empirical indications and information deduced from practice.

It is interesting to discuss how the quantity of light may vary according to the geometrical dimensions of an interior without altering the effect. It would appear at first sight that, in order to give the same lighting to two apartments geometrically similar, the quantities of light provided must be in proportion to their surfaces or the squares of the homologous dimensions.

This would be so in the theoretical case of the lighting of spheres from their centres; but it is altogether different in practice. M. Fontaine has ascertained that in most cases the quantity of light should be proportional to the volume of the hall, and not merely to its superficies. For a hall with walls of medium tint, for example, it has been determined that a quantity of light working out to 0.5 candle per cubic metre of the content gives satisfactory lighting when lamps of from 10 to 16 candle power, properly distributed, are employed.

It should be remarked that a hall is never quite empty. It contains furniture and other objects which are so many obstacles to the propagation of light. The supports of the lamps, lustres, candelabra, &c., also intercept a notable amount of light; and, finally, the air itself has not the perfect transparency which the law of radiation supposes. All these detrimental can be summed up in the statement that the efficient lighting of a source stops short of its full calculated value. The amount of the discrepancy depends upon a variety of practical considerations—the number of obstacles, and the state of the air. It is not the same for a public hall, when the middle space is entirely empty, as for a furnished saloon, for a workshop full of tools, &c.; and it is obviously greatly altered in times of fog.

Taking account of all these qualifying considerations, Dr. Palaz remarks that the data relating to the lighting of interiors of various kinds are very vague. All appears to be reducible to a first assumption of the number of candles per square unit of surface, or cubic unit of capacity, and then to a distribution of the light-sources in such manner as to obtain the most uniform lighting. If, says Dr. Palaz, some specialists in lighting installations are to be followed, it will result that calculations based upon the fundamental laws of photometry will be insufficient to govern installations of all kinds. Cotton and woollen mills, for example, need a great deal of light, especially when coloured or black threads and fabrics are handled therein. According to the experience of M. Uppenborn, if one 10-ampere arc lamp (say, 400 candle power net) will light a space of 2000 square metres out of doors, or 1400 square metres in a railway station, it will only light 500 square metres of a foundry, 200 square metres of a machine-shop, and the same area of a spinning-shed. Dr. Palaz says that a simple way of testing the quality of lighting in a works or factory consists in asking the work-people where they can see best; and he remarks that “the quality and the quantity of the output of a workshop is an indication of quality of the lighting.” He adds the remark that the object in artificial lighting is not always the distribution of light with strict uniformity. For manual work or reading, it is often desirable to concentrate the light upon certain points; and in luxurious lighting it is desired to produce a harmonious mixture of light and shade which gives relief to figures, ornaments, &c., even at the expense of the general lighting. Speaking of the common use of reflecting shades for concentrating light downwards, Dr. Palaz protests against the usual constrictions of these at the top, which prevent satisfactory illumination of the ceiling.

This topic of reading-shades leads up to the consideration of the amount of light required for reading. Mr. L. Weber says that the rapidity with which a person can read depends directly upon the degree of lighting. Mr. Cohn declares that nobody ought to attempt to read much or long with less light than that of 10 candles at the distance of 1 metre from the printed page. Dr. Palaz remarks that if anyone wishes to read cursorily a certain printed text at a given distance from the eye, there is a minimum of lighting at which this can be done. If the lighting falls below this limit, the reading is no longer cursive—every word has to be separately read; and the general tendency is to draw the page nearer to the eyes in order to increase the apparent angle subtended by the characters. Now, these observations are of a photometrical nature—being based upon the visual acuity; and they are sufficiently precise to afford measurements of lighting. If anyone repeats the experiment with characters of unequal sizes, it will soon appear manifest that, with the same distance from the eye to the page, the lighting must be so much better for cursive reading as the characters diminish in size. A single sheet of paper containing a series of phrases printed in characters of graduated sizes will therefore constitute a true, but simple, photometer of lighting. Mr. Schutte has designed a photometer upon this principle; and so has M. Wybauw. Dr. Palaz concludes his treatise on this subject by briefly discussing the Weber and Mascart photometers for diffused light.

Mr. R. E. Middleton has been appointed as an Assistant-Commissioner to the Royal Commission on the Metropolitan Water Supply.

Death of Mr. A. E. Carter.—We regret to record the death, on the 13th inst., of Mr. Alfred Edwin Carter, Superintendent of the West Middlesex Water-Works Company. For nearly thirty years deceased filled the position of Inspector and Superintendent of the Company's Kensington district; but about ten years ago he was entrusted with the supervision of the whole of the London district. Last month he completed his fortieth year of service with the Company; and as he was intimately acquainted with their entire system of distribution, and always proved himself to be equal to meeting any emergency, his loss will be greatly felt.

TECHNICAL RECORD.

THE PRODUCTION OF OIL GAS FROM RUSSIAN PETROLEUM.

At the Meeting of the London Section of the Society of Chemical Industry yesterday week, at Burlington House, Piccadilly—Mr. THOS. TYRER, the Chairman, presiding—a paper was read by Professor VIVIAN B. LEWES, F.I.C., F.C.S., of the Royal Naval College, Greenwich, on the above subject.

The author commenced with a reference to a paper read before the Society by Professor H. E. Armstrong, in 1884, on the manufacture of gas from oil. In that paper, the writer gave the result of his analyses of the liquid deposited from oil gas under pressure, which showed it to be rich in such benzenoid hydrocarbons as benzene and toluene, mixed with the hydrocarbons of the $C_n H_{2n}$ and $C_n H_{2n-2}$ series. This, Professor Lewes remarked, was of great interest, as it showed that the vapours of these compounds were present in the uncompressed oil gas. But as the deposition of nearly a gallon of these liquid hydrocarbons from 1000 cubic feet of the gas only reduced its illuminating value from between 50 and 60 candle power to 40 candle power, it was evidently important to gain an insight into the nature of the hydrocarbons present not only in the gas, but also in the tarry residue which distilled over during decomposition; whilst to trace the decompositions taking place, it was necessary to examine the products formed at lower temperatures than those usually employed in oil-gas manufacture.

Professor Lewes here described the apparatus he employed to carry out the destructive distillation of the oil for the earlier of the experiments recorded in the paper. He used an iron retort 10 inches long and 4 inches in diameter, the mouth of which was closed by a flat iron disc. The oil-supply pipe was led through the front disc to within $\frac{1}{2}$ inch of the back of the retort; and the gas passed away by a pipe running upwards from near the mouth of the retort to the vessel in which the residue was condensed. In order to observe the temperature of the side and interior of the retort, the furnace and the disc were provided with sight holes; and the retort was packed with coarse iron turnings to give as large a heating surface as possible. The gases were led into small 10 cubic feet gasholders, and were analyzed directly they were cold; and also after standing. [A description of the method of analysis employed will be found at the bottom of the second column of p. 692 of the JOURNAL for April 14 last year.] Having briefly referred to this method, the author remarked that, in the tables exhibited in the room, the hydrocarbons were given as saturated and unsaturated; his experience being that at present it was absolutely impossible to attempt any subdivision of these bodies, and that, in cases where it had been attempted, the results were most misleading. An Evans photometer was used to determine the illuminating value of the gases; the burner, pressure, and rate of flow being carefully regulated to suit the quality of the gas, and give the most perfect flame—the results being then calculated to a consumption of 5 cubic feet. With this exception, the testings and corrections were all made according to the “Instructions” of the Gas Referees. The temperatures employed were judged on the basis of Pouillet's experiments, as the form of apparatus used did not lend itself to direct pyrometric determinations.

The author then referred to the figures contained in the table on the next page.

Commenting upon the experiments made in the small retort (the results of which are shown in columns A, B, C, and D), Professor Lewes said that, starting with a temperature of 500° C., and running the oil in at a definite rate of flow, only 12 cubic feet of gas were obtained, and a large percentage of residuals. But the latter did not represent the whole of the residuals, as a considerable proportion of hydrocarbons, which were present almost entirely as vapours, went forward with the gas, and condensed in the gasholder. After their condensation, the gas only amounted to 12 cubic feet, and contained the unsaturated and saturated hydrocarbons in almost equal proportions. The low temperature was an important point. In the second column, he gave the results of decomposing the oil at 700° C.; in the third, at 900° C.; and in the fourth, at 1000° C. Here they could trace the effect of the increase of temperature not only upon the yield of gas, but upon the proportions of the unsaturated and saturated hydrocarbons. At 900° C., it would be seen that there was not only an increase in the volume of the gas, but in the illuminating power; while the unsaturated hydrocarbons were the same as in the previous column, but the saturated hydrocarbons showed a large increase. At the same time that they had these changes in the gas, they also found considerable changes taking place in the residues. In the second column, the residuals were shown to have decreased from 59.1 to 22.7 per cent. of the original oil decomposed; and 36.5 per cent. distilled below 200° C., 9 per cent. at 123° to 125° C., and 9.5 per cent. at 140° C. to 150° C. Of the 12.7 per cent. of residuals in the third column, not more than 1 per cent. distilled at 100° C., and 5 per cent. at a little over 110° C. At 1000° C. (column D), there was another increase in the volume of the gas; but the illuminating power fell to 42 candles. The percentage of saturated hydrocarbons slightly increased; while the hydrogen rose to 21.54 per cent.

The Decomposition of Russian Distillate Oil.

Specific gravity = '864. Flash point, 149° Fahr. = 65° C.

	A	B	C	D	E	F
Temperature of retort	500° C.	700° C.	900° C.	1000° C.	900° C.	900° C.
Size of retort	1 ft. 10×4 in.	1 ft. 10×4 in.	1 ft. 10×4 in.	1 ft. 10×4 in.	4 ft. 6×2 in.	3½ ft. ×9½ in.
Cubic feet of gas per gallon	12	60	72	84	92	98
Percentage of residuals	59'1	22'7	12'7	11'8	18'3	20'2
Illuminating Power in—						
Candle power per 5 cubic feet	54'8	50'7	57'1	42'2	46'0	49'6
" " " gallon of oil	131'5	608'4	822'2	708'9	846'4	972'1
In grains of sperm do.	15,782'4	73,008	98,668'8	85,075'2	101,568	116,659'2
Analysis of gas percentages—						
Unsaturated hydrocarbons	39'13	36'56	36'55	22'04	29'79	33'16
Saturated hydrocarbons	42'41	49'45	53'97	54'83	62'30	45'15
Hydrogen	13'58	6'26	11'86	21'54	4'79	19'65
Acetylene	0'052	0'084	0'38	0'46	—	—

On the other hand, the unsaturated hydrocarbons fell to 22'04 per cent. The colour of the gas had become "sooty," from separation of the carbon; and this, as well as the increase in hydrogen, showed that the temperature had been forced to a point at which some of the hydrocarbons were entirely broken up, and that it had been the unsaturated hydrocarbons which had been destroyed. The residuals collected from the gas made at this temperature were of nearly the same volume as those obtained by decomposing the oil at 900°; but they differed from it in containing nothing with a lower boiling point than 140° to 150° C. It would be observed that the best results in columns A to D were those obtained in C—72 cubic feet of 57'1-candle gas; but as anyone who has worked with oil gas on a continuous scale with large retorts would only too well know, this was a poor result.

After these preliminary experiments, the next thing the author did was to try larger retorts, to see how far the surface in the retort affected the changes taking place. For one experiment he used an iron retort 4 ft. 6 in. in length and 2 in. diameter, closed at one end, and with an oil-tube passing down the centre, and terminating about an inch from the closed end, while the gas was led away from the other. For the second experiment, a Patterson oil-retort, 3 ft. 6 in. by 9½ in., was employed, with two oil-tubes passing to the back. A temperature of 900° C. was used in each case. In this way, it was possible to find the conditions under which the oil could be decomposed to the best advantage, as the experiments already described gave the cracking of the hydrocarbons with a very little heating of the gases after their formation; whilst the long (2 inch diameter) tube retort gave an excess of heating by contact with the red-hot side of the tube, and with the large round retort, on account of its capacity, the effect of less contact with the sides, but a longer baking in mass of the oil gases and vapours, could be traced. (The results obtained are given in the columns E and F in the table.) The author pointed out that here they had a large increase in the volume of gas, and in the illuminating power per gallon of oil used. Taking the Patterson retort, they had 972'1 candle power per gallon of oil; while with the short retort, the best result obtainable was 822'2 candles.

Continuing, Professor Lewes said that Russian petroleum was widely different from the Pennsylvania product, and had been shown to consist largely of hydrocarbons of the $C_n H_{2n}$ group—*pseudo-olefines* or naphthenes; and, with the exception of $C_{13} H_{26}$, a complete series from $C_8 H_{16}$ to $C_{16} H_{30}$ had been separated from it. When this oil was first cracked by contact with heated surfaces, it decomposed, yielding both saturated and unsaturated hydrocarbons, the latter containing homologues of acetylene. Some of these hydrocarbons were gaseous, whilst the remainder varied in their boiling-point from 60° C. to very high temperatures. From experiments he had made, he found that, on heating ethylene by passing it through a heated narrow tube, nothing happened until a temperature of 800° C. was reached, and then at between 800° C. and 900° C. it broke up into acetylene and methane; and if the heat was kept well up to this, the acetylene polymerized to benzene, which could be condensed from the gas and identified. If the heat were continued and raised to about 1000° C., further polymerization would take place, with the formation of still higher bodies, among which crystals of naphthalene were conspicuous; whilst, at 1100° C., these again broke down to acetylene, which then decomposed into carbon and hydrogen. Methane, when heated at 900° C., practically underwent no change; but ethane at this temperature gave up hydrogen, and became ethylene, which again decomposed into acetylene and methane. From his experience, the author had little doubt that the formation of benzene from Russian petroleum was due not to one action but to several. In the first place, all experimental evidence clearly showed that benzene was formed from acetylene by polymerization, and that this took place at temperatures existing in the oil-gas retort. But it was not conceivable that this addition could do more than contribute its share to the 20 per cent. of benzene to be found in the oil-gas tar from the Russian oil. Then, again, when the original oil was decomposed, large quantities of the higher paraffins were formed; and these, by elimination of hydrogen, yielded benzene. And, finally, the higher *pseudo-olefines*, of which the Russian oil itself consisted, probably partly broke down directly to benzene and paraffin in the same way that the simplest member of the group ($C_2 H_4$) yielded acetylene and marsh gas. The ease with which benzene could be obtained from Russian petroleum, he added,

was shown by the fact that, not far from Novgorod, it was manufactured on a very large scale by Messrs. Ragosin and Co., who obtained, according to Dr. Dvorkovitch, 400 kilos. of 50 per cent. of benzene and 30 per cent. of anthracene from 1000 kilos. of oil.*

In decomposing oil in retorts, the paper proceeded, two distinct periods of decomposition took place—(1) The breaking up of the oils under the influence of heat; and (2) the changes taking place in the first-formed products during their passage up the heated retort. An examination of the constituents of the gases formed during decomposition at a low heat in the short retort—conditions which practically eliminated the secondary action—gave a valuable indication of what was taking place. They found that, in the gas made at 500° C., the saturated and unsaturated hydrocarbons were in nearly equal proportions, but that, as the temperature rose, the unsaturated hydrocarbons gradually decreased in quantity, while the saturated hydrocarbons increased, as, although the higher paraffins were broken down by the heat, they formed methane, which was but little acted upon, and also hydrogen; and it was this breaking down of the richer hydrocarbons into a larger volume of simpler ones which gave the great increase in volume found at high temperatures and the consequent loss in illuminating value.

In examining the residuals obtained by "cracking" the oil in the Patterson retort, the author found that the original tar had a specific gravity of '944; and, on fractionally distilling it, there were found certain temperatures at which a far higher proportion came over than at others. He here exhibited a diagram, which strongly suggested that the large proportion of paraffins present in the portion distilling between 60° and 150° C. consisted of normal hexane and hexylene, which boiled at 68° to 71'5°, heptane and heptylene, which boiled at 90° C., and nonane, which boiled at from 136° to 138° C., while benzene was responsible for the large distillate at 80° C.

To determine the proportion of saturated and unsaturated hydrocarbons present, the distillates below 100° C. were mixed together, treated in a manner described by the author, and distilled; the result being: Olefines, 70 per cent.; benzene, 19 per cent.; and paraffins, 11 per cent. The fractions distilling between 100° and 150° C., had a specific gravity of '809, and gave: Unsaturated hydrocarbons 19 per cent. and saturated hydrocarbons, 81 per cent.; from 150° to 260° C., a specific gravity equal to '956, and gave unsaturated hydrocarbons 20 per cent., and saturated hydrocarbons, 80 per cent.; from 260° to 315° C., a specific gravity equal to 1'002, and gave unsaturated hydrocarbons 12 per cent., and saturated hydrocarbons, 88 per cent. This, Professor Lewes said, showed that the higher the distilling point and specific gravity of the fraction, the greater was the percentage of saturated hydrocarbons; while in the most volatile portion of the residue, the unsaturated hydrocarbons preponderated. During the fractional distillation of the tar, large quantities of naphthalene volatilized and condensed in the neck of the retort.

In concluding the paper, Professor Lewes remarked that in all experiments upon the decomposition of Russian petroleum, and in making oil gas from it on a large scale, great trouble was found from the ready deposition of carbon and pitch, which seemed to form from it more readily than from shale and American oils; and he imagined that it was upon this that the formation of so large a proportion of saturated hydrocarbons in the residuals depended. When cracking the Russian oil by itself, the best results obtained were 98 cubic feet of 48'5-candle power gas, equal to 972'1 candles per gallon of oil; and this agreed very well with the best results obtained in working in this way on a big scale. But when the Russian distillate oil was decomposed in the presence of an inert gas, and was then exposed to a high temperature for some time, a considerable increase in the total amount of illuminating power obtainable from the oil was observed. At the Beckton Gas-Works this oil was used on a large scale for making carburetted water gas, according to the improved Lowe system; and the illuminating power obtained and the volume of gas formed was considerably higher—1200 candles per gallon of oil being obtained instead of 972 candles. This was an increase of more than 23 per cent., and was due partly to the diluting influence of the water gas, which prevented the decomposition going too far, and also to the breaking up of the benzene, which otherwise would have found its way into the residuals. An analysis of the tar obtained from the carburetted water-gas plant at Beckton, and which was given in

* See ante, p. 960.

a paper read by Messrs. Paddon and Goulden at the May meeting of the Incorporated Institution of Gas Engineers, showed that it contained above 76 per cent. of water, and on removing this only 1.19 per cent. of benzene was found in the concentrated residue.*

In the course of the discussion which followed,

The CHAIRMAN said that several important communications had been read before the Society on the subject of petroleum, and the present one was by no means the least important of them. He would remind the members (as they had already been reminded by Professor Lewes) of a paper which, at the time it was read, was predicted to become historic—he referred to the paper by Dr. Armstrong. If he might say so, without any disrespect to a scientific man, he thought it would have been well if the promise which was then made had been carried out by a continuation of those researches. He believed it was admitted, if his memory served him right, that Dr. Armstrong's paper had in it the germ of a revolution as to the views held by scientific and practical men with regard to the decomposition that took place when liquid hydrocarbons were submitted to high temperatures under given conditions. It was to be regretted that the work then began was not continued; and his object in making these remarks was to urge once more upon the members not to drop, for their own sakes, a good thing when they had one in hand. There were many luring topics for criticism, investigation, and research; but research was nothing if it was not painstaking and continuous.

Mr. T. FAIRLEY, of Leeds, remarked that he had been very interested in Professor Lewes's experiments. He had not himself had any practical experience with oil gas; but he had had a good deal to do with ordinary coal gas work. He should like to ask the author of the paper if his notes supplied any information with regard to the rate of flow of the oil into the retorts, coupled with the amount of heating surface and the temperatures.

Mr. WATSON SMITH said he should like to ask Professor Lewes, if it would prove that benzene did, on high heating, pass into naphthalene. Benzene, when strongly heated alone, did polymerize and form diphenol; and this was its chief tendency. It was possible, however, that benzene, together with some lower unsaturated hydrocarbon, might yield naphthalene; but he could hardly conceive benzene polymerizing and forming naphthalene. Possibly diphenol derivatives were obtained. Was that the case?

Mr. BOVERTON REDWOOD said the paper before the meeting appeared to demand more consideration than he for one had been capable of giving it during the time which had been occupied in its delivery; but there were nevertheless a few general remarks which perhaps he might be permitted to make, without having fully digested all that the author had said. As to the practical importance of this subject, there could not be two opinions. Anyone who had taken the trouble to consider what had been done in the United States in the substitution of carburetted water gas for coal gas, would see that the time was approaching, and was within measurable distance, when to a large extent carburetted water gas or carburetted hydrogen would be introduced into general use in this country. The difficulty of obtaining cannel coal for carburetting was an increasing one, and the labour trouble was naturally favourable to such a change. They had only to consider that, in New York and other important cities in the States, the illuminating gas supplied was almost entirely carburetted water gas, to see that it was at any rate quite feasible to make the change he had indicated. Of course, circumstances here were somewhat different in regard to the supplies of material which it was proposed to use as a substitute; and he might be pardoned perhaps, as one who had taken some special interest in the subject of petroleum, for looking upon this change as a probable one upon a somewhat slender basis of fact. But the subject demanded, and was deserving of, the fullest consideration; and he therefore thought they should feel greatly indebted to Professor Lewes for having undertaken the investigation of this question. There was no doubt that a great deal of the work which had been done in this country, although experimental and practical, had been carried out unsystematically and unscientifically, and (he believed he might say) unintelligently. He did not apply this remark to the whole of the work that had been done; but a great deal of it had been wasted, from the fact that there had been no intelligent system adopted. He had had a good deal of experience in the manufacture of oil gas; and he believed he knew something of what the difficulties were that had to be contended with in carrying out such an investigation as Professor Lewes had undertaken. The results depended upon certain factors, and these factors were of a certain character under the particular conditions of the experiment; and it was difficult to work out from the results obtained under certain conditions the results one would get under different conditions. As to the view Professor Lewes had put forward with regard to the conversion of acetylene into benzene and other hydrocarbons, it was a convenient and pretty theory; and there was no doubt much to be said in favour of it. When in St. Petersburg, he had the privilege of witnessing experiments carried out by Messrs. Nobel, who were at that time effecting the conversion of the Russian residues on a large scale; and they

obtained extremely satisfactory results. The particular hydrocarbons composing Russian oil did lend themselves to that change with great facility; and he thought there could be no doubt whatever that the oils were therefore very suitable for use in the manufacture of oil gas. On the other hand, he was not at all clear—having in view his experience of many years ago in the manufacture of oil gas, and more recent experience in the conversion of the heavy hydrocarbons into lighter hydrocarbons—that it was wise to attempt the direct conversion of the heavy Russian oils into gas. He could not speak with confidence, as he had not carried the matter out experimentally to a large extent. As far as Professor Dewar's and his own experience had gone—he must not be taken to commit Professor Dewar to anything in his absence—their results led him to the conclusion that it might be desirable, in the utilization of these heavy hydrocarbons (which had a comparatively small commercial value), to effect their preliminary conversion into other hydrocarbons; and these might be more readily converted into gas—in point of fact, they were more manageable. One might more easily control the cracking of the liquid hydrocarbons into other liquid hydrocarbons of a lower specific gravity and greater volatility, and then the conversion of these into gas, than one could the conversion of the heavier hydrocarbons direct into gas. He hoped Professor Lewes would not overlook this point; and he believed he would find it a fruitful subject for investigation. His paper was a thoroughly practical and valuable contribution to their knowledge of the subject.

Professor W. FOSTER, having remarked that it was beginning to dawn on those interested in this question that a large amount of work had been done in this direction without any system or science, referred to the work of Drs. Edward and Percy Frankland, for which, he said, he had the greatest regard. Some of Frankland's work had never, in his opinion, been appreciated at its true worth. A few years ago, Dr. Percy Frankland showed the relationship between the paraffins. He tried marsh gas, and then took ethane and propane gas; and he believed he stopped there. The curious point was the olefines of the C_2H_4 series gave him 70 candles per 5 cubic feet. The CH_4 he believed he put at 5. The C_2H_6 had a light of about 35 candles. He forgot what the C_3H_8 had, but it was practically 53 candles. His (Mr. Foster's) point was this, that last year he had the opportunity of getting C_4H_{10} ; and the lighting value was almost double that of ethylene. The extraordinary thing about it was that ethylene had a lighting value practically double that of ethane. With the olefines they could get just double the lighting value for the same volume.

Mr. MORRISON inquired whether Professor Lewes had tried any experiments with regard to the permanency of the gas.

Mr. W. J. BUTTERFIELD asked if it was possible at a certain temperature to form acetylene from naphthalene. If this was so, he should be glad if Professor Lewes would kindly tell them the temperature, as naphthalene was a residual product in gas-works, and it would be quite easy to make a valuable thing of it if they knew the exact temperature at which acetylene could be formed. He was not quite clear on this point either. He understood that 20 per cent. of benzene could be found in the residues in certain instances; and he should like to know the conditions under which this obtained. Of course, he presumed that Professor Lewes meant benzene and not hydrocarbons of the benzene series. Again, as to the amount of benzene in the residuals of carburetted water gas, Professor Lewes quoted from a paper by Messrs. Paddon and Goulden, who gave a little over 1 per cent. of benzene. Was this in the residual dehydrated, and were there any paraffins accompanying it of about the same body or boiling point, or not? So far as he (Mr. Butterfield) had seen, from residuals from carburetted water gas, they had from 4 to 5 per cent. of benzene; but unfortunately it was considerably contaminated by paraffins of much the same boiling point. It would also be interesting to know if there was any large proportion of anthracene in the residuals from either pure oil gas or carburetted water gas. If 20 per cent. of benzene was obtained, or any amount of anthracene, it would be almost worth while making the gas as a residual. (Laughter.) He should further like to know whether the yield of gas, or say the value in candles per gallon of oil, was not larger from heavier Russian oil than the author of the paper had experimented with. Certain Russian oils would give (roughly speaking) 1000 to 1200 candles with admixture with water gas; and he should like to know if Professor Lewes had tried any heavier oils.

Professor LEWES, in reply, said that Mr. Fairley asked if he could give him any data as to the rate of flow of the oil into the retorts. It was manifest that, in the variations in the sizes of retorts employed, it would have been impossible to have used a constant rate of flow. In A, B, C, and D, the experiments were made with the same sized retort, and everything was done that could make them as nearly uniform as possible; and in these experiments he was working with a rate of flow of 2 pints per hour. It should be remembered that this was only a small retort. With the large Patterson retort, on the other hand, they were working with a flow of about $1\frac{1}{2}$ gallons per hour; and the way in which the three experiments at 900° were made comparable was by noticing the colour of the gas. When they were making gas at $500^\circ C.$, the gas came off as a dead white vapour. When they reached $700^\circ C.$, the gas was of a yellowish buff colour; and

* See ante, p. 908.

this meant that they were doing much better work. At 900° C.—the best temperature for cracking the oil—the gas was of a rich chocolate brown. In the three experiments, they simply worked to the colour of the gas; and the flow of oil was so regulated that they kept the gas at a rich chocolate brown. Mr. Watson Smith asked some questions as to the polymerization of acetylene into benzene, and then the formation of naphthalene afterwards. His experiments had gone so far as this: He had been working with narrow tubes, and taking the temperature of the gas as it passed through the tubes under conditions mentioned in the paper, he found that acetylene was formed when he reached a temperature of 800° and upwards. At 900° and close upon 1000°, if he placed a small cool receiving vessel at the end of the tube, he obtained a liquid which had the smell of benzene, which could be identified by the aniline test. Then, as the temperature rose, he got a smaller quantity of far heavier substance, and crystals of naphthalene began to appear; and carrying the heat of the tube to a still higher temperature, he did not get these, but simply carbon and hydrogen. This showed that, working at a temperature of from 800° to 900°, these various changes took place, and the building up of these various compounds resulted; but with a temperature (say) of 1250°, the higher compounds were not formed. Mr. Morrison asked a question as to the permanency of the gas. Properly made oil gas was far more permanent than coal gas. If they took a $\frac{1}{2}$ -inch compo. pipe, 120 feet long, made it into a small coil, and put it into a bucket of water at freezing-point, and passed coal gas through it of 16-candle power and upwards, they would not afterwards be able to read the illuminating power; but if they took a well-made oil gas of (say) 45-candle power, and passed it through the coil at freezing-point, it would be found that not more than 3 candles had been taken out of it. Oil gas made at low temperatures would not do this. The question as to the 20 per cent. of benzene he thought arose from, he was going to say, a misconception; but what he intended to infer, and what he said was, that 20 per cent. of the hydrocarbons distilling below 100° C. consisted of benzene, but 20 per cent. of benzene was absolutely obtained from the Russian oil. The figures he quoted were 40 per cent. and 50 per cent. benzene; and they also had 30 per cent. of anthracene formed. One gentleman said that, if this was the case, it would be worth while to make the residuals as the chief thing, and to use the gas as a bye-product, and this elicited a laugh. In two or three years time, they would find that this was what would be done. They could make a tar which would be of the greatest possible value with the Russian oil; and they would get an enriching gas from that at a very low rate indeed. He was also asked whether it was not a fact that, by using heavier oil, a higher illuminating value could be obtained. That was perfectly correct. If they used the crudest Russian oil obtainable, they would get, as one gentleman suggested, 1000 candles (he would not go so far as 1200 candles); and, moreover, they would obtain such a deposit of pitch, that they would not be able to work more than a few hours at a time.

A hearty vote of thanks was then passed to Professor Lewes for his paper.

Contemplated Purchase of the Runcorn Water-Works by the Local Authority.—The members of the Finance Committee of the Runcorn Improvement Commissioners have waited upon the Directors of the local water-works for the purpose of making preliminary inquiries with regard to the works being transferred to the local authority. The deputation having stated the object of their interview, the Directors promised to carefully consider the subject, and furnish, as soon as possible, the desired information.

The Rathmines Water Commissioners and their Reservoirs.—A special meeting of the Rathmines Commissioners was held on Monday of last week to consider the position in which they stood as to the decision of the House of Lords in the matter of the construction of reservoirs on the Dodder. It was agreed, after a full discussion, to engage the services of an eminent engineer, if found necessary after conference with the mill-owners, to report fully on the present state of the water-works, having regard to the judgment against the Board.

Sales of Shares.—Among a number of shares in various companies sold at Portsea a few days ago, were two £5 (1861 issue) 10 per cent. shares in the *Portsmouth Water Company*, which realized £13 7s. 6d. each; also one "C" £50 fully-paid share in the *Portsea Island Gaslight Company*, which produced £98, and two others, which fetched £99 per share. At Dundee last Friday, an annuity of £45 11s. of the *Dundee Gas Commissioners* was put up at £289, and was purchased by the Commissioners at £300 5s. per £10 annuity—£1362 in all—or about 30 years' purchase; and a £3 annuity of the *Broughty Ferry Gas Commissioners* was submitted at £89, and was sold at £90 5s.

The Water Supply of Pudsey, Farsley, and Calverley.—The Joint Committee of the Pudsey, Farsley, and Calverley Local Boards have decided to apply to the Bradford Corporation to be supplied with water in the three districts on the terms that the Liversedge Local Board had obtained by their opposition to the Corporation Bill—viz., that they should be supplied with water on the same terms as it was supplied within the borough, or at the price of 6½d. per 1000 gallons when delivered in bulk, and to begin at 1s. 6d. for small consumers where the present scale commenced at 3s. 6d. per quarter. If the Corporation refuse to place them on these terms, the Committee state that they will be justified in asking if they decline the responsibility of supplying water; and if they receive an affirmative answer, they understand that they will then be in a position to buy water in the open market. If the Corporation agree to supply on the Liversedge terms, the plant just acquired by the Joint Boards will have to be sold at a valuation.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

A Question for the President of The Gas Institute.

SIR,—Mr. Valon, in his most interesting Inaugural Address to The Gas Institute, made the following statement: "It is well known that, if every trace of free ammonia is removed before passing the gas through lime, the action of the lime will liberate the fixed ammonia and although no free ammonia is at the inlet, free ammonia will appear at the outlet in larger quantities than is sometimes desirable."

I should be glad to learn if Mr. Valon has proved the presence of "fixed" ammonium compounds in the gas at the inlet to the purifiers at a time when no free ammonia was indicated.

It is well known that gas free from ammonia at the inlet of a lime purifier frequently shows traces of that impurity at the outlet; but it is, I think, generally believed, on the authority of Professor W. Foster (*vide JOURNAL*, Vol. XL., p. 1124), that the ammonia so liberated is supplied by the decomposition of calcium cyanate.

Birmingham, June 16, 1892.

E. LLEWELLYN PRYCE.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills read the first time: Bexhill Water and Gas Bill; Newcastle-upon-Tyne Improvement Bill.

Bills read a second time and committed: Birmingham Corporation Water Bill; Exmouth and District Water Bill; London Water Bill.

Bill referred to a Select Committee, consisting of Lord Northington (Chairman), the Marquis of Bristol, Earl Lindsay, Earl Radnor, and Lord Tollemache; to meet on Wednesday, June 15: Birmingham Corporation Water Bill.

Bills referred to a Select Committee, consisting of Lord Brougham and Vaux (Chairman), Earl Abingdon, Lord Zouch of Haryngworth, Lord Fingall, and Lord De Saumarez; to meet on Wednesday, June 15: Electric Lighting Orders Confirmation Bill (No. 5); Lanarkshire (Middle Ward District) Water Bill; Water Orders Confirmation Bill.

Bills reported: Bournemouth Improvement Bill; Electric Lighting Orders Confirmation Bill (No. 5); Lanarkshire (Middle Ward District) Water Bill; London Water Bill; Rhyl Improvement Bill; Water Orders Confirmation Bill.

Bills read the third time and passed: Airdrie and Coatbridge Water Bill; Brynmawr and Abertillery Gas and Water Bill; Electric Lighting Orders Confirmation Bill (No. 5); Gas Provisional Orders Bill; Stamford and St. Martin's Stamford Baron Gas Bill; Rhyl Improvement Bill; Water Orders Confirmation Bill.

Petitions against the following Bills have been presented:—

Birmingham Corporation Water Bill, from the Corporations of Aberavon, Hereford, and Neath; the County Councils of London, Glamorgan, and Monmouthshire; the Local Authorities of Barry and Cadoxton, Briton Ferry, Bridgend, Cardiff, Maesteg, Margam, Merthyr Tydfil, Ogmore and Garw, Penarth, Pontypridd, Swansea, and Ystradyfodwg; and several private persons whose interests are affected.

Water Orders Confirmation Bill [Sevenoaks Water Order], from Owners of property and ratepayers in the district of the Sevenoaks Local Board.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Bills read the first time: Electric Lighting Orders Confirmation Bills (Nos. 4, 5, and 6); Water Orders Confirmation Bill.

Bills read a second time and committed: Bexhill Water and Gas Bill; Gas Orders Confirmation Bill.

Bills reported: Bexhill Water and Gas Bill; Gas Orders Confirmation Bill; Ilkley Local Board Bill; Newport Corporation Bill; Rhymney Valley Gas and Water Bill; Western Valleys (Mon.) Water (Gas Purchase) Bill.

Bills read the third time and passed: Ashton-under-Lyne Water Bill; Bexhill Water and Gas Bill; Bradford Corporation Water Bill; Glasgow Corporation Water Bill; Newcastle-upon-Tyne Improvement Bill; Newport Corporation Bill; Pontypridd Water Bill; Rhymney Valley Gas and Water Bill; Swansea Corporation Water Bill; Western Valleys (Mon.) Water (Gas Purchase) Bill.

Bexhill Water and Gas Bill.—This Bill, which was introduced into Parliament late in the session, and has passed through all its stages in the Lower House, authorizes the Bexhill Water and Gas Company to raise additional share and loan capital for the purposes of their undertaking. It was proved to the Committee who considered the Bill that the undertaking was in course of development, that the Company had not paid any dividend on their existing share capital, and that if provision were made in the Bill for the offer of the additional capital proposed to be raised by public auction, there was no likelihood whatever of its being issued at a price equal to par. Under these circumstances, the Committee were of opinion that the provisions of the Standing Orders ought not to be required in the case of the additional capital authorized by the Bill. They further reported that they had amended the preamble by inserting a recital that the Company had not paid any dividend on any portion of their capital.

MISCELLANEOUS NEWS.

EDINBURGH AND LEITH GAS SUPPLY.

The Financial Position of the Undertaking.

The accounts of the Edinburgh and Leith Gas Commission for the year from May 16, 1891, to May 15, 1892, were issued last Friday. They show that the stock capital remains at £350,000, and that the loan capital is £134,698—an increase of £30,000 during the year. The Commissioners have still borrowing powers to the amount of £165,301. The capital expenditure during the year was as follows: Works and manufacturing plant, £1306; main and service pipes, £13,050; meters, £812; and gas cooking and heating stoves, £235. The total expenditure upon capital account was £15,419. After raising £30,000 upon mortgage, there still remains a debit balance of £6722 upon the capital account, which now amounts to £491,421. In the revenue account, coal (135,219 tons) cost £125,267; purifying materials, oil, water, and sundries, £6799; salaries of engineers, &c., and wages and charges at works, £35,571; repairs and maintenance of works and plant, £7791; distribution charges, £20,326; management, £6420; feu duties, rates, and taxes, £8231; law and parliamentary expenses, £7336; pensions and allowances to old employees, £1474; discounts, rebatements, and bad debts, £6205—making a total of £218,423. The revenue consisted of: Gas (1,221,513,700 cubic feet), £270,918; coke, £5996; tar and ammoniacal liquor, £15,603; waste lime, £53; rents of properties not in the occupation of the Commissioners, £317; and transfer fees, £23—making a total of £292,912; and leaving a balance of £74,489. In the profit and loss account, the revenue was, with a balance of £14,569 from the previous year, and £74,488 from last year, £89,058. On the expenditure side, annuities required £34,000; interest on debentures, £3836; interest on bank overdrafts, £885; other interests, £205; and expenses of mortgages, £168—making a total of £39,096, and leaving a net balance of £49,962. The sinking fund for the repayment of borrowed money amounted on the 15th of May, 1892, to £3304; and for redemption of annuities, to £23,012. To the former there falls to be added, in terms of the Commissioners' Act, £1197; and to the latter, £7267—together £8464; raising the former to £4501 and the latter to £30,270. The reserve fund, which prior to the above-named date amounted to £28,604, is now only £2703; the money having been employed to defray the cost of renewals in the Edinburgh works. The general balance-sheet shows a debit of £91,587, made up as follows: Balance at debit of capital account, £6722; annuities account, £16,828; unclaimed dividends, £78; deposit receipt accounts, £1966; debenture interest account, £2081; North British Railway stock (held in security), £1000; house-rents outstanding at Whitsunday, 1892, £119; trade accounts (tar and ammoniacal liquor), £1516; gas consumers' accounts outstanding, £39,651; gas-stove accounts outstanding, £90; and coal, lime, and other stores on hand on the 15th of May, £21,533. On the credit side, the items are: Current bank accounts, £909; deposits from consumers, £5384; payable for coal, £7859; other accounts due by Commissioners, £250; dividends of gas companies unclaimed, £78; deposits from contractors (held in security), £4966; debenture interest unpaid, £2081; annuities unpaid, £16,828; wages due to workmen on the 15th of May, £456; feu duties payable at that date, £107; reserve fund, £2703; and balance at the profit and loss account, £49,962.

DUNDEE GAS COMMISSION.

Increase in the Price of Gas.

The Annual Meeting of the Dundee Gas Commission was held on Wednesday last—Lord Provost MATTHEWSON presiding.

Mr. J. MITCHELL, Convener of the Finance Committee, in presenting the annual report, expressed his regret that the result should be somewhat disappointing, and that the estimate framed a year ago should not have been realized. This result, notwithstanding an increased sale of gas, had arisen largely from the fact that the yield per ton of coal carbonized fell short of the estimated quantity by 162 cubic feet per ton, as also from the unprecedentedly low prices ruling during the year for secondary products. In place of getting, as they reckoned, 10,000 cubic feet per ton, they only had 9838 feet, or a short extract on the quantity of coals carbonized of 8,324,694 feet, representing a sum of fully £1500. This and other things caused the debit balance of £2381 with which the year was commenced (and which the Committee expected to wipe out) to be increased at the close to £4780. Acting on previous experience, at the beginning of last year, they reckoned on an increased consumption of gas; but they were not prepared for anything like the rise which had taken place. They reckoned that 490 million cubic feet would meet the requirements, and that for this 49,000 tons of coal would be needed. This was contracted for at an average price, with firemen's wages, &c., of 20s. 8d. per ton. In place of 490 million cubic feet being produced, the quantity was 504,778,600 cubic feet, or 14,778,600 cubic feet over the estimate, and fully 34,000,000 cubic feet beyond the quantity produced in the previous year. Of this there had been sold 448,245,950 cubic feet, 5,633,100 cubic feet were consumed at the works, and 50,899,550 cubic feet were unaccounted for, or about 10 per cent. of the total make. This increased output of gas naturally caused a corresponding increase in the coal and other accounts. Instead of 49,000 tons, they carbonized 51,387 tons; costing, on an average, 20s. 10½d., or a sum of £53,644. For purifying, in place of £920 as estimated, they had to spend the sum of £1513, or £593 over the estimate. The total expenditure, including the debit balance with which the year was commenced, was £94,732, or an increase of £3853 beyond the estimate. The additional consumption of gas naturally gave them an augmented revenue; gas sold and meter-rents producing £81,439, as against £79,596 estimated, or an increase of £1843. But against this there was a marked decreased revenue from coke and residual products, the former yielding £1227 instead of £3000, and the latter £6906 instead of £8166; or in all a deficiency from these two sources of £3031. The result of the year's working

was a debit balance of £4780, which had to be met out of the year's revenue. It had not been considered advisable to reckon upon any increase in the demand for gas over last year. This, he thought, was wise, more especially in view of the probable early introduction of the electric light, as well as from the depressed condition of the general trade of the city. They had reckoned upon requiring 50,500 tons of coal, which, at 10,000 cubic feet per ton, should yield 505,000,000 cubic feet of gas. The average price of the coal already purchased did not exceed 16s. per ton; and they were hopeful that they would be able to purchase what might be needed for the remainder of the year at this, if not at a somewhat less price. With firemen's wages, breaking, &c., the price would not exceed 19s. 8d., or 1s. 2½d. per ton below the actual cost of last year. He concluded by moving that the price of gas be fixed at 1d. per 1000 cubic feet higher than last year, and that the residual products should be sold to the best advantage and at the market price of the day, but subject to all existing contracts now to be entered into. He took the opportunity of testifying to the zeal and attention of the Gas Engineer (Mr. J. M'Crae) and all the officials with whom he came into contact, and on whom the economical and successful management of their large undertaking so largely depended.

The motion was seconded by ex-Bailie MACDONALD, and adopted.

OLDHAM CORPORATION GAS AND WATER SUPPLY.

Annual Reports.

The Manager of the Oldham Gas and Water Works (Mr. H. Andrew) has prepared the following reports on the results of the operations of the two departments during the year ending March 25 last.

Referring to the gas-works, Mr. Andrew states that the expenditure on capital account in the past year has been £7020. The gross revenue for the year on gas-works account amounts to £125,233; and the gross expenditure to £106,578—the balance carried to profit and loss account being £18,654. Adding the interest on reserve fund account (£1053), makes £19,708. The annuities amount to £3591; the interest on loans and stock, to £8337; and the sums payable to the respective sinking funds to £5428—making a total of £17,356; the surplus on the year's working being £2351. The balance brought from the previous year's accounts was £5980, which gives a disposable surplus of £8332. The amount which can be paid to the borough funds from profits is £7177; leaving a balance to carry to the credit of next year's account of £1155. The quantity of gas supplied to the Corporation street-lamps and municipal buildings free of cost during the year was 62,016,000 cubic feet. The benefit to the borough fund for gas thus supplied, based on its selling price, is £6637. The amount of profits to be handed over, as stated above, is £7177; thus giving a total sum of £13,814. The quantity of gas manufactured at the different works during the year was: Oldham station, 186,515,000 cubic feet; Higginshaw, 390,981,000 feet; Hollinwood, 338,906,000 feet; and Royton, 49,536,000 feet—making a total of 969,938,000 feet, against 938,341,000 feet in the preceding year. The quantity of cannel and coal carbonized was 94,658 tons. The average quantity of gas made per ton was 10,204 cubic feet; and the loss of gas from leakage, &c., was 51,849,000 feet, or 5.367 per cent. of the quantity made. The maximum quantity of gas delivered in 24 hours was on Dec. 24 last—7,218,000 cubic feet, as compared with 6,018,000 feet in the preceding year; showing an increase of 1,200,000 feet. The minimum quantity of gas delivered in 24 hours was on June 28—660,000 cubic feet, against 624,000 feet; being an increase of 36,000 cubic feet. The average illuminating power of gas supplied was equal to 19.69 candles. In the course of the year, 541 new meters were fixed, and 525 consumers added. The total number of meters now in use is 44,272; and the number of consumers is 43,306.

The report with regard to the water-works states that the expenditure on capital account during the year has been £18,747. The gross revenue amounts to £53,953; and the gross expenditure, to £14,601—the balance carried to profit and loss account being £39,352, on which are the following charges: Annuities and interest, £28,244; sinking fund for the liquidation of debt on water-works, chargeable on revenue, £10,223—total, £38,468; the surplus being £883. The income during the year was £53,953, against £52,867 in the previous year. The water-rental during the year was (including meter-hire) £52,673, against £51,541 in the previous year, or an increase of £1131. There was an advance of £468 from the water-rents for domestic purposes, &c., and £662 from the supply for trade purposes per meter. The receipts from rental of lands, mills, cottages, &c., during the year were £1280, against £1325 in the previous year; being a decrease of £44. The expenditure was £14,601, as compared with £17,171. The number of houses supplied with water is 43,595; being an increase of 311. There are 1220 water-meters in use, against 1202 in 1890-1. The report concludes by mentioning that, on Sept. 30 last, the ceremony of opening the Castleshaw Water-Works was performed by the Chairman (Alderman Buckley, J.P.).

HEYWOOD CORPORATION GAS AND WATER SUPPLY.

Annual Reports.

The Manager of the Heywood Corporation Gas Department (Mr. W. Whatmough) has issued his report for the year ending March 25 last. It appears therefrom that the gross revenue amounts to £16,075; and the expenditure to £15,175—leaving a net profit of £900. The total amount of the reserve fund is now £3909; and the expenditure on renewal of engines, exhausters, boilers, and gasholder, out of this fund has been £3161—leaving a balance of £748. The total outlay on revenue account is £951 more than last year, £590 of which is due to the increased quantity of coal carbonized, and the additional cost per ton; the price being 13s. 0½d., as compared with 12s. 0½d. for 1891, and 10s. 11½d. for 1890. An increase of £178 for carbonizing wages includes £40 for further advance of wages, granted by the Gas Committee in November last. The total increased charge to this account in consequence of advanced rate of wages is £280, as compared with the

rate of payment before the first advance was conceded. The total amount realized for residuals is £2754, or an increase of £271 upon the previous year, notwithstanding a reduction of 1s. 2½d. per ton in the price of coke, and 15s. per ton for sulphate of ammonia. The total quantity of gas made in the year amounted to 90,117,000 cubic feet; being an increase of 5,232,400 feet, or 6·16 per cent., and the average yield per ton of coal carbonized was 9629 cubic feet—the reduced quantity being due to the higher illuminating power of the gas supplied, and other causes. The average illuminating power for the year was 18·51 candles, as against 17·55 for 1891. The total quantity of gas sold reached 79,715,204 cubic feet—an increase over the previous year of 5,232,400 cubic feet, or 5·25 per cent., which has realized an additional revenue of £654. Of the gas sold 70,420,380 feet were used by ordinary consumers, and 4,228,200 feet for stoves and motive power; the former showing an increase of 5·54 per cent., and the latter 36·70 per cent. The quantity of gas unaccounted for is 9,576,146 feet; representing a leakage of 10·62 per cent. With regard to the department under their charge, the Water Committee report that the total payments on capital account during the year amounts to £2441. There has been an increase of 84 in the number of consumers; and it is encouraging to observe that the net receipts for water during the year are £343 more than in the previous year, and £727 in excess of the amount for the year ended March 25, 1890. Should this rate of increase continue, the receipts will in a few years' time be sufficient to meet the additional charges against revenue in respect of interest and sinking fund consequent upon the construction of the new works in the Naden Valley.

BELGRANO (BUENOS AYRES) GAS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Thursday, at Winchester House, Old Broad Street, E.C.—Mr. C. J. HEGAN in the chair.

The SECRETARY (Mr. H. M. Gerrard) read the notice convening the meeting; and it was agreed to take as read the report of the Directors for the year ending Dec. 31 last.

The CHAIRMAN, before proceeding to the consideration of the report, referred to the serious loss the Company had sustained in the death of Mr. F. A. Hankey, who had occupied the chair from the formation of the Company. With regard to the filling of the vacancy thus created, there were, he said, two shareholders who possessed good qualifications for the seat—Mr. J. T. Woolley and Mr. C. P. Ogilvie; and so the Directors thought they could not do better than elect them both. The last-named gentleman had a very practical and personal experience of Buenos Ayres; and as his business called him out there periodically—in fact, he was in Buenos Ayres at the present time—he would be of the greatest value to the Company. Turning to the events of the past year, the Chairman proceeded to remark that it was undeniable that it was a very disappointing period to look back upon. It was some consolation, however, to the Directors to feel that they were not alone in their misfortunes; every company doing business in the Argentine Republic being, to a greater or less degree, in the same position as themselves. The depreciation of the paper dollar had been their chief difficulty; and in the past three years, on this account, the receipts showed a falling off of something like 60 per cent. For such a state of things, there was only one remedy—viz., increasing the price of gas; but this was much easier said than done. The different Gas Companies supplying Buenos Ayres agreed upon a sliding scale for the formation of a new tariff. Although this was only a partial remedy (it would be impossible by any sliding scale to recoup themselves entirely for the loss occasioned by the depreciation of the paper dollar), it would have been a *modus vivendi*, and they could have gone on with it. The Municipality, however, stepped in, and denied the right of the Companies to increase the price of the gas without their consent. The Companies strongly protested, and were still protesting, against this. This attitude on the part of the authorities had caused great difficulty in getting the accounts paid by private consumers. But this was not the only trouble the Company had had with the Municipality. They had declared their concession at an end three years sooner than the Directors thought in justice it should have been; and they also allowed their accounts for public lighting to remain unpaid until the amounts due assumed formidable proportions. As a last resource, the only course open to them was to cut off the supply. The inconvenience to the public, not to say the danger, made the Directors very loth to take this step; but they had pointed out, both publicly and privately, that it must come to this, unless the accounts were paid. This seemed to be having the desired effect; for their last advices from the other side stated that negotiations were in progress which pointed to a speedy arrangement for the settlement of all arrears, and by which a fresh contract would be made for the public lighting—the contract which existed with regard to Belgrano having ended when the concession was terminated. The Directors did not consider that the lapse of the concession would interfere with the development of the concern. The concession applied only to Belgrano, where, having the field to themselves, they had little to fear from competition; whereas their progress took place almost entirely in Buenos Ayres, where competition was very severe, and where no company enjoyed any special privileges. The one feature which attracted most attention, he regretted to say, was the debit balance in the accounts of £13,928, which certainly looked very unsatisfactory, but it admitted of explanation. It was not a loss in trading, although it was in the profit and loss account; and it was explained by the large amount (£51,755) which it was necessary to write off on the other side in connection with the loss on exchange. The Directors looked forward, with the fullest confidence, to having a better statement to place before the shareholders twelve months hence than they had on the present occasion. In conclusion, he moved the adoption of the report and accounts.

Mr. J. T. WOOLLEY seconded the motion, which was carried unanimously.

The retiring Directors (Mr. A. Hooper and Mr. Woolley) and the Auditors were re-elected; and, after a vote of thanks had been accorded to the Chairman and Directors, the proceedings terminated.

THE METROPOLITAN WATER SUPPLY COMMISSION.

Monday, June 13.

(Lord BALFOUR OF BURLEIGH, Chairman; Sir G. B. BRUCE, Sir A. GEIKIE, F.R.S., Professor DEWAR, F.R.S., Mr. G. H. HILL, M.Inst.C.E., Mr. J. MANSERGH, M.Inst.C.E., and Dr. W. OGLE, Commissioners.)

The case for the London County Council was entered upon to-day; but before this was done,

Mr. J. J. Francis, Engineer of the New River Water Company, was recalled to supply supplementary information which had been asked for and promised concerning the standing water-levels, the ordinary pumping-levels, ground surfaces, &c., at the Company's works.

Mr. W. E. Bryan, Engineer to the East London Water-Works Company, was also recalled; having been requested to hand in a tabular statement, showing the amount of water supplied by the Company in 1891 for other than domestic purposes, and plans showing the position of rain-gauges and the rainfalls as recorded there. It being pointed out to witness that, in one instance at least, with more rain a less quantity of water passed over the weirs, he explained that it depended upon the part of the year at which the rain came whether the quantity flowing over was increased by the fall. If, for instance, much rain fell now, when the grass in the valley was long, it would scarcely produce any difference; but if it came in the early spring, it would make a considerable difference in the amount passing over each weir. On certain occasions, with a moderate rainfall, in the spring there was a great increase; and in the summer, before the hay was cut, a heavy rainfall made no perceptible difference.

The CHAIRMAN mentioned that there was another table to be handed in by witness. Taking certain parishes in his Company's district, he offered to have their supplies counted; and he was to see that these parishes were fairly typical.

Witness selected Bethnal Green and Poplar; and, in the former, the supplies numbered 19,141, and there were 17,109 houses according to the census; while for Poplar the figures were 8962 and 10,173.

The CHAIRMAN inquired what was the explanation of the circumstance that, in the one case the supplies numbered more than the houses, and in the other less.

Witness said he could hardly tell. He did not know whether large institutions had each been taken as one house, or as several.

In reply to Dr. OGLE, who observed that the census papers were not yet published for parishes, witness mentioned that he had taken the parliamentary districts as published in the preliminary census table.

The CHAIRMAN remarked that he found in this another of the many pitfalls with which the Commission met; and they might put on the notes that, so far as could be ascertained at present, the 10,173 should be 7404. In the country districts, he added, witness had taken the two parishes of Leyton and Walthamstow; and, for the former, the supplies were put down at 11,506, and the houses at 10,714.

Witness stated that the latter figure was taken from the census. In Walthamstow the supplies numbered 8799.

The CHAIRMAN asked if any allowance was made for uninhabited houses in these four totals.

Witness answered that some of the houses would be uninhabited from time to time.

The CHAIRMAN: But on any given day there would be always a certain number uninhabited?

Witness: There would.

What deduction then is to be made for that?—It is almost impossible to say; and I do not know how to arrive at it.

The CHAIRMAN: If we do not do something to eliminate the uninhabited houses, we shall get into error in two ways—over-estimating population, and therefore under-estimating the daily supply per head.

Dr. OGLE said he had added together the supplies given for the two urban parishes, making the total 28,103; the census put the population of these two parishes in 1891 at 185,515. Dividing, then, this number by the total supplies, he obtained 6·6 as the number of persons in the parishes per supply. In the same way, he dealt with the two rural parishes, where the total supplies were 20,305; and the population by the census of 1891 was 90,252—making 4·4 persons per supply. Next, he reminded witness that, in his former evidence, he stated that the number of London supplies was 104,000, and country supplies 68,310; and, then, multiplying the former by 6·6, and the latter by 4·4, and adding the results together, he found the population supplied by the Company was 589,696; while—the average daily supply of water in 1891 being 40,282,200 gallons—the number of gallons per head per day was 40·7. This figure was obtained by dividing the average daily supply by the population.

Witness objected to this calculation, on the ground that the inhabited houses and supplies were confused in it; and it was impossible to take two parishes and make them representative in the way done in the calculation.

The CHAIRMAN told witness that, before the Commission founded anything upon calculations of their own, they would take steps to have them checked in every possible way.

Dr. OGLE thought, if the parishes taken were not fairly representative, they should have some that were.

To further discuss the matter, the Commissioners retired for a few minutes, and then

The CHAIRMAN announced that they were going to take a little more time to consider the figures; but said it was quite clear, from what had passed on several occasions, that they must endeavour to find a method of getting information upon the important point of supplies and population in a way more accurate than they had yet managed. Possibly they might call in for consultation some of the officers of the Water Companies. But when they had made up their minds, they would, after full consideration, address a communication to the Companies for the information they wanted, having first carefully adjusted what they did require, so that there might be no difference of opinion about it, and so that every opportunity and sufficiency of time might be given for supplying the information asked for.

Mr. A. R. Binnie, the Chief Engineer of the London County Council, was then called.

The CHAIRMAN remarked that Mr. Binnie had handed in several voluminous tables and maps; and the Commissioners should require for the consideration of some of these a longer time than they had yet had, before they could question witness upon them with any useful results. There were, however, some parts of his statement that they might go into that day; but before doing even this, they should like a distinct explanation once for all of certain terms which witness used, in order that there might be no doubt hereafter as to what was signified by them. He employed the term "Municipal London." What area did he describe by that?

Witness replied that he used the term in common with the term County Council area. They were practically the same. There was a small district at Penge which was in dispute between the two areas (it is included in the County Council area, and not in the census); but, with that exception, the areas were coterminous.

Is Municipal London the area over which the County Council preside?—Yes.

Now you use the expression "Greater London." Do you mean London under the Metropolitan Police?—I do; the area taken in the census as 701 square miles.

Then there is "Water London." What is that?—It is the area as near as I am able to ascertain at present supplied by the Water Companies in contradistinction to the area over which they have parliamentary powers, which is given in the twentieth annual report of the Local Government Board as extending to 514 square miles. Then "Registration London" is practically the same as the area formerly spoken of as Municipal London.

Do you mean absolutely the same?—Absolutely, without the parish of Penge.

Sometimes you qualify the expression Registration London by the term "Inner Ring." Do you mean Municipal London?—Yes.

Then the "Outer Ring"?—That is the district outside Municipal London, but within the larger area which the census returns call Greater London, the police district.

Registration London, including the Inner and the Outer Ring, is the same as Greater London?—Yes.

I understand, then, that Registration London, with the term Inner Ring added, is the area of the London County Council?—Yes.

In further examination, witness pointed out that his information bore upon the number of persons supplied by the Water Companies, and the rate of the supply per head in gallons. He invited the assistance of the Water Companies to furnish him with data for 1861 and 1871; but he did not ask the same for 1881, thinking at the time, he had the information already furnished in certain reports. This he had now reason to doubt. Having regard to this, he had found a difficulty in making calculations upon the cases he had set before the Commission. He could not reconcile the populations with the number of houses supplied, and both these with the quantity of water said to be furnished by the Companies.

The CHAIRMAN, noticing that witness referred, in the statements he had sent in, to two different sets of documents—the first being the various census returns since the commencement of the century, and the second the returns made at various periods of population, number of houses supplied with water, and the quantity consumed, as given by the eight Companies—inquired how the population was arrived at.

Witness said the "population" of the Water Companies varied; and he derived it from three distinct sets of calculation. In one table was given the quantities of water said to be supplied to London by the Companies, and the theoretical populations which would be supplied by these quantities, at 30, 32½, and 35 gallons per head per day. For 1891, according to the published returns, 182,456,905 gallons were supplied by the Companies; and the question arose, how many persons were supplied? If the rate of supply were 30 gallons per head per day, the number would be 6,081,896. Now, it was perfectly clear that this population did not exist in London, or in Outer London, or in Greater London, or in any other district supplied by the Companies. On the assumption that 32½ gallons per head was the supply, they had a population of 5,614,059. But this again was clearly an impossible population, because Greater London, which included the bulk of the water area—he might say almost the entire water area—contained only 5,633,000 people. If, again, they took the rate per head of supply at 35 gallons, and divided the 182,456,905 gallons by 35, they obtained a probable population of 5,213,054, which was, in his opinion, somewhat more likely to be correct than any of the other estimates.

The CHAIRMAN: That is in a subsequent calculation the figure you take as the nearest basis you can get for your future estimate?

Witness: It is one of them.

But the fact that the Companies' districts and the registration districts are not co-extensive, makes it extremely difficult, if not impossible, to get anything but an estimate?—Yes.

Asked how he arrived at the 182,456,905 gallons already mentioned, witness said the figure was compiled from the Water Examiner's monthly reports for 1891.

The CHAIRMAN: Have you the detailed figures for each Company before you, because, comparing your figures with all the Companies' figures, there is a discrepancy of about 400,000 gallons; and I should like to see where that arises.

Witness: I could work it out in detail.

I do not say the discrepancy is intentional; but I want it cleared up?—I have been feeling the difficulties as keenly as you have; and you will get all the assistance I can give you.

The CHAIRMAN, reverting to the figure 182,456,905, asked if there would not have to be some reduction made in the quantity to allow for slip in the valves and short stroke in the pumps.

Witness said no, because for years past the statements had been made by the Water Companies that they supplied certain total quantities; and they must have known either that these quantities were correct or that they were incorrect.

The CHAIRMAN observed that the East London Company claimed a reduction of 10 per cent., the Grand Junction 7½ per cent., and some other Companies 5 per cent.; and he inquired if witness allowed any such reductions? He wanted witness's comment on the point.

Witness said the reduction no doubt was perfectly correct. The only

complaint he had to make was that all the returns to the Water Examiner had been knowingly incorrect. An engineer would not return a quantity of water pumped without deducting for the slip in valves; and no pump discharged the theoretical quantity of water.

The CHAIRMAN remarked it was quite possible there might be some misunderstanding about this; and he wanted to say, with all friendliness, that the Commissioners desired, if possible, to conduct this inquiry without any allegations of knowingly false returns. They did not want to raise up any unnecessary feeling in what was a very difficult investigation.

Witness said he felt that; but, on the other hand, in assisting the Commission, he could not but remark on the statistics on which he had to base his calculations.

Further examination of the tables being proceeded with, it was disclosed that the population of the Metropolis seemed to double itself in 40 years. The figures for 1841 were about double those for 1801; and those for 1881, double those for 1841. But the increase for the last ten years appeared to have been rather less rapid. Witness also noticed that the number of houses was increasing in a greater ratio than was the population; the tendency being for fewer persons to live in one house than was formerly the case. But this circumstance would not in his mind affect the question of water supply, because he rather based his calculations on the total population than on the number of persons per house. Entering into a further explanation of some of the tables sent in, he deduced that, in 1931, the population of Greater London would be between 10,966,000 and 11,877,000; and in 1941, between 12,977,000 and 14,312,000. Some details concerning the estimated water supply, he reserved for another occasion; his object that day being to take a comprehensive view only. He estimated that in Greater London, on a mean of estimates, the probable future population would be, for 1901, 6·7 millions; for 1911, 8 millions; for 1921, 9·6 millions; for 1931, 11·4 millions; and for 1941, 13·7 millions. Or, on another basis, in 1941 the total population of "Water London" might be estimated at 12,373,243; and the probable consumption at 35 gallons per head per day, would be 433,063,505 gallons. So he thought they would not be far wrong in assuming, comparing the Water Companies' returns, the area supplied, and the census returns, that the consumption was at the rate of 35 gallons per head per day at the present time. He had not been able, up to the present, through stress of other matters, to make a division between domestic and trade consumption. His experience had taught him it was exceedingly difficult, if not impossible, when a certain consumption of water had been established, to reduce it to any very material extent, owing to habits of greater cleanliness being inculcated. His efforts in this direction in Bradford had been partially successful; yet in those portions of the town where modern houses, provided with baths and water-closets, were in full use, and supplied under constant pressure, he was unable to reduce the quantity per head per day much below 35 gallons for strictly domestic purposes. He would mention, as being instructive figures, that in Marseilles the consumption was 99 gallons per head per day; in Paris, 47 gallons; in Washington (U.S.A.), 154 gallons; in Detroit, 126 gallons; in Chicago, 95 gallons; in Boston, 76 gallons; in New York, 65 gallons; and in Philadelphia, 56 gallons. In Dublin it was 47 gallons daily; in Glasgow, 50 gallons; and in Edinburgh, 40 gallons. He remarked that it should not be forgotten that London, as compared with continental cities, was far behind in appliances for the public distribution of water for ornamental, sanitary, and cleansing purposes; and compared with only one example—notably that of Paris—it might be said to be deplorably in the background. Paris employed for public purposes, on an average, about 18 gallons of water per head of the total population per day; while London probably did not use one-twentieth of this quantity. He consequently felt that it would not be safe to reckon in the future on a less quantity than 35 gallons per head per day for so important a city as London. Although for the sake of comparison, he had given estimates of consumption in the future at rates of 30, 32½, and 35 gallons per head per day, yet he considered the latter to be the most reliable; and he would, but for the fact that 35 gallons appeared to be the present actual rate of consumption, have preferred to base his estimates on a total of 40 gallons per head per day. He considered that, if 35 gallons were taken as the basis of calculation, it would permit, on the one hand, of some slight reduction due to savings which might be effected in the prevention of waste, while, on the other hand, it would provide for a more legitimate use of water generally for all purposes. In all estimates as to the future of London, they were looking to a time when water would no longer be the luxury of the rich; and he referred to the cases in the United States as showing that, among a democracy, that state of things had been arrived at for which they were striving. In England it might be called waste; but he thought it was one of the problems of the future which they would have to face.

The CHAIRMAN said, without wishing to enter into an argument, he must remind the witness that, to go into such matters as the figures in American cities would take them into a wide field of investigation; as climate, temperature, and so on, would be important factors.

Witness remarked that, as to increase of population in London, he certainly did not think it was fair to be guided by the increase in the outer ring merely, but to take the mean increase of population of the inner and outer ring.

Dr. OGLE: Of course, all estimates of growth of towns in the future are more or less speculative. Do you not think it is almost too speculative to judge as to what would be the case fifty years hence, on a basis of what has happened in the last ten years?

Witness replied that he saw nothing to lead him to suppose, taking London as a whole, that it would not go on increasing; but he would admit that, the farther one looked into the future, the more speculative it became. He might state, however, that the County Council felt that they would in the future be the custodians of the water supply, and, by an express resolution of their Committee, they wished to look fifty years ahead; and he had endeavoured to carry this out.

Dr. OGLE: In one of your methods of estimating the future, you take the number of acres in the outer ring and the density of population per acre, and you apply it to that portion of the Water Companies' area which is outside of London?

Witness replied that this was so; but he was most anxious not to appear

to make his estimates of the population too low, as compared with those of the Water Companies. The Companies' estimates were vastly too high; and he was anxious to take a moderate view. But it was quite correct to say that the 3·83 was the average of the whole of the outer ring, while no doubt the population supplied was in a denser district; and it would not be fair to apply to West Ham a density per acre which was obtained from the highly rural parts of the outer ring. As to the distinction between the number of supplies and the number of houses served, he was not able to draw it. The Water Companies had, however, for years past returned the average number of houses supplied; and there must be some basis of truth in that return. He could not believe that eight great public Companies in London year after year sent to Her Majesty's Government returns under that heading if there was no semblance of truth in them. He thought that, unless the Commission had before them a map on a sufficiently large scale to show the pipes of distribution and each house supplied by the Companies, they would be unable to unravel that difficulty.

Dr. OGLE reminded the witness that representatives of one of the Companies had stated that, by the introduction of the waste-meter system in their district, they had materially reduced the quantity of water consumed per head.

Witness replied that this was true; but he agreed with the evidence of his friend, Mr. Bryan, that, as fast as the waste was reduced to certain theoretical low limits, the habits of the population tended to drive up the consumption. They could, however, do something. They could, for instance, very largely reduce such waste as was caused by leakage through public pipes; but as to domestic consumption, though he would not say it was useless, it was a very uphill battle.

In reply to Mr. MANSERGH, witness said that in Bradford he had brought the supply down from 24 to 20 gallons per head per day; but getting that average meant that many consumers were having only 6 or 7 gallons daily—Bradford not being a water-closet town. But the whole of London might be said to have a water-closet system. In addition to the 20 gallons per day for domestic purposes, a similar quantity was consumed in Bradford for trade purposes.

In reply to Mr. HILL, witness stated that he thought the consumption in London might be reduced a little by proper inspection and examination of water-fittings; and he was certainly startled by the evidence of Mr. Bryan as to the bad fittings at the East-end. His estimate of 35 gallons per head per day for London was for all purposes—trade, domestic, and public. But he expected a large increase for domestic use. There were 5 million persons in London; and he had taken some trouble to ascertain what quantity of water was used in private and public baths. He found it varied from 100 down to 75 gallons. Supposing it were 75 gallons, and everybody in London had a bath, 375,000,000 gallons of water would be required per diem. Of course, they could hardly suppose that everyone would have a bath. They might assume, however, that in the future there would be a bath in every house; and if there were seven persons in each house, and the bath was used once a day, so that each had a bath once a week, 55 million gallons would be needed. It would therefore require, for bathing purposes alone, 11 gallons of water per head. He did not contemplate any increase in regard to water-closet supply, as London, as he had already stated, had a water-closet system. The figure 7·6, the number of persons to each house, was taken from the census returns, and was the mean of Inner London. He could not tell what proportion of this area was now built over. He had been trying to ascertain, but found it exceedingly difficult. However, if the Commission would accept a very rough figure indeed, he might state that about 20,000 out of 77,000 acres still remained to be covered. It was frequently said that estimates which were based on a past increase in population were useless for future guidance, because London was becoming so rapidly built upon as not to allow of a very much larger population than it at present contained. Witness put in a table which showed that, supposing that Greater London were populated at the same rate per acre as the registration district of Whitechapel, it would be capable of containing a population of 87,000,000 persons; if as densely as the registration of Westminster, 76,256,000 persons; if as densely as the Chelsea registration district, 53,500,000 persons; if as densely as the Kensington registration district, 33,500,000 persons; if as densely as St. George's, Hanover Square, with all its open squares, broad streets, and portions of some of the public parks, 30,500,000 persons; if as densely as the comparatively suburban districts of Greenwich and Fulham, from 20,000,000 to 21,000,000 persons; and if as densely as Hampstead, 13,500,000 persons. It would be noticed that the most extreme estimate for Greater London in 1941, of 17,500,000 persons for an area of 701 square miles, could be accommodated within such area without their being so crowded as they now were in the suburban district of Fulham, a large portion of which was not yet built upon.

The CHAIRMAN remarked that the consideration of the chalk wells in and around the county of London would be best dealt with when the scientific and geological section of the inquiry was embarked upon; and as to that part of the evidence of the witness which dealt with the abstraction of water from the Thames, the Conservancy were going to give evidence the next day, and the Commission thought it better to take the information from that body in the first instance.

Witness then remarked that, with regard to 100,000,000 gallons of water a day being abstracted from the Thames by the Southwark and Vauxhall, the Lambeth, the Grand Junction, the West Middlesex, and the Chelsea Water Companies "under agreement," he should ask for the production of the agreement, as he could not believe in its existence until it was placed before some tribunal. Last year the Companies were challenged in Parliament to produce it; but they did not do so.

The CHAIRMAN said the Commission had been furnished with a copy.

Witness then stated that, under the Act of 1867, the East London Company abstracted from the Thames 10,000,000 gallons of water a day; and, under an agreement of 1886 with the Thames Conservancy, the Southwark and Vauxhall Company abstracted 4,500,000 gallons daily; the Lambeth and Grand Junction, each 4,500,000 gallons. Under the head "West Middlesex," he disputed the figure of 4,500,000 gallons which had been stated. If the Commissioners would refer to section 8 of the West Middlesex Company's Act of 1886, they would see

that the Company were, in express statutory terms, restricted to 20,000,000 gallons a day. The section ran: "The Company shall not at any time take from the River Thames any water in excess of the quantity of 20,000,000 gallons a day which, under agreement between the Company and the Mayor and commonalty and citizens of the City of London, now represented by the Conservators of the River Thames, the Company are now authorized to take." He said, therefore, that neither the Thames Conservancy Board, nor the Companies, nor Sir Henry James, could set aside a statutory provision. Under the head "Chelsea," he did not agree with the information laid before the Commission that 2,000,000 gallons of water a day, in addition to the 20,000,000 gallons, were taken under agreement by the Chelsea Company. As the Commission would see by referring to the 25th section of the Chelsea Water-Works Act of 1875, this would be contrary to the Act. Witness then handed in a table showing "dates upon which the Southwark and Vauxhall Water Company drew more than the statutory quantity of water from the Thames." The figures given were from the monthly reports of the Official Water Examiner. From them he drew the inference that the Company had no hesitation whatever in exceeding their statutory quantity of water. In July, 1878, the Southwark and Vauxhall Company, according to the returns made to the Local Government Board, drew from the Thames daily an average quantity of 25,196,388 gallons. At other times, according to their own showing, they were restricted to 20,000,000 gallons a day. The allegation was that throughout the month of July, 1878, they drew on an average 25,000,000 gallons a day.

The CHAIRMAN remarked that the question of the abstraction of water from the Lea and the Thames he avowedly postponed until the Commission had had the evidence of the Conservancy; but he wished the last-mentioned tables to be put in, in order that, they having been before the Commission, the members might have an opportunity of examining them.

The Commission then adjourned till the following day.

Tuesday, June 14.

On the re-assembling of the Commission to-day, the case for the Thames Conservancy was taken.

Mr. J. H. Gough, Secretary to the Conservancy, was the first witness called. He said that the Conservancy had put in statements in reply to queries of the Commission; and he had lodged copies of the agreements mentioned in those statements dealing with the amount of water which the respective Companies might take from the Thames. One of the paragraphs ran thus: "In the Acts, the Companies have statutory rights to take water without limit, and it is only by the agreement that they are restricted as to quantity; the Acts merely providing an ample saving clause for the rights of the Corporation of London as Conservators." These Acts were named in the deposited statement; but as there seemed to be some difficulty in grasping the position, he explained that, after the passing of the Metropolis Water Supply Act of 1852, the Companies moved their intakes above Teddington, and then they obtained power to take water without limit. That power existed up to 1866, when the Conservators availed themselves of a Bill, which was introduced by the West Middlesex Water Company, to confer on them various fresh powers, to ask Parliament to insert a clause to confirm a limit of 20,000,000 gallons per day imposed by an agreement made between the Company and the Corporation of London when the latter were Conservators of the Thames. This was in 1852; and, by the agreement, the Company were bound to limit their power to take water without limit to 20,000,000 gallons. The clause was inserted and became law. Subsequently to this, other arrangements were made between the Companies and the Conservators. The circumstances which led up to these were as follows: In the year 1866, when the Board of Trade transferred the Conservancy jurisdiction of the river above Staines, they applied to the Water Companies, and the five Companies agreed to pay £1000 a year to the Conservators for the maintenance of that part of the river. Then in 1867 the East London Water-Works Company applied for powers to take a supplemental supply from the river at Sunbury; and they agreed to pay for it £1000 per annum, which was to rise eventually to £2000. Next, in 1878, the Conservators applied to Parliament for an additional income; and then the Companies agreed to pay £1000 a year in addition to the amounts already paid. But these amounts of £12,000 were after a time found to be insufficient; and in 1886 the Conservators were proposing to apply to Parliament for extra contributions from the Companies. The Companies had interviews with the Conservators; and they eventually agreed to pay a further sum of £4500, which was made up of the sum of £500 additional from the Chelsea Company, making £2500 from that Company in respect of the Upper Navigation Fund, and £1000 each from the other four Companies—the Grand Junction, the Lambeth, the Southwark and Vauxhall, and the West Middlesex. The East London Company declined to pay any more money. The total annual contributions from the Companies then were: Chelsea, £2500; East London, £2000; and each of the other four Companies, £3000 to the fund. By the old agreement of the Lower Navigation Fund (the fund applicable to the river below Staines), the Companies paid as follows: Chelsea, £300; Grand Junction, £300; Lambeth, £250; Southwark and Vauxhall, £300; and West Middlesex, £300—making in all, £1450 to the lower fund. Witness explained that in the case of the Companies restricted by statute to a certain quantity of water, such as the West Middlesex, the Thames Conservancy had, by agreement with them, given them power to draw more. Asked under what statute the Conservancy were acting in that, witness stated they had under their consideration at the time the whole of the powers which they possessed; and by the Act of 1878 there was conferred, by section 15, a power of inter-sale between the Companies. Subject and without prejudice to all other terms and conditions contained in any subsisting agreement or Act, it was provided that it should be lawful for any one of the six Companies to supply any part of the total quantity of water which the Company were empowered to take from the Thames, or any tributary, and which was not required for the purposes of their district, to any other of the Companies. And the Conservators, under that power, and under their general powers, felt that they were able to grant an additional supply of 20,000,000 gallons per day.

The CHAIRMAN inquired if the Act of 1878 was the Act for the interpretation of which the arbitration was held before Sir H. James.

Witness said it was pleaded before Sir Henry James; but he did not know if section 15 was pre-eminently before him. The Conservators were not parties to the arbitration. Under the Metropolis Water Act, the West Middlesex Company required to seek the arbitration as to the legality of the payments. The Conservators were not parties in the matter, nor were they allowed any *locus standi*.

Was there any other power which the Conservators had to give water from the Thames, except that conferred by this section of the Act of 1878?—As I apprehend, there was no power except that contained in the Act of 1852 and the Acts of 1866 and 1875; the two latter Acts being those by which the Companies were restrained from taking more than 20,000,000 gallons per day from the Thames.

The CHAIRMAN remarked that, as he read the section, but without attempting to give any legal opinion, which he certainly would not think of doing, it seemed to him that the only power given to the Conservancy was not to add to the total amount of water taken, but to re-allocate between the Companies the quantity which they might take.

Witness thought the view would be this—that to the three Companies and to the East London Company there was an unlimited supply in times of flood; and the Southwark and Vauxhall, the Lambeth, and the Grand Junction Companies were able to take a quantity without limit, except so far as the Act of 1852 restrained them. Those Companies could draw a large quantity; and there was a power of inter-sale between them and the other Companies.

You mean that, some Companies being limited and some being unlimited, according to your view the Thames Conservancy have the right to transfer to the limited Companies such proportion as they choose, and as the unlimited Companies may take?—Precisely. In the first instance, the Conservators decided simply on a bulk amount of 20,000,000 gallons a day; and the apportionment of the amount was a matter for future arrangement with the Companies between themselves.

Surely the apportionment is distinctly over and above the 20,000,000 gallons in every case?—In the first instance, the Conservators agreed to the 20,000,000 gallons; and then the agreement set out afterwards, by arrangement with the Companies, the 2,000,000 and 4,500,000 gallons respectively.

But in addition to the initial 20,000,000 gallons?—No; that was the apportionment of it. There was first 110,000,000 gallons; then the Conservators agreed to 20,000,000 gallons more, which was apportioned in the quantity set out in the statement put in.

I fear there has been some misunderstanding. Is the position not this: Under agreement with the Corporation of London, dated 1852, five Companies take 20,000,000 gallons a day; under the Act of 1867, the East London Company take 10,000,000 gallons a day—the total authorized, as given before the Royal Commission in 1869, 110,000,000 gallons a day; under agreement with the Thames Conservancy in 1886, four Companies each take 4,500,000 gallons a day, and the Chelsea Company, 2,000,000 gallons?—Yes.

But these quantities of 4,500,000 and 2,000,000 gallons are distinctly over and above the first 20,000,000 gallons?—Certainly.

Then how can you say that there was a re-allocation between the Companies of any part of the 20,000,000 gallons?—I say that the sum of these quantities is 20,000,000 gallons, and it was granted by the Conservators first on the initiative of the Companies; and this amount, which they felt they had power to grant to be taken out of the river, was apportioned in the various quantities set out. I am not speaking of the 20,000,000 gallons granted to each of the Companies, but of the 20,000,000 in addition to the 110,000,000 gallons.

I see you claim the 20,000,000 gallons in place of the 110,000,000 gallons?—In addition thereto.

Witness then, in reply to a request to explain exactly under what authority the 20,000,000 gallons was claimed, said it was claimed to be given under the powers which the Conservators had. They were not restrained in any way by their own Acts from granting an additional supply of water. But the Water Companies originally had unlimited power. This remained to three of them; the other two—the West Middlesex and the Chelsea—were restrained by clauses inserted in subsequent Acts. Those three Companies could take water to any extent, except for the agreements with the Conservators. Then the Conservators granted 20,000,000 gallons more to the Companies in block beyond the 110,000,000 gallons; and this 20,000,000 gallons was apportioned by a subsequent arrangement between the Companies.

The CHAIRMAN again asked how far the Conservators were acting under the statutory powers they had to give water, in granting 20,000,000 gallons a day, and how far they were simply regulating the power which the unlimited companies claimed to have, of taking their unlimited supply.

Witness said he knew of no powers whatever—no specific powers—by which the Conservators were able to give any quantity of water; but he knew that the Companies, as he had already said, had unlimited powers—only limited in the first instance by the action of the Corporation of London in 1852, and by the Conservators applying to Parliament in 1866 and 1875 for the confirmation of the agreements—and that the Conservators could, by the agreement entered into with the Corporation in 1852, regulate the three Companies which he stated were unlimited. With regard to the considerations which guided the Conservators in giving the water to the Companies whose powers Parliament had restricted, they felt that the clauses were introduced at their instance only, and that those in the Companies' Acts were merely for their protection, in order that the *régime* of the river should not be prejudicially affected, so far as they could prevent. They considered the question of what would be the effect of granting 20,000,000 gallons more to the whole of the Companies; and they came to the conclusion that it would not prejudicially affect the river. There were other bodies besides the London Water Companies which took a supply of water from the main stream of the Thames—the Oxford Corporation, for the supply of the city of Oxford; the Windsor Corporation; the South-West Suburban Water Company; and the West Surrey Water Company. The Oxford Corporation were entitled to take as much water as they required, free of payment, and by a main-pipe not exceeding 24 inches in diameter,

which would allow a maximum of 5,500,000 gallons daily; the West Surrey Water Company, 3,000,000 gallons; the South-West Suburban Water Company, 1,000,000 gallons—making a total of 9,500,000 gallons. The Windsor Corporation's quantity was undefined; but none of it was taken direct from the river.

The CHAIRMAN pointed out that the Windsor and Eton Water Company took water from land belonging to them, but not from the river direct, and he asked for information concerning this source.

Witness said he was afraid he could not say very much about this. Several years ago, the Company applied to Parliament for additional powers. The Conservators of the Thames opposed the Bill; but their petition was dismissed. The preamble of the Bill was proved; and all that the Conservators knew was that the Company had power to pump water from the soil. He believed the water was drawn from deep wells in the chalk; but he was not certain. The London Water Companies and the other bodies named included, as far as he knew, all those which took water from the stream of the Thames for supplies. As to the statement frankly made by some of the Water Companies, that they took water from gravel-beds at various points not far from the Thames, the Conservators had no official knowledge of what the Companies were doing in this respect, except with regard to the Southwark and Vauxhall Company. Witness next gave information concerning the character of the sewage works of towns on the Thames and its tributaries above the inlets of the Companies; and he pointed out that, without efficient inspection on the part of the Conservancy, it would be unsafe to rely upon what occurred at the effluent of some of the works. Speaking of the paper-mills on the river, he said they were most carefully looked after with respect to impurities proceeding from them into the stream; and the Conservators had also to watch 750 scattered houses and farms, the sewage and waste from which they had caused to be diverted from the river. Another aspect of the question of pollution was that of the discharge from house-boats. These had had to be watched most carefully, more particularly because there had been assertions from time to time that there was a large mass of pollution from them. The manure and cabin barges formed an infinitesimal portion of the craft on the Thames. The principal part of the barge traffic was in open barges, without sleeping accommodation in them. Witness also gave it as his undoubted opinion that the raw water of the Thames had improved in quality in recent years.

Mr. C. J. Moore, M.Inst.C.E., the Engineer to the Thames Conservancy, supplied information as to the gaugings at Teddington Weir, and as to the flow of water there after the abstraction of the Water Companies' supplies. The average volume on seven consecutive days had fallen as low as 179,600,000 gallons. This occurred in August, 1887. Having regard to all the circumstances, the present maximum of 130,000,000 gallons, which the Companies might abstract from the river, was the most which, in a dry season, should be allowed to be taken out by them. At times other than dry seasons, more might be safely drawn having regard to other interests involved in the river. The statement that one or other of the Companies pumped, from the gravel-beds close to the Thames, water that was passing away from the river, he could not understand. He thought such water, if left alone, must go into the river.

In reply to Mr. MANSEGH, witness admitted that the abstraction of water by the Companies must affect the Thames slightly, but not very far down. If 500,000,000 gallons were coming down, and 100,000,000 gallons were taken out, the surface of the river would be lowered about 4½ inches; and if the total which might be abstracted by the Companies—130,000,000 gallons—were taken, it would make a further difference of 1,500,000 gallons. The difference would diminish as the stream flowed, till at Hammersmith there would be little effect at all.

Mr. C. E. Groves, F.R.S., the Consulting Chemist to the Thames Conservancy, was likewise examined. He said he did not dissent from the view that the water of the Thames had been improving; and he was satisfied that it was not rendered materially bad by the matter passing into it. There had, however, been no systematic chemical examination of the water from time to time, which would establish these views. The impurities might be regarded as of two kinds—dead matter and living organic matter; and the former was not likely to prejudicially affect the water. The bacteria would be of two kinds—one which would produce disease, and one which would not. The latter, indeed, was rather beneficial than otherwise, because by it, so far as they knew at present, organic matter was destroyed; and the former seemed to be got rid of when it came in contact with light and air, which it did in passing over weirs, &c.

The Commission then adjourned till yesterday.

Neath Gas and Water Supply.—At the monthly meeting of the Neath Town Council yesterday week, the Gas Committee recommended that the necessary steps be taken for applying in the next session of Parliament for additional borrowing powers for gas-works purposes; the powers contained in their Act of 1874 having become exhausted. The sum proposed to be borrowed was £30,000. They also presented a report on their operations during the past financial year. The gross profit, after meeting all expenses, amounted to £1907; being a decrease of about £90. There had been an increase of £428 in the cost of manufacture; coals cost more, due to the larger quantity used; wages had been higher; and wear and tear had increased by £150, owing to a considerable extent to the floods and gales which prevailed some time since, when the town was almost in darkness. On the other side, a steady increase in the gas-rental of about £320 was shown; and although the prices of residuals, tar in particular, were at present very low, they exhibited an increase of about £80—this being due, to a great extent, to the more efficient apparatus used now than formerly. After some discussion, the report was adopted; but the recommendation as to additional borrowing powers was deferred for further consideration. Pursuant to notice, Mr. Cuthbertson subsequently moved that the purchase-money of £47,000 be paid to the Neath Water Company for the whole of the undertaking in Neath, Briton Ferry, and Skewen, subject to a satisfactory arrangement being come to with Mr. C. E. Thomas, for a sale or lease of the filter-beds to the Corporation. There was no seconder, and therefore the motion fell through.

SOUTHWARK AND VAUXHALL WATER COMPANY.

The Half-Yearly General Meeting of this Company was held last Tuesday—Alderman Sir H. E. KNIGHT in the chair.

The SECRETARY (Mr. A. Jelley) having read the notice convening the meeting, the report of the Directors and the statement of accounts were taken as read.

The CHAIRMAN, in moving the adoption of the report and accounts, stated that the latter showed that the Company was still pursuing its steady progress, and enjoying that prosperity which had attended it for so many years. Savings had been effected in the pumping and engine charges, to the amount of between £1100 and £1200, owing to the good contract made by the Directors for the supply of coal, and also to the greater economy that had been caused by the new engines which their Engineer (Mr. J. W. Restler, M.Inst.C.E.) had constructed. Altogether, the savings under these heads amounted to close upon £2000; but the increase in the rates and taxes, compared with the amount the Company had had to pay for the corresponding period of 1891, had reduced them by one-half. The figures under the head of management were within a few pounds of what they were a year ago. He was happy to inform the proprietors that the water-rents accrued to the date of the accounts this year had been £106,899; showing an increase, compared with the corresponding period of last year, of about £2000, which represented £4000 a year—this being the normal increase in the revenue. It appeared to be generally maintained; and he thought it was satisfactory. They had also the satisfaction of seeing that the allowances were again a little lower than they were a year ago; and out of the £8000 set aside for this purpose, they had been able to save £3477. This left a balance of profit of £58,000 to transfer to dividend and interest account; showing that they had made about £3000 more than they did in the corresponding half of 1891. But although they carried forward this increase in the profit, the amount available for dividend was only £34,500, against £40,000 a year ago. The explanation of this, however, was simple, and was due to two items. In the first place, they had had to pay more interest on the debentures they had issued for the construction of new works; and in the next place the decrease was due to what he could not but feel was the unjust expense which was put upon the Company year after year through the opposition brought against them by various public bodies. That a Company like theirs—honestly pursuing its course, and doing its duty satisfactorily in every way—should be laid open to attacks which threw upon it an expense of about £3000 per annum to defend its position, was most unjust. If two men went to law, the one who was beaten had to pay the costs of both sides; and he could not but think that it would be just and equitable that a public body, when they attacked a Company like this, should be made to bear the costs when they were defeated. It was a matter that would have to be seriously considered. He could not see why it was that a concern working honestly under its Acts of Parliament should have its profits diminished by attacks being made continuously on it, and charges made which were never substantiated in the end. The Company were able to declare the same dividend as in the previous half year; but had it not been for the circumstances mentioned, they would have paid an increased dividend, and been accumulating a little surplus besides. The results had fully borne out what he anticipated many years ago; but it was impossible for him or anyone else to fight against unforeseen contingencies. With reference to the London Water Bill, it was successfully resisted by the Water Companies; and the Committee of the House of Commons were by no means in favour of it. The only clauses in the Bill that were brought forward were struck out, excepting those which enabled the London County Council to spend £10,000 of the ratepayers' money in making an inquiry as to the Water Companies. In other words, it was giving them public money to harass undertakings like their own. The Committee, however, limited the expenditure to £10,000; so that if any more money was wanted, the County Council would have to go to the House of Commons for a further grant. Under the circumstances, the result was as good as the Companies could have anticipated. On all other points, the Committee were with the Companies. In regard to the question of the purchase of the undertakings, the County Council seemed to have the impression that the ordinary course pursued under such circumstances, as directed by the Lands Clauses Consolidation Acts, would not suit them; but, as was said by one of the members of the Committee, he believed they wanted to purchase the works of the Companies and to be their own arbitrator. This principle had been condemned twice by the House of Commons, who would not hear of it; and he (the Chairman) believed, if the time ever came for the Companies' properties to be bought up by any public authority, that they would find the purchase would have to be effected in accordance with the fair and equitable procedure which had been adopted for so many years past. With reference to the Royal Commission which had been appointed to inquire into the present sources of supply of the Water Companies, it was difficult for him to say much about the matter; and it would not be becoming in him to forecast what the decision might be. The Commission were giving earnest attention to the question submitted to them. The Companies had appeared before them in support of their case; and he must say that, from what he saw of the proceedings, the care and attention given by every member of the Commission were such that they might feel thoroughly satisfied that nothing would be left undone by them to arrive at a decision on a substantial basis. In their own case, they had been enabled to prove to the Commission that, by their powers, the works they had in hand, and those which they could carry out under the Acts they had obtained in recent years, they had not only ample water at their disposal to supply all the possible wants of the community for the next 40 years, but he thought that, if he doubled this time, there was not the least doubt, as far as their Company was concerned, that they would have ample water without going to other sources than those which they had at present at their command. He thought those who had followed the reports of the case presented by the other Companies would find that the latter were in a similar position; and he had not the slightest doubt—at any rate, as far as he was able to judge from the case of their own Company—that

there was at the door of Londoners ample water for all their requirements for centuries to come. The Commission had heard the case of the Companies, and had received them with every courtesy. The proprietors would have seen, by the reports which appeared in the papers, that the case of the London County Council was under consideration on the previous day. He did not propose to make any remarks as to what occurred on that occasion; but he could not but think that the gentlemen of reputation, the professional advisers of the Water Companies, who had put their statements before the Commission with a due sense of their responsibility, and their knowledge from their connection with these concerns for a long series of years, must be more capable of arriving at the facts than gentlemen who had had comparatively little knowledge of the position and interior working of the Companies, and who had simply picked up their facts from published statistics which might be found available. Up to the present time the Companies had not put before the Commission the evidence of the geologists and other scientific gentlemen; and, as a matter of convenience, this evidence had been left to the end of the inquiry, when it would be received on behalf of the united Companies. He did not himself think they had anything to fear from the report of a body of gentlemen constituted like the Commission; and he looked forward without any fear to their report. He believed the public would be surprised to learn that London was well placed for its supply of water for many centuries to come; and they would find that the reports to the contrary had been made indiscreetly, and without sufficient evidence as to the real facts. The Company, as the shareholders would find if they referred to their accounts for many years past, was in a sound and strong position, and steadily progressing; and they would have been paying a much larger dividend long since but for circumstances over which they had had no control, and which no one could have anticipated. He did not know that he need say anything further with regard to the contemplated purchase of the Companies' undertakings. He had often spoken upon this question; and they had constantly before them small cases of such transactions. They had in times past had principles laid down upon which such undertakings should be purchased; and in *The Times* of that day they would find a report relative to the purchase of an undertaking at Accrington, where the terms agreed upon had been 30 years' purchase. The principles upon which these works should be bought up were well defined; and, without repeating what he had already said, he had no doubt that, when the time came, those principles would not be departed from.

Mr. C. M. VIALLS seconded the motion.

The CHAIRMAN, in answer to questions, stated that the arrangement which had been made for obtaining the additional land for the Company's requirements were regarded by the Directors as advantageous, and such as would promote the interests of the concern. They had been endeavouring for years to get rid of the Battersea station altogether, as they considered that it was too near town. They had 40 acres of very valuable land there; and they had been working for an end which he believed would come in time. They might receive £300,000 or £400,000 for this land; and the money would be used for the construction of works which might be necessary for the purpose of the Company.

The motion was then put and carried unanimously. Dividends were afterwards declared for the half year at the rates of 5 per cent. per annum on the preference, and 6½ per cent. per annum on the ordinary stock and class "D" shares of the Company; and the proceedings closed with votes of thanks to the Chairman, Directors, Engineer, and staff.

GRAND JUNCTION WATER-WORKS COMPANY.

The Ordinary Half-Yearly General Assembly of this Company was held last Wednesday at the Offices, 65, South Molton Street, Brook Street, W.—Mr. FRANCIS TAGART in the chair.

The SECRETARY (Mr. J. W. Fisher) having read the notice convening the meeting,

The CHAIRMAN expressed regret at the absence, through a long and severe illness, of the Chairman of the Company (Mr. C. J. B. Hertslet). He was also sorry to inform them that Lord Knutsford had written stating that he could not be with them that day owing to a Cabinet Council; the present being the first time since he was elected a Director in 1875 that his Lordship had been absent. His colleagues had therefore asked him (Mr. Tagart) to take the chair; and he hoped they would make allowance for any shortcomings on his part. He thought that the accounts were, taken on the whole, satisfactory. It was not necessary for him to go through them; for there was only one item which differed very much, as compared with the corresponding period of last year. He referred to the sum of £1462, which had been charged against the revenue account in connection with the Dorney scheme of 1888. The shareholders would remember that that scheme was fully explained to them at the time; and it met with their approval. They promoted a Bill in the House of Commons in connection with it; but it was rejected upon the second reading—to their great disappointment, and, he might add, their great surprise, for it was an unusual course. They were not allowed to enter upon the merits of the scheme. Although they had kept it in existence for some time, they felt that they must now close the account. It had cost them a pretty round sum of money; but he thought that, as men of business, they would not lament this, because it went to show that the Company were then alive to their duties, and not indifferent to the future. The outcome of the half-year's working was that they were enabled to offer a dividend at the rate of 8½ per cent. per annum. A year ago, he believed, their dividend was reduced; but the Chairman then explained that this was owing to exceptional circumstances, which had turned out to be the case. This year they had fairly earned the dividend mentioned; and he hoped this result would be satisfactory to the shareholders. They would remember that some three years ago they gave the Directors power to raise £50,000 of share capital. They did not think it necessary to avail themselves of the whole sum at the time, and the £20,000 which they limited themselves to had carried them on fairly well; but they now considered it was advisable to raise the balance of £30,000. As stated in the

report, they had had large works in hand. The Board thought that the works should be kept up to the mark; and he felt sure that the proprietors would agree with them in this. It was also necessary to have a little working capital. Although it was usual in large companies like theirs, he thought it was not desirable for them to be under obligations to any considerable extent to their bankers. With reference to the constant supply, it was introduced partly at their own initiation; and they proposed to bring the whole of the district under this system. It was very good and beneficial no doubt to have the constant supply—that was, provided the fittings were well adapted to it, because if they were not, the constant supply system might be wasteful without being healthful. After the very great attention which had been called to the water supply of the Metropolis, it was not surprising that the Government should have appointed a Royal Commission to inquire into the matter; and the Commission, composed of able and impartial men, were at present pursuing a very searching investigation. In the first instance, it was natural that they should ask the Water Companies for a statement of their position. They did not, however, give very much time in which to prepare evidence; but the Company's Engineer (Mr. A. Fraser) presented the Directors very soon with a report setting forth what the Company had done from the beginning, what they were doing now, and what they proposed and hoped to do in the future. He would do an injustice to Mr. Fraser if he were not to say that his report was a very admirable one. It was considered by the Court with full deliberation, in the presence of their Secretary, and with the invaluable advice of their Solicitor, Mr. Bonnor Maurice; and, with very few additions and alterations, it was sent on to the Royal Commission. Subsequently to that—after the drafting of the Directors' report, in fact—Mr. Fraser was examined before the Commission, when he amplified and fortified his report. A similar course had been followed by all the Water Companies, with whom they had been acting in perfect harmony; and it had been agreed among them that the general and scientific evidence at their disposal should be deferred until towards the end of the inquiry—a course which had appeared to commend itself to the Commissioners. In connection with this matter, they had sustained a very great loss by the death of their old friend Dr. Tidy, who had made the analysis of the Thames Valley water—of which he had a high opinion—his lifelong study. Acting in concert with the other Companies, they had done their best as regarded the appointment of a successor to Dr. Tidy, so that the general and scientific evidence which they had to offer should be, on behalf of all the Companies, fairly put before the Royal Commission. The Thames Conservancy were now offering their evidence, and other evidence would be brought before the Commission; so that, as he had already said, the inquiry would be a searching one. This was the position at present; and he could only say that they awaited with patience and confidence the issue of the investigation. Pending the inquiry, it might have been supposed that proceedings in Parliament affecting the Water Companies would have been stayed, but that had not been the case. Bills had been promoted both in the House of Lords and the House of Commons. They had thought it inexpedient to oppose these Bills on the second reading; but they had been able to introduce amendments in Committee, which, he might say, would take the sting out of the Bills. The wisdom of this course had been shown. What the aim and scope of the Bill introduced by the London County Council might be, it was very hard for him to say. He should, perhaps, allude to the Bill for introducing a fresh supply of water into Birmingham. It was a very important Bill, and one not uninteresting to themselves. But he would ask this question: If it was to take eight years to bring this water from a distance of 50 or 60 miles—some said 80 miles—to Birmingham [A VOICE: Ten years], what would it cost, and what time would it take, to bring a perfectly new supply into the Metropolis? This was a very important question for the ratepayers to consider. He held in his hand a letter which was written by a ratepayer to *The Times* on, he believed, the 16th of October, dealing with this subject exhaustively. In reference to the market value of their property, it was no business of the Directors to stimulate its price; but it was their duty when—as they saw in the early part of the year—a very rapid fall took place, to calm any alarm, if there seemed to them, at least, no reasonable cause for apprehension. It was true that a very distinguished member of the London County Council, at an early period of the meetings of that body, had rejoiced over the fall in the value of their shares; but he would fain hope that the words in question fell from him hastily, and in the heat of debate, and that he himself would have afterwards regretted if—as might have been the case—a cruel and manifest injustice had been done to those who were obliged at the time to part with their property. The fall in the market value of the shares was not peculiar to their Company—it had extended to the other Water Companies; but he was happy to say that since the speech referred to, all the shares had risen. They might be assured that no Legislature of this country would allow their property to be unfairly depreciated with a view to its acquisition at its so lessened value. Such a principle (or want of principle), if it were to prevail, would amount—he would not use the word “confiscation,” because, happily, it was practically unknown to us—but it would be a fatal precedent if introduced under the plea, the false plea, of benefiting the ratepayers. It would begin with water, but did they for a moment suppose it would end there? It would not; it would extend to gas, railway, tramway, dock, and canal property. In fact, it would be a very heavy blow and great discouragement to all shareholders, and would throw a blight over every large industrial undertaking in the United Kingdom; and it was to be borne in mind that the prosperity and progress of this country so far had been owing mainly to the enterprise of private individuals—by persons associating together under the faith of Acts of Parliament, and not as they saw abroad, where great undertakings were nurtured, fostered, financed, and guaranteed by the aid of states or municipalities. An amount of ignorant prejudice prevailed against the Water Companies, though he could not say why; for they endeavoured to be on good terms with all their customers. On the previous day, he noticed in the streets, on the backs of “sandwich men,” a curious exhibition, which would be ridiculous if it were not malicious. Legal proceedings indeed might be

taken against the parties; but they did not intend to oblige them, and he would not have alluded to such a contemptible advertisement if it did not lead him to refer to the last report of Dr. Frankland, who said: “The water abstracted from the Thames by the Chelsea, West Middlesex, Southwark, Grand Junction, and Lambeth Companies was, for river water, of a high degree of organic purity, the river being fed during the dry season chiefly by springs in the chalk and oolite. It was efficiently filtered before delivery.” That was pretty strong; but beyond that he saw last week in the papers the report on the public health (from which he also proceeded to quote), contrasting the death-rate of London, 17·4 per 1000 with that of Liverpool, 21·9, and Manchester, 24·2. He maintained that, in the face of these documents, no candid person could draw any other inference than this—that the existing supply of water to the Metropolis was not injurious to health. If he had strayed from their immediate business, he would not, at any rate, commit the further error of attempting to forecast the future—not even the immediate future, for events travelled fast; but so long as the Directors were favoured with the confidence of the proprietors, their path was clear. It was to uphold their rights as they had been granted to them by Acts of Parliament, and to maintain their property in such a condition that, if they should, sooner or later, have to hand it over to any other trust, it should be delivered up in good working order. Further, and in the meantime, their effort should be to see that the large and important district committed to their charge was daily and abundantly supplied with good and wholesome water. He concluded by proposing—“That the report of the Directors and the statement of accounts be approved and confirmed, and that the recommendations contained therein be adopted.”

Mr. F. TENDRON seconded the motion. They had, he was certain, all listened with the greatest interest to the admirable address of the Chairman; and he most cordially endorsed every word that had been said by him.

Dr. LEESON expressed great satisfaction at the very speedy progress of the Company “all along the line.” He felt quite sure that, whatever the demand might be in the future in connection with the water supply of the Metropolis, it could be met by the present Companies; and that, if they could not meet it, no power on earth could, seeing that they possessed the experience and had all the appliances at hand. Those who read political economy would know that masters on the subject had always laid down this principle—that private companies could manage and govern things very much better than could the State; and they had only to go abroad and travel on a railway owned by the State to realize this. As a medical man, he was quite sure that the public could feel that they had a thoroughly good supply of water. He did not say it was cheap, for a good thing could not be obtained cheaply.

The motion was unanimously adopted.

Resolutions were afterwards passed, declaring the dividends recommended, and re-electing the retiring Directors and Auditor; and votes of thanks to the Chairman, Directors, Engineer, Secretary, and staff terminated the proceedings.

CHELSEA WATER-WORKS COMPANY.

The Half-Yearly General Meeting of this Company was held at the Offices, Commercial Road, Pimlico, last Thursday—Sir W. H. WYATT in the chair.

The SECRETARY (Mr. G. H. Gill) read the notice calling the meeting, and the Directors' report was taken as read.

The GOVERNOR, in moving the adoption of the report and statement of accounts, said he thought that they were very satisfactory on the whole. They showed an increase on their gross income for the half year of £1900, which was very gratifying; but, unfortunately, the expenses had also increased. For instance, their rates and taxes were very much larger; and they had had to pay in the half year £623 more under this heading. They also had to incur considerable expense in connection with the monstrous Bills which were periodically brought forward, but which happily did not come to much. With regard to the Bill promoted by the London County Council, the Committee took the same view as the former Committee—that they were not going to empower them to be the Water Authority; and the Bill was simply reduced to an arrangement by which the London County Council might spend a certain sum of money on inquiries. Of course, as ratepayers, they would have to pay a portion of the £10,000 which the County Council were going to expend, and which probably would do no good. It was, however, gratifying to know that they were not going to be considered the Water Authority—a point happily settled. The officers and Directors had also been very much put about in getting the evidence ready for the Royal Commission. He could not say how long the inquiry of the Commission was going on; but they would adjourn almost directly until October. He did not know (and no one else knew) whether they would make a report; but if they did, from what he could see of the Commission, he thought it would be a tolerably fair report. He did not think that the Commissioners would be able to find much fault with the quality of the water; but when they were asked what quantity they would be able to provide 50 years hence, it was difficult to express an opinion. He did not suppose that London would go on increasing in the next 50 years as it had done in the past; but they had plenty of water if their district did increase. They had also had to contend against the action—he would not say of the whole of the members of the London County Council, but of the persistent and malicious effort made by a certain section of that body in trying to depreciate the Water Companies' stocks. It had not succeeded, though it knocked their own stock down to 231; but it very soon regained the greater part of the loss. It was, however, a malicious and vicious thing to do, to support statements which were known not to be accurate. He felt convinced that, if they ever did buy up the undertakings of the Water Companies—he did not believe that it would be for some years yet—it would be found that they would have to pay for them. Parliament would never sanction their property being taken over without a fair equivalent being paid for it. There had been a transaction

to the extent of £700,000 with one of the Lancashire Companies—it was at Accrington—where probably fair terms had been given. That concern had been bought at its statutory dividend of 10 per cent., plus 1 per cent. All this showed that the proprietors need not be alarmed by what was occurring. Some people said that they did not care to go into securities which they might have to change in a few years time; and that, of course, affected their stocks. There had been several new supplies laid on in the past half year, as the report informed the shareholders. He was glad to tell them that the Directors had satisfied themselves, not only from the reports of their officers but from personal inspection, that the whole of the works, plant, machinery, buildings, &c., had been, and were being, maintained in efficient order. They had largely increased the constant supply. Since their last meeting they had put on very nearly 4000 houses. Whether this was to do any good for anyone he did not know; but still, the London County Council had the power to demand it, and the Companies were obliged to meet the demand. He did not think that anyone wanted the constant supply in the Company's district. The Superintendent of the district, who had been in the Company's service for the long period of 30 years, had resigned, receiving the proper scale of superannuation. This had enabled them to make fresh arrangements, which he believed (allowing for the superannuation) would not increase their expenses, though not much saving would be effected; but the change would produce much greater efficiency in the working and management, which was the most important object to aim at. They had had some anxiety, as the proprietors could easily imagine, about their coal. They made a very favourable contract for Durham coal; but that, of course, had been suspended. Under the contract, they were to be supplied with Welsh coal if Durham coal could not be furnished them. This had been done, and the Directors were not dissatisfied with the result; but just now they were in a little anxiety again. The contractor said that he would be able to send them Durham coal in a week's time, and he was trying to avoid sending them Welsh coal, which cost him a great deal more; but they had written to him informing him that they might have to buy elsewhere, under the terms of the contract. He had, however, done very well for them up to the present time. It was natural that he should be anxious to put things off for a week or two, so as to save money; but they must not let him go beyond a certain extent in this direction. He might say that, under the advice of the Engineer, they were making experiments at their Molesey works with a view to obtain an auxiliary supply of water from the gravel beds; and he thought that this might produce good results at a moderate cost, and be of advantage to them.

The DEPUTY-GOVERNOR (Mr. F. S. Clayton) seconded the motion, which was unanimously adopted.

Resolutions were afterwards passed authorizing the payment of the dividends mentioned—the distribution on the ordinary stock being at the rate of 10 per cent. per annum for the half year, less income-tax; and re-electing the retiring Directors and Auditor.

The GOVERNOR, in acknowledging a vote of thanks, said it was quite true, as had been said, that the Directors had experienced an anxious time; and he was afraid that that would be the case for some little while yet. All that they could do was their best to protect the interests of the Company; and he had great confidence that those interests would be protected, not only by the Directors, but also by those who were in authority. No one knew what the future would bring forth; but he did not think that their Company would suffer much. There was no fear that they would have any difficulty about their supply of water. They had ample for anything their district could ever require; and in this respect, perhaps, they had not the same anxiety as some of the Companies. They had a district entirely in the County of London; and they knew that there were only 528 acres of it uncovered. Supposing it was covered to the fullest possible extent, they would have an ample supply. He had heard some gentleman ask why the officers were not included in the vote of thanks passed to the Directors. He was sure that the Directors would be very glad if they would pass a separate vote to the officers, who certainly deserved the thanks of the proprietors. They had an excellent staff, all the members of which were anxious to do their very best for the Company; and they spared themselves no trouble or pains to do so. He then proposed a vote of thanks to the officers and staff.

The DEPUTY-GOVERNOR seconded the motion, which was unanimously adopted.

The SECRETARY, in reply, remarked that the officers had had a very anxious time and a time of hard work for some years; but their labours were lightened by the kindness and consideration of the Directors.

The proceedings then terminated.

Crosbie's Paints.—The London County Council have accepted the tender of Mr. Adolphe Crosbie, of Wolverhampton, for the supply of paints, &c., for the next twelve months.

A Burst in the Vyrnwy Aqueduct.—At the meeting of the Liverpool Corporation Water Committee last Tuesday, Mr. G. F. Deacon, the Engineer of the Vyrnwy works, reported that on the night of Thursday the 9th inst., when the water was passing through the main aqueduct and bye-pass pipes at the Mersey into the Prescott reservoir, one of the special pipe castings on Cuerdley Marsh burst. The effect was to wash away a large quantity of the soft earth of the marsh, and to allow a 42-inch valve, weighing about 10 tons, to sink below the level of the pipes. The water could not be stopped in time to prevent a certain portion of it from entering the tunnel. Owing to the nature of the ground, it was not thought safe to relay the disturbed pipes and valve without bedding them on concrete. The broken pipe had been taken out; and it was found that the fracture passed through a hidden flaw about 12 inches in length. Such a flaw could not have been detected beforehand. The whole of the pipes had previously been subjected to the full pressure for a lengthened period, with the exception of a few pipes, including the broken one. This is the second fracture that has occurred between Norton and Prescott, and the third on the whole length of main aqueduct between Oswestry and Prescott—a distance of about 50 miles; and a proportion so small as this is, Mr. Deacon believes, unprecedented.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

When last year the Edinburgh and Leith Gas Commissioners published their accounts, the tale they had to tell was that of a largely increased business, with a debit balance. This year the reverse is the case. Their accounts, which were issued yesterday, show a decreased business, with a large credit balance. Gas sold amounted to 1,221,513,700 cubic feet, a decrease of 27,010,000 cubic feet upon the sale in 1890-91; but the revenue from gas was £270,917, an increase of £41,110. This result was, of course, attained by the increase of 9d. per 1000 cubic feet which was made last year. It was inevitable that there should have been a shrinkage of the consumption, consequent upon such a large increase in price; though, as I have stated already, another reason is given—viz., that, the gas being of better quality, less of it was required. Both reasons probably operated. [But whatever causes and effects may be traced in the accounts by ingenious critics, the result is highly satisfactory. The policy of the Commissioners may be criticized, and consumers may grumble at the price they are called on to pay; still the gas is consumed, and that is the best justification the Commissioners could have. If anyone should be bold enough to say that the business of the Gas Commissioners was not in a healthy state, the reply is to refer them to the results of the past two years; and the refutation is complete. In the first of these two years, the Commissioners were harassed by troubles, some of which—such as the rise in the price of coal—were foreseen, but the greater proportion of which—such as the railway strike and the demands of their workmen for higher wages—could not have been anticipated. They were compelled to supply an inferior gas, while charging a high price for it; but the community, though grumbling was rife, consumed their gas to a larger degree than had ever been known before, the consumption rising in that year by nearly 100 million cubic feet. The year just closed has been an uneventful one. So far as outside troubles are concerned, the Commissioners have sailed in smooth waters. Their employees have worked loyally; and the public, though burdened with a heavy price, have not only ceased to grumble, but have contributed to the revenues of the Commissioners for gas a sum of £41,110 more than they did the previous year. This is the most satisfactory feature of the accounts, because the business of the Commissioners is primarily to sell gas; and it is one that points forward as well as backward, and should encourage the Commissioners in their work. In other departments there cannot be the same satisfaction; for unfortunately the markets have not been propitious. Upon coke, for instance, there was a decreased return to the amount of £2750; and upon tar and ammoniacal liquor, of £5281. The total income was £292,212—an increase of £32,958, and the largest which the Commissioners have yet had. Their expenditure was £218,423, an increase of £5611. The coal account amounted to £125,267, which was £12,291 higher than in the previous year. Where the saving was effected was in wages and charges at the works, the repair and maintenance of meters, law and parliamentary expenses, rates and taxes, and pensions. The saving on the last head is due to the death of the late Mr. J. K. Watson, the former Manager of the Edinburgh Gas Company; and I feel confident that the Commissioners are so fully alive to the benefits they derive from Mr. Watson's life-long labours in the promotion of the gas interest in Edinburgh, that they would rather have continued to pay his retiring allowance than have it cut off by his demise. One of the most pleasing features of the accounts is that the Commissioners have, by the issue of mortgages to the amount of £30,000, brought their capital account into something like order. A year ago they were working upon an overdraft to the amount of £21,302. During the year they added £15,419 to their capital expenditure, which left it £36,722 behind the amount raised. There is now only a debit balance of £6722 on the capital account; and that it is to be hoped will soon disappear. They have, after meeting all charges, and contributing £8464 to the sinking fund and reserve fund, a net surplus of £41,497, which they may devote to any purpose they please. It might not be out of place to suggest that they should wipe out this discrepancy in the capital account with it. It is more than likely, however, that, in view of necessary extensions of plant, they will be disposed to carry the whole sum forward. It is to be observed that the accounts do not give the output of gas; and it is consequently impossible to calculate the quantity unaccounted for. That will doubtless be given when the accounts are explained in detail by Bailie Archibald at the July meeting. Meantime, everyone must be pleased to see that the Commissioners have once more engineered themselves into a handsome surplus.

Notwithstanding the expression of disappointment with which Mr. Mitchell, the Finance Convener of the Dundee Gas Commission, introduced the annual accounts of the Commission to the meeting on Wednesday, I do not yet believe the Commissioners have anything to be troubled about in their past year's working. Of course, it must not be forgotten that he was introducing the report of the Finance Committee; and that it was in their department that there was any defect. The deficit in the accounts for the year was £4780, of which £2381 existed at the commencement, leaving £2399 accrued during the year. It is a question how much of this deficit of £2399 arose in consequence of an altered policy of the Commissioners. Two or three years ago it dawned upon the Commissioners that they were drawing uncomfortably near the limit of their capital account; and since then everything has been done which could be done to prevent its increase. That means that more is charged to revenue than used to be. As a matter of fact, £600 was this year paid out of revenue as a one-third instalment of the cost of procuring the Electric Lighting Provisional Order—an expenditure which cannot on any ground be set down as a renewal of gas plant. A similar sum of £600 has this year been charged as one-third of the cost of a retort-bench which it would not have been much of a stretch to charge to capital. Then the Analyst's department cost £324, which is a new charge. There may be other items in the same position; but if these three alone were taken off, the debit balance would thereby be reduced to £857. Mr. Mitchell made

a great deal about the inferior coal, which produced only 9838 cubic feet per ton, instead of 10,000 feet. It is significant to observe that a year ago Mr. Mitchell lamented that, whereas they had contracted for coal to produce 10,200 cubic feet per ton, they had only got 9631 cubic feet; so that last year they had a return of 207 cubic feet more per ton of coal than they did in the previous year. The Commissioners evidently expected less from the coal they contracted for a year ago than they did from the coal they purchased for the year 1890-91, because they estimated that it would produce 200 cubic feet per ton less. It, however, produced 207 cubic feet more; and where the disappointment with it comes in, I cannot see. It appears to me they are inclined to place too much reliance upon the work of their Analyst. It is a well known fact that no coal stands in the works the test of the laboratory; and the Commissioners should allow for that in their estimates. Their idea seems to be that the coalowner should make some allowance—a policy against which nothing can be said, but in favour of which much might be urged, if the gas industry were able to enforce it. Unfortunately, there is no understanding among the owners of gas undertakings on that head; and so long as there is a strong competition for the better qualities of gas coal, it is difficult to see how one body can maintain this position. There is another feature of the accounts which Mr. Mitchell did not refer to—the great increase of unaccounted-for gas. Two years ago it was only 6½ per cent. Last year it was reported to have risen to 9½ per cent.; and for the past year it was 10 per cent. This must have affected the revenue largely. I do not consider there is anything out of the way in the loss on this head; because other places show the same result in their accounts this year. The reason is probably to be found in climatic conditions. After all is said, however, the Commissioners have a healthy business; and though their financing of it may be open to some criticism, that is no reason why anyone should express disappointment at the results. They ought rather to be thankful at the magnificent expansion which was experienced in the consumption of gas.

It must be matter of the utmost gratification to all connected with the gas industry that Mr. Whimster, the veteran Manager of the Perth Corporation gas undertaking, should be able to present a record for the past year which can only be characterized as magnificent. The Gas Commissioners had troubles, of their own creating, a few years ago; but they have surmounted them, and are now prosperous. Last year they had an output of 92,231,200 cubic feet of gas—a decrease of 1,600,000 cubic feet—which, considering that the price was last year raised by 6d. per 1000 cubic feet, is highly satisfactory. But better than the output, is the fact that the sale of gas amounted to 85,114,200 cubic feet, which was 658,800 cubic feet more than in 1890-91. This result was attained by a reduction of the leakage from 10 per cent. to 7·23 per cent. Mr. Whimster is exceedingly fortunate in that respect; and the consideration of his good fortune is heightened by the fact that he obtained a yield of 10,540 cubic feet per ton of coal—a return which I have not seen equalled this year, and which shows that Mr. Whimster, with all his years, is still able to give a lesson to many who consider themselves leaders in gas engineering. Possibly the results he has attained are due to the new plant which was put down a couple of years ago; but, there again, he has the credit, for it was he who urged a somewhat stubborn Commission to go in for the renewals and extensions. The revenue for the past year was £18,859, of which £17,316 was derived from gas. The expenditure was £18,163; so that there was a surplus on the year's accounts of £695. Out of this balance, and out of the saving which they expect to make this year upon cheaper coal, they propose to construct two new oxide purifiers at a cost of £650, and to expend £600 in laying new mains. It is proposed to retain the price of gas at 4s. per 1000 cubic feet; and that the gas shall be of 22-candle power. The average price of their coal contracts for this year is 15s. 1d. per ton, which compares very favourably for the Commissioners with the 18s. 6d. per ton which they paid last year, and justifies the expectation that, the existing price of gas being retained, they will make money off it. A motion was made that the price of gas should be reduced by 2d. per 1000 cubic feet, which might have been adopted without loss; but it was not pressed, and in view of the flourishing position of the undertaking, the Commissioners did right, considering that their consumption of gas is still increasing, to endeavour to strengthen their financial position before contemplating a reduction in their revenue.

A deputation of the Edinburgh and Leith Gas Commissioners, including Mr. Mitchell, the Engineer, paid a visit to Paisley last week to inspect Mr. G. R. Hislop's patent process for the recovery of spent lime. The Commissioners were pleased with what they saw; but Mr. Mitchell has still to report upon whether or not it would be advantageous to introduce the process. They use about 4600 tons of lime a year in the Edinburgh works; and the expectation of the deputation is that they might save £2000 a year by the use of the recovery process. Mr. Hislop informed them that it would probably cost £3200 to erect the necessary retorts for the re-burning of the lime. The Commissioners have been put to a great deal of trouble over their waste lime. Some time ago, they acquired land near Penicuik, about 14 miles from the city, and upon it they have laid down several thousand tons of lime. Now the County Council objects that the lime-heap is polluting the water supply of a village in the vicinity; and the Commissioners have been paying the railway company again to bring it back and make use of it in a railway embankment. Even that has now been stopped, on account of the stench; and the Commissioners are at their wits' end what to do with it. Circulars have been sent out to farmers, offering them 6d. per ton to take it away; but, so far, the demand for it has been small.

At the forthcoming annual meeting of the Hawick Gas Company, the Directors will recommend that the price of gas be raised by 7½d. per 1000 cubic feet. Even then it will only be 3s. 11½d. per 1000 feet.

The Brechin Town Council on Monday had before them the subject of the agreement with the Gas Company as to the power of the latter to open the streets for pipe-laying. The agreement is that, in consideration of the Company supplying gas for the public lamps at 4s. 2d. per 1000 cubic feet, they are to be allowed to lay their pipes in the streets free of charge. After some discussion, the Council sent the agreement to a Committee to consider.

The Glasgow Gas Commissioners have again been very successful in

the coal market, having obtained contracts for the current year at from 7s. to 8s. 1d. per ton—which is much lower than anything that has been secured by any of the other gas-supplying bodies. One explanation of the very favourable terms which the Commissioners got is the large quantity they take; and another is that the cost of carriage is very small, there being, for the Dawsholm and Temple works, both railway and canal facilities for delivery. The price is a little lower than it was last year.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, June 18.

Sulphate of Ammonia.—The market is assuming a steadier tone; and there are indications that, at all events for the present, the bottom has been touched. There are now buyers at £9 15s. at the various ports. But few sellers can be found; and £9 16s. 3d. has actually been refused for a parcel for Hull delivery. A firmer market can hardly come as a surprise, when the present reduced production and the deliveries are taken into consideration. Although the demand is by no means large, it is still sufficient for the present ratio of production. Speculative forward business is still taking place on a considerable scale; and it is impossible to explain the *raison d'être* of these sales. There is nothing to warrant a still lower range of prices than that already existing; and it cannot be denied that sulphate has never been so low before. If nitrate has any influence at all upon the sulphate market, it is certainly strange that such risks are being run, seeing that the nitrate market is getting dearer—no doubt in consequence of the news that an agreement has been made among the producers to limit the total imports of 1892 to 17,000,000 quintals, at the same time restricting the January-February (1893) shipments to about 35,000 tons per month, and prohibiting steamer shipments during these two months.

LONDON, June 18.

Tar Products.—This market in all positions is in a depressed state. The little spurt in benzols passed away; and to-day they are distinctly weaker than a week ago. The production of benzols, however, has largely decreased during the past month; and it is not likely that prices will go much lower. It is stated, however, that merchants are offering to sell at current rates for twelve months; but makers are not offering beyond the next two or three months. Anthracene is likely to go lower; and sales are reported at less money than lately quoted. There is a little better demand for creosote and salts, but at low prices. Carbolic acid is more sought after; but, so far, value has not improved. An important tar contract over a lengthened period is reported to have been made at a shade above 10s. Pitch is moderately firm; but there are "bear" sellers at less than to-day's quotation. Prices: Tar, 9s. to 11s. Pitch, 28s. Benzol, 90's, 1s. 8d.; 50's, 1s. 4½d. Toluol, 1s. 2½d. Solvent naphtha, 1s. 3d. Crude benzol naphtha, 30 per cent., 8d. Creosote, 1d. Naphthalene salts, 20s.; pressed, 45s. Carbolic acid, crude, 60's, 1s. 1d.; 70's, 1s. 4d.; crystals, 5d. Cresol, 8d. Anthracene, 30 per cent., "A" quality, 10d.; "B" quality, 7d.

Sulphate of Ammonia.—There is more business being done; but the price does not improve. The only encouragement that can be extracted from the position of the market is that prices have remained fairly steady for the last two or three months. There is a better feeling in the market; but it is too much to expect that, at this season of the year, the price will seriously advance. Considerable sales have been made at prices varying from £9 12s. 6d. to £9 15s., less 3½ per cent. Gas liquor (10 oz.) is nominally quoted from 5s. to 6s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—There is no very new feature to notice in the coal trade of this district, beyond what I reported last week. The holiday stoppages of the pits have for the time checked the putting down of stocks, and the accumulation of any large surplus supplies upon the market. But the demand has been extremely quiet for all descriptions of round coal; and although quoted prices are nominally unchanged, the tendency continues decidedly in favour of buyers. The better qualities of round coal are necessarily only in very restricted request for house-fire purposes, and concessions are here and there made to effect sales; but quotations remain on the basis of about 12s. for best Wigan Arley, 10s. to 10s. 6d. for Pemberton four feet and second qualities of Arley, and 8s. 6d. to 9s. for common house-fire coals, at the pit mouth. The chief difficulty which colliery proprietors are experiencing is, however, with the lower qualities of round coal, which are becoming a drug in the market, owing to the unsatisfactory condition of the principal coal-using industries; and prices show a decided downward tendency. At the pit mouth, the average quotations are not more than 7s. 9d. to 8s. 3d. per ton for good qualities of steam and forge coal; but under these figures is often taken, and buyers would have no difficulty in placing orders at about 7s. 6d. per ton for ordinary descriptions of steam coal. For shipment, even lower prices are being quoted; and although there have been smaller supplies offering at the ports on the Mersey, common steam coal has been quoted at 8s. 9d. to 9s. per ton delivered at the Garston Docks or the High Level, Liverpool. For the better qualities, some of the colliery proprietors are still holding to 9s. 3d. and 9s. 6d. per ton. As regards gas-making coals, there has been little or nothing doing towards the settling of contracts during the holidays; but, so far as there is anything to report, prices seem to be generally well maintained at close upon the basis of those obtained last year. I do not hear of concessions of more than about 3d. per ton being quoted; although, in some very exceptional cases, I believe 6d. under last year's prices has been taken. Some further inquiries for locomotive fuel are coming upon the market. But, as I reported last week, there seems to be a growing determination on the part of the leading colliery firms not to entertain the low prices which were accepted recently for one or two contracts placed with the L. and N. W. Railway Company; and it seems more than doubtful

whether the further contracts which are to be given out will be placed, except at some more satisfactory prices to the colliery proprietors. For engine classes of fuel, there has been a generally good demand; and prices are well maintained at late rates, with a hardening tendency in some instances where low figures were being quoted. At the pit mouth, good qualities of burgy are firm at 6s. 3d. to 6s. 9d.; the better qualities of slack, 4s. 9d. to 5s. 3d.; and common sorts, 3s. 3d. to 3s. 9d.

Northern Coal Trade.—The coal trade of the North is now settling down to steady work; and prices are generally easier. Best Northumbrian steam coal is quiet at about 10s. 6d. per ton f.o.b.; but small steam coal has fallen more in proportion, and may now be had at 4s. 9d. per ton—or half the maximum price in the strike. Durham coals are lower; though the fall is rather unequal. Best gas coal has been sold at from 8s. to 9s. 6d. per ton f.o.b.; and the price depends much on the position and the extent of the contracts of the various collieries. In one or two cases, the pits have still to supply the coal that should have been sent out in the strike time; and thus such collieries have very little coal to sell. But in one or two instances, the buyers of the coal have got alternative supplies in the time of the strike; and they have decided not to take the quantity that the northern pits would have furnished. The latter have therefore fair amounts of free coal; and thus the pits ask rather unequal prices. Bunker coals are weaker at from 8s. to 8s. 6d. for unscreened; and the manufacturing coals are also a little lower in price. Household coals are rather dull; and most of the landsale collieries have lowered the prices. There is a good demand for smithy coals. Coke is now in rather larger supply; and from 17s. to 17s. 6d. per ton is the general price for best Durham makes. Gas coke is dull; but the production is only very limited just now.

Scotch Coal Trade.—Main coal has been selling freely this week; but other varieties remain unchanged. As for some weeks past, all business done has been for prompt delivery. Buyers are holding back to see what effect the re-starting of the Durham pits will have on the market. The demand for foreign gas-works has now ceased, which should have a lowering effect upon that for home gas undertakings. The prices quoted are: Main, 7s. 9d.; ell, 8s. 6d. to 8s. 9d.; splint, 8s. 3d. to 8s. 6d.; and steam, 10s. to 10s. 3d. per ton. Shipments still continue to be very heavy. The latest returns show 159,371 tons, an increase of 18,825 tons over the corresponding week of last year; and for the year to date, 3,196,381 tons, an increase of 425,610 tons.

Gas Exhibition at Middlesbrough.—From Tuesday to Friday last week, the Davis Gas-Stove Company, Limited, held an exhibition of gas appliances in the crypt of the Town Hall, Middlesbrough. Miss Ida Cameron delivered free lectures on cooking by gas twice daily.

Electric Lighting in Oxford.—Last Saturday evening the principal streets of Oxford were lighted by electricity; the current being switched on by the Mayor (Mr. F. W. Ansell), after an invitation dinner given by the Oxford Electric Lighting Company at the generating station, under the presidency of the Chairman (Mr. J. Irving Courtenay). The lamps, which are of 3000-candle power each, are situated near the railway station, on Carfax, in High Street, Broad Street, and Magdalen Street, and the work has been carried out by the Electric Construction Corporation, of Wolverhampton, for the Company, of which Mr. George Offor is General Manager and Secretary.

The Neepsend (Sheffield) Gas-Works Ambulance Class.—The members of this class held their annual meeting last Wednesday, when, in the presence of a large gathering, a very enjoyable programme of music and recitation was gone through. Mr. Allan, the Manager of the works, presided; and, referring to the report of the Examiner (Dr. Cassidi, of Derby), complimented the members on their efficiency—all having succeeded in passing. He also heartily congratulated Dr. Pearson, who had so ably instructed the class. During the evening, the certificates were presented to the members by Mrs. Allan; and, on behalf of the class, Mr. Allan presented Dr. Pearson with a handsome silver inkstand, which he suitably acknowledged.

The Purchase of the Accrington Gas and Water Works by the Corporation.—On Monday last week the Accrington Town Council decided, subject to certain safeguards, to purchase the undertaking of the Accrington Gas and Water Company. The Company supply gas and water to four local board districts, as well as to Accrington. The terms agreed upon are the payment of perpetual annuities amounting to £23,474, which is equal to the maximum statutory dividend, plus 10 per cent., with an additional £9000 for compensation to officers and costs. It was stated that the Company's net profits amount to upwards of £24,000 a year; and that for years they have paid the statutory dividends, and left handsome surpluses from which bonuses and back dividends have been paid, new offices built, and the plant kept in excellent order. At 30 years' purchase, the sum agreed upon is upwards of £700,000; and it was stated that, assuming Parliament will grant time for the repayment of the sinking fund, it is hoped the transfer can be effected without being any burden on the rates.

Bradford Corporation Water Department.—In moving, at the meeting of the Bradford Town Council last Tuesday, a resolution for the adoption of the annual estimates and the laying of a general district rate, Alderman John Hill, the Chairman of the Finance Committee, gave a few statistics showing the financial position of the Water Department. He said that the receipts during the past year had been—for water-rents and meter supply, £114,315; for rents of property and other items, £3828—making together, £118,143. The payments had been as follows: For interest and sinking fund, £100,101; wages of workmen, £5211; salaries, £2537; rents, &c., £973; rates and taxes, £6326; repairs and paving, £3109; soak and goit, £184; Gilstead filters, £820; Heaton pumping-station, £624; waste-water department, £1218; and sundry items, £1347—making a total of £122,454, and showing a deficit of £4311. This deficiency was caused partly by a falling-off in the receipts for water by meter, but chiefly by extra outlays, such as cleaning out Chellow reservoir and other works. The Water Committee and the Finance Committee had decided that this loss should be met from a reserve fund of over £17,000 still existing to the credit of the Water Department.

The Kirkleatham Water-Works Arbitration.—The Stockton and Middlesbrough Water Board have decided to appeal against the decision of the Divisional Court, as given in the JOURNAL for the 7th inst. (p. 1067), confirming the alternative award of the Arbitrator in the Kirkleatham case, and reducing the amount from £25,424 to £8006.

Gas Affairs at Leeds.—At last Thursday's meeting of the Leeds Corporation Gas Committee, the salaries of Mr. Tooley, Manager of the Meadow Lane works, and of Mr. Smith, Manager of the New Wortley works, were increased by £50 each. The Committee also accepted a tender amounting to £2414 for the construction of an overhead railway at the Meadow Lane station, and another for the necessary brick work, amounting to £1072.

Assault on a Gas Company's Servant.—At the Wandsworth Police Court last Friday, Arthur Jones, a butcher, of 2, The Terrace, West Hill, was summoned for assaulting Albert Attwell, a servant in the employ of the Wandsworth and Putney Gas Company. Mr. Besley said the defendant was indebted to the Company in a sum of £12; and as applications for payment had been of no avail, the complainant was sent to cut off the gas. While doing so, the defendant committed the assault complained of. Mr. Denman said men must be protected in the discharge of their duties; and he fined the defendant 20s.

Extensions of Gas Plant.—Among other plant which Messrs. Clapham Bros., of Keighley, are now carrying out, are six large purifiers for the Douglas (Isle of Man) Gas Company, and a similar number for the Sheffield Gas Company; three "Eclipse" washer-scrubbers (Laycock and Clapham's patent)—one for Penrith, one of 2 millions per day for Stockport, and one of similar size for Dewsbury. Fittings for 550 retorts for the Manchester Corporation, and for 60 retorts for the Ilkley Gas Company are in hand; and the firm will shortly commence the erection of a patent condenser to pass 3 millions per day for the Burnley Corporation.

East Surrey Water Company.—The report of the Directors of this Company, which was presented at the annual general meeting of shareholders last Saturday, stated that there was a balance of £2579 on the 25th of March last; and they recommended that dividends of 5 per cent. on the preference shares, and 4 per cent. on the ordinary shares, should be declared. These (less the interim dividends) would amount to £2239, and leave £340 to be carried forward. The business of the Company continues to increase; an accession of 261 consumers having taken place during the past year. The works, under the Manager and Secretary (Mr. J. R. Downes) have been extended; and the new pumping-station at Kenley will shortly be in regular use.

The Gas War in Cleveland (Ohio).—The contest over the price of gas which has been going on for a year in Cleveland (Ohio) has now, says the *Engineering Record*, ended by a compromise which includes not only the lowering of the price of gas by the two Companies, but a readjustment of their relations to the Municipality. A year ago the Council passed an ordinance reducing the price of gas from \$1 to 60 c. per 1000 cubic feet. The Companies declared the order equivalent to a confiscation of their property; and they carried the matter to the United States Circuit Court. The hearing had progressed to the presentation of testimony for the city, when a compromise was agreed upon, whereby the Companies accept a rate of 80 c. per 1000 cubic feet for a term of ten years, and also agree to pay into the city treasury 6½ per cent. of the gross receipts for gas, and bear the expenses of litigation. This is a much more sensible outcome than to waste capital by building competing works, which would ultimately have been absorbed and paid for in some way.

Abolition of Differential Prices at Walsall.—An important discussion took place at the meeting of the Walsall Town Council on Monday last week, on a recommendation of the Gas Committee to abolish, as from the 1st prox., the existing differential charges for gas, and make the price a uniform one of 2s. 6d. per 1000 cubic feet to all classes of consumers. To this an amendment was brought forward, to adjourn the discussion until a table had been prepared giving the number of consumers at the present rates of 2s. 4d., 2s. 6d., and 2s. 8d. per 1000 cubic feet, and showing the difference the proposed uniform rate would make on the consumption of the past year. After some debate, the amendment was rejected by a large majority. Another was then submitted to make the price 2s. 4d. per 1000 cubic feet. But the Town Clerk pointed out that, if it was carried, it could not come into effect until next year, as the estimates had been made out, and the average profits of the gas undertaking calculated thereon; and on being put to the vote, it was rejected. A further amendment, to make the price 2s. 5d., met with a similar fate, though the majority against it was smaller than in the other cases. The original proposition was then put and carried.

Annual Report of the Coventry Corporation Gas Committee.—The annual report of the Gas Committee of the Coventry Corporation for the year ending March 25 last states that, after providing £1381 the year's payment into the sinking fund, there is a net profit of £309 available for the general district fund in relief of rates, as against £2015 in the previous year, and £2560 the year before. There has been an increase in the sale of gas amounting to nearly 34 million cubic feet, as compared with the preceding year, or rather more than 12 per cent. The receipts, however, have not risen in proportion to the increase in the amount of gas sold, owing to the reduction of 1d. per 1000 cubic feet made in June last; while, on the other side of the account, there is a further rise in the price of coal, as well as the increase in wages granted in May, 1891. The market for residuals also has not been so good as formerly. These causes together account for the serious reduction in the net profits. The Committee mention that they have taken advantage of the flourishing state of trade during the last few years to rebuild the oldest of the retort-houses, which was in a dangerous condition. This has been done at a cost of £2684, which has been provided out of revenue, and has been spread over the last three years. In renewing the retorts in that house, they have been built on the inclined principle; and it is anticipated that this will effect a saving in the cost of labour to the extent of about £1000 a year.

Completion of New Works for the Cirencester Gas Company.—The old works of the Cirencester Gas Company, erected in 1833, have lately been replaced by new ones, which have been put up under the superintendence of Mr. E. M. Beecham, the Company's Manager. They have been constructed from the plans of Mr. Thos. Newbigging, M.Inst.C.E., of Manchester; and they are admirably adapted to meet the requirements of the Company's business. The retort-house is 70 feet by 62 feet, with an adjacent coal-store, 70 feet by 30 feet, next the railway, and an engine and boiler house 36 feet by 25 feet. The bulk of the plant has been supplied by Messrs. R. and J. Dempster, of Newton Heath, Manchester. There are three gasholders, of 100,000, 60,000, and 25,000 cubic feet respectively. The engine and exhauster were supplied by Messrs. George Waller and Co. The capacity of the new works is about 50 million cubic feet per annum, as compared with 30 millions, the productive power of the old ones.

Damages Under the Employers' Liability Act.—At the Westminster County Court, on Monday last week, Mr. F. Bayley and a jury had before them the case of *Parrish v. The Gaslight and Coke Company*, in which the plaintiff sought to recover damages for injuries sustained in the Company's service. He was at work in the coal-store at the Haggerston Station, filling coal-buckets, which were hauled up through the roof; and while so engaged, a large plank, as he averred, fell from the roof and struck him on the head. For the defence, a foreman in the Company's employ was called, and swore positively that there was no plank which could have fallen upon the plaintiff; and, moreover, the roof had not been uncovered at the part where he alleged that the plank had dropped through. Pieces of coal, he said, often lodged on the cross beams of the building; and it was the duty of the men to push them down. He saw the plaintiff shortly after the accident, and he appeared to be a little dazed; but he was certainly not insensible. A number of other witnesses, including the medical men who attended the plaintiff, were also called. The jury found that there was a defect in the defendants' works or machinery; and they awarded the plaintiff £10 damages, but did not attach any blame to the foreman. The judge entered a verdict accordingly, with costs.

The Stoke Corporation Gas Department.—At the meeting of the Stoke Town Council last Thursday, Alderman Leason announced that for the year ended March 31 last, the gross profits of the gas undertaking had been £5954, and after paying all the extra charges of the year, there was left a net profit of £2577 for the reduction of the rates. The Gas Committee recommended, and it was agreed, that, at the special request of Mr. Lass, the following letter from Messrs. Alfred Lass, Wood, and Co., bearing upon matter which transpired at the previous meeting (*ante*, p. 1028), should be entered on the minutes: "The figures in our report with reference to the sinking fund are perfectly correct. They are based upon the figures settled by the Board of Trade in the Stoke Provisional Order, 1888; and we cannot go behind that Order. The figures in Mr. Sant's table differ from those in the Provisional Order to the extent of £1600, which constitutes the whole difference between Mr. Sant's figures and ours. You will also observe that we have given credit to the sinking fund for the full amount of the repayments shown in the published accounts of the Committee for the year ended March 31, 1891—viz., £4217. We have not the books to refer to at this moment; but as far as our memory serves us, we think you will find that the £1600 was paid off very shortly after it had been borrowed, and the Board of Trade no doubt took that into consideration when they settled the figure given in the Provisional Order as £41,900, instead of Mr. Sant's figure of £43,500. If it is desired that the £41,900 mentioned in the Provisional Order of 1888 should be altered for the purpose of making it agree with Mr. Sant's table, it appears to us that application will have to be made for another Provisional Order." The Gas Committee also recommended that £1000 should be handed to the Town Council towards the reduction of the rates; and this was agreed to.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.
For Stock Market Intelligence, see *ante*, p. 1182.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.					£ s. d.
GAS COMPANIES.								
590,000	10	13 Apr.	10½	Alliance & Dublin 10 p. c.	10	16½-17½	..	6 0 0
100,000	10	"	7½	Do. 7 p. c.	10	11-12	..	6 5 0
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105-107	..	4 13 5
100,000	20	27 May	8	Bahia, Limited	20	10-12	..	13 6 8
200,000	5	12 May	7½	Bombay, Limited	5	6½-6¾	..	5 11 1
40,000	5	"	7½	Do. New	4	4½-5	..	6 0 0
380,000	Stock	26 Feb.	12½	Brentford Consolidated . . .	100	212-217	..	5 12 11
150,000	"	"	9½	Do. New	100	164-168	+1½	5 10 1
220,000	20	11 Mar.	11½	Brighton & Hove Original . .	20	40-42	..	5 9 6
888,500	Stock	11 Mar.	5	Bristol	100	95-100	..	5 0 0
320,000	20	13 Apr.	11½	British	20	42-44	..	5 2 3
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	10	19-20	..	5 15 0
51,510	10	"	8½	Do. 7 p. c.	10	15-16	..	5 6 3
328,750	10	"	—	Buenos Ayres (New) Limited	10	6½-7½	..	—
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	94-97	..	6 3 9
150,000	20	26 Feb.	8	Cagliari, Limited	20	25-27	..	5 18 6
550,000	Stock	13 Apr.	13	Commercial, Old Stock . . .	100	229-234	..	5 11 1
165,000	"	"	10	Do. New do.	100	180-185	..	5 8 1
130,000	"	15 June	4½	Do. 4½ p. c. Deb. do.	100	117-120*	..	3 15 0
800,000	Stock	15 June	13	Continental Union, Limited .	100	218-223*	+3	5 16 7
200,000	"	"	10	Do. 7 p. c. Pref.	100	185-195*	+1	5 2 7
75,000	Stock	30 Mar.	10	Crystal Palace District . . .	100	185-195	..	5 2 7
486,090	10	29 Jan.	10	European, Limited	10	19-20	..	5 0 0
354,060	10	"	10	Do. Partly paid	7½	14-15	+½	5 0 0
5,470,820	Stock	12 Feb.	12	Gaslight & Coke, A, Ordinary	100	207-212	-½	5 13 2
100,000	"	"	4	Do. B, 4 p. c. max.	100	94-98	..	4 1 7
665,000	"	"	10	Do. C, D, & E, 10 p. c. Pf.	100	250-255	..	3 18 5
30,000	"	"	5	Do. F, 5 p. c. Prt.	100	118-123	..	4 1 3
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	169-174	..	4 6 2
1,300,000	"	"	7	Do. H, 7 p. c. max.	100	154-158	..	4 8 7
463,000	"	"	10	Do. J, 10 p. c. Prt.	100	247-252	..	3 19 5
476,000	"	"	—	Do. K, 6 p. c. Prt.	100	148-153	..	3 18 5
1,061,150	"	15 June	4	Do. 4 p. c. Deb. Stk.	100	114-116*	+1½	3 9 0
294,850	"	"	4½	Do. 4½ p. c. do.	100	118-121*	+1½	3 14 4
908,000	"	"	6	Do. 6 p. c. do.	100	163-166*	+½	3 12 3
3,800,000	Stock	12 May	12	Imperial Continental	100	210-214	-1	5 12 1
75,000	5	15 June	6	Malta & Mediterranean, Ltd.	5	4-4½*	..	6 13 4
560,000	100	1 Apr.	5	Met. of Melbourne, 5 p. c. Deb.	100	108-110	..	4 10 11
541,920	20	15 June	5	Monte Video, Limited	20	14-15*	..	6 13 4
150,000	5	27 May	10	Oriental, Limited	5	7½-8½	..	6 1 2
60,000	5	30 Mar.	7	Ottoman, Limited	5	4-5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited	10	2-3	..	—
People's Gas of Chicago—								
420,000	100	3 May	6	1st Mtg. Bds.	100	106-110	..	5 9 1
500,000	100	1 June	6	2nd Do.	100	100-103	..	5 16 7
150,000	10	15 Oct.	10	San Paulo, Limited	10	8-9	..	—
500,000	Stock	26 Feb.	15½	South Metropolitan, A Stock	100	265-270	..	5 14 10
1,350,000	"	"	12	Do. B do.	100	215-220	-1½	5 9 1
200,000	"	"	13	Do. C do.	100	230-240	..	5 8 4
725,000	"	30 Dec.	5	Do. 5 p. c. Deb. Stk. . . .	100	142-146	..	3 8 6
60,000	Stock	11 Mar.	11½	Tottenham & Edm'ton, "A"	100	225-230	..	5 0 0
WATER COMPANIES.								
729,331	Stock	30 Dec.	10	Chelsea, Ordinary	100	253-258	+1	3 17 6
1,720,252	Stock	13 Apr.	8	East London, Ordinary . . .	100	195-200	..	4 0 0
544,440	"	30 Dec.	4½	Do. 4½ p. c. Deb. Stk. . . .	100	138-142	..	3 3 4
700,000	50	11 Dec.	8½	Grand Junction	50	99-103	..	4 2 6
708,000	Stock	12 Feb.	10½	Kent	100	260-265	..	3 19 3
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max. . . .	100	224-228	+2	4 3 4
406,200	100	"	7½	Do. 7½ p. c. max.	100	190-195	+2	3 16 11
279,700	Stock	30 Mar.	4	Do. 4 p. c. Deb. Stk. . . .	100	121-124	..	3 4 6
500,000	100	12 Feb.	12½	New River, New Shares . . .	100	325-335	..	3 12 4
1,000,000	Stock	29 Jan.	4	Do. 4 p. c. Deb. Stk. . . .	100	127-130	+1	3 1 6
902,300	Stock	15 June	6½	S'thwk & V'xhall, 10 p. c. max.	100	147-152*	+2½	4 5 6
126,500	100	"	6½	Do. D 7½ p. c. do.	100	134-138*	+3½	4 14 3
1,155,066	Stock	15 June	10	West Middlesex	100	237-242*	..	4 2 8

† Next dividend will be at this rate.

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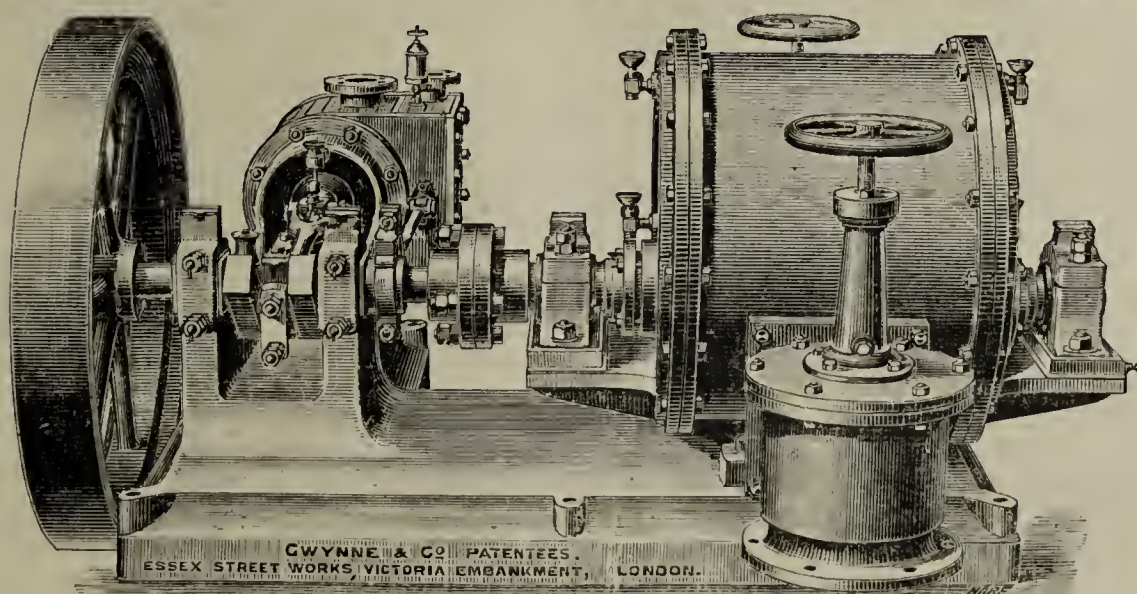
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A Station Meter, 1200 cubic feet per hour.
Two Annular Condensers, 10 ft. 5 in. high, 1 ft. 9 in. diameter.

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THE
**JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.**

TUESDAY, JUNE 28, 1892.

Gas in the New Parliament.

LAST week we commented upon the position in which the Eight-Hour Day men will find themselves in regard to the General Election. We return to the same engrossing topic now for the purpose of drawing attention to the possibility that the result of the election may be to bring

the compulsory extinction of the Metropolitan Gas Companies, and perhaps others with them, "within the range" of practical politics." So far as can be gathered from the addresses of many candidates for Metropolitan constituencies, the growth of the "Progressive" spirit in modern municipalities has impressed politicians of all shades; and if there should be time, in the period of the existence of the next Parliament, for the extension of municipal responsibilities to embrace many matters now left to private enterprise, there will not be any party of whom it can be said that they are pledged to resist this variety of State Socialism. The acquisition of the gas undertakings of London by the County Council was once regarded as a point in the Progressionist Charter only; but now there is little or no resistance to the suggestion from any quarter. It is treated as essentially a question of expediency. There is nothing to complain of in this development of public opinion; for when the subject comes to be inquired into, it will be upon grounds of expediency, and on these alone, that the result will be based. And what applies to the Metropolis will do so with equal force to all parts of the country. The next Parliament, if it lives long enough, will almost certainly register some further advances in the direction of the decentralization of domestic government; and from these alterations, whatever they may be, the arrangements for gas supply will hardly be excluded. Meanwhile, it is interesting to notice that the gas interest will not be better represented, numerically, in the new Parliament than in the old; and it may easily be worse off in this respect. Colonel Makins, M.P., the Governor of The Gaslight and Coke Company, does not intend to seek re-election. Mr. William Woodall, M.P., has a personal and family connection with the gas interest, and will probably be returned again for his old constituency, Hanley, although this time he is to be opposed. A very well-known and popular Gas Engineer and Manager (retired), Mr. D. Ford Goddard, lately Mayor of Ipswich, stands for that city; and the hopes of all his old colleagues of the profession, irrespective of party, will be with him in his effort to enter Parliament. Mr. John Aird's name is familiar in many circles besides that to which these lines are addressed. His seat should not be in serious danger. Sir Julian Goldsmid, Bart., the Chairman of the Imperial Continental Gas Association, is again offering himself to the electors of South St. Pancras; and he is being powerfully supported. We believe we have now named the principal representatives of the gas industry who are actually engaged in wooing constituencies with a view to sitting in the new House of Commons in the novel or customary capacity of Elect of the People. The list is short, but uncommonly select. Bearing in mind the importance of the gas industry of the United Kingdom, however, it may be surprising to some that it is not more largely represented in Parliament. It is a craze of the day that no order, class, or section of the community is safe in the enjoyment of its rights and privileges unless it is able to send to the House of Commons a sworn band of delegates, who, whatever else they do, shall be under orders to defend the cause for which they sit. Well, it has never been suggested that the gas interest, on the whole, has been hardly treated by the Imperial Legislature; but it is true that, considering its financial and industrial importance, this interest has been poorly represented in the Lower House. There is more in this reflection than meets the eye; but it is not for us to draw the inference.

A Question of Accuracy.

SOME notice should be taken of the remarkable figures relating to the illuminating power of Salford Corporation gas, which (as will be seen from an abstract report in another column) Mr. George E. Davis recently laid before the Manchester Section of the Society of Chemical Industry. The paper dealt generally with the testing of the illuminating power of coal gas, and related the author's experience of standards of light and photometers. This part of the paper was interesting. The author "slew the" "slain" in denouncing the parliamentary standard candle as a standard of light for photometrical work. He called it the "boasted" parliamentary standard; but it would have been more to the purpose if he had admitted, what he must know perfectly well, that the term "abused" would have been more accurate. Mr. Davis also spoke with a spirit which is more that of a partisan than a man of science in his further references to the standard candle as

something that "might suit gas engineers, but not a chemist with any idea of accuracy." Pray, who is Mr. Davis, and what are chemists as a class, that he, for himself or for them, should so presume to habits of "accuracy"? As we have already shown, Mr. Davis commits a glaring breach of this estimable quality in any man, whether he be chemist or controversialist, in misdescribing the current reputation of the standard candle. He knows that there is actually sitting at the present time a Board of Trade Committee, whose duty it is to find an acceptable substitute for the parliamentary standard of light; and we have yet to learn that it is to the scrupulosity of chemists, as such, that the origination of this movement should be ascribed. It is plain fact that the candles do *not* suit gas engineers; and it is to the productions of gas engineers that chemists like Mr. Davis have to take when they want something better. All this indication of the existence in Mr. Davis's paper of a lack of accuracy of description which, in such a stickler for exactitude as the author, is a deplorable proof of the frailty of human nature, does not predispose one to accept his returns of the illuminating power of Salford gas as incontestable. We do not know why Mr. Davis took all this trouble with Salford gas. At any rate, granting that every gas consumer has an indefeasible right to examine, personally or by a skilled deputy, the gas with which he is supplied, and that this particular consumer chose to exercise his right in the manner and with the results recorded in Mr. Davis's paper, what is to be said about it? Although the cloven foot of the partisan unquestionably peeps out from under the habit of the scientific observer which the writer of this paper put on before his public, we do not deny to Mr. Davis the regard due to his professional standing. No partisanship can be imagined of the necessary strength to make Salford gas indicate $12\frac{1}{2}$ candles illuminating power if it left the gas-works 5 or 6 candles better. It appears to be a part of Mr. Davis's "brief" to prove that the testing of gas at the works is insufficient. Where the district of supply is large, this view is reasonable. But it may be remarked that Salford is not the only gas-consuming town in the kingdom; and that in London, as well as in some other places, the principle of testing gas at a distance from the works is regularly followed. There is nothing new, therefore, in this suggestion. It is perfectly certain, however, that there is no such difference between the quality of the London gas as made and as tested daily in various parts of the Metropolis, as Mr. Davis has found in the case of Salford. This is a matter for the particular consideration of the Salford Corporation Gas Committee. The circumstance that such statements as those of the paper should ever be published is indicative of the possibility that a gas supply may not be above suspicion, even when administered according to the tenets of an advanced Municipalism.

The Unit of Lighting.

AN animated little controversy has been going on in the columns of our contemporary *Industries*, between the Editor and Mr. Trotter, whose recent paper on "Illumination" was discussed in the *JOURNAL*, respecting the most convenient manner of expressing the intensity of lighting. The question is as to whether the amount of illumination received by a given surface (as the floor of a room, a writing or reading desk, &c.) is better stated as being equivalent to n candles at a distance of one foot, or to the light of one candle at n distance. As our contemporary puts it, "Mr. Trotter takes the illumination due to a standard candle one foot away as unit illumination. The unit of light (lighting?) is then taken as the light falling on a square foot which is one foot away from the candle. This leads to the curious result that a candle gives a total light of 4π , or $12\frac{1}{2}$ candles," which is perfectly correct if we remember that it is merely the conventional way of treating all problems arising out of the phenomena of radiation, whether of light or of any other of the undulatory forces. All the same, it is not without a shock that one is brought for the first time face to face with the assertion that there is mathematical reason in ascribing to one candle the potentiality of giving a total lighting effect of $12\frac{1}{2}$ candles. It will be a mercy if the electricians do not get hold of this pleasing mathematical convention, and hoodwink unsuspecting local authorities with it. One can, indeed, hardly contemplate with equanimity the result of bringing such a magnificent specimen of the "unearned

"(mathematical) increment" within arm's length of the Brush Company. The puzzle, of course, is merely one of definition. If the light received upon a surface one square foot in area at a distance of one foot from a candle is to be called lighting of one candle intensity, then every other square foot of the spherical surface at the same distance from the candle must also be held to receive one candle light; and since the surface of a sphere with radius unity is 4π , then the total lighting of the imaginary interior surface of a spherical shell of this dimension, which has a superficies of about $12\frac{1}{2}$ square feet, must be $12\frac{1}{2}$ candles!—*Q.E.D.* But the result is more than a little confusing to a practical mind, and therefore many engineers are in favour of doing without such a ticklish standard of illumination as one candle at one foot distance, or the "candle-foot," as Mr. Trotter calls it, and stating illumination in terms of the distance at which the standard candle would give the same lighting effect. This is the more natural method, because it seems reasonable to think of anyone, desiring a certain degree of lighting upon his work, moving a candle about until he gets it at the right distance. There is no quadratic computation about this method of settling the matter. If we tell a man that the light by which he is reading is equal to that of one candle at a distance of one foot from the page, he understands what is meant; and if he is of an inquiring turn of mind he can satisfy himself of the fact. So perhaps he could understand the "candle-foot," if the expression were never to vary from the unit value. When it came to fractions, however, he would readily follow the idea of placing the candle at any distance measured in feet and inches, or inches and tenths; but who can grasp at the meaning of a fraction of a candle-light? The question is worth a little more study than it has hitherto received from gas engineers, who, while they do most of the lighting in the world, leave the electricians to profess the monopoly of learning in the matter.

Gas at the Chicago Exhibition.

COMMENTING last week upon a certain passage in Mr. W. A. Valon's presidential address to the Incorporated Gas Institute, we ventured to intimate the existence of a doubt respecting the realization of the desires of the World's Fair Committee of the American Gaslight Association for a grand combined national gas industry exhibit at the Chicago Exhibition. Bearing out this statement comes a report published in the last number to hand of the *American Gaslight Journal*, which shows that up to the middle of June not half the amount of the guarantee fund estimated to be necessary for a respectable gas industry exhibit had been secured. The backwardness of the Gas Companies of the United States in supporting the World's Fair Committee is reviled by our contemporary in terms such as we commonly find employed in American newspapers with respect to those who are guilty of conduct with which the writers are not in sympathy. This, however, does not advance the matter. It is naturally a disappointment to members of the Committee and their friends to find that the largest and wealthiest Gas Companies of the country are not willing to support the movement which they have started; but it may be doubted whether the use of incoherent abuse in the public press will procure what has been denied to respectful importunity. Our enthusiastic, and somewhat hot-headed Transatlantic contemporary concludes its diatribe against the capitalists who do not yet see their way to subsidizing the World's Fair Committee with the suggestion that a time should be named for closing the subscription list, when the Committee should "go ahead with a building such as might be completed out of the funds already pledged." The article winds up with the noble, if somewhat vague, declaration: "If we cannot have the cake of union, let us consume the bread of independence." What would the Yankee newspaper writer be without his metaphors! It appears that the guarantee fund has reached at the present time a total of something like \$60,000, or (say) £12,000. This would be a very respectable sum to be applied to the purpose of erecting an annexe to an English or a Continental exhibition; but, in view of the scale upon which the Chicago operations are being conducted, it is a mere trifle. Nobody knows to a million or so what the Chicago Exhibition will cost; but it is understood that by no conceivable fortune can it be preserved from realizing

a heavy loss. Everybody is going to lose money over it; and the electricians who have taken the contract for lighting the buildings and grounds are resigned, so they say, to sacrifice huge sums for the glory of the national celebration. Why, then, should the wealthy Gas Companies of New York, and even of Chicago itself, hesitate to make a similar sacrifice? Well, they do; and, as it seems to us, for very sound reasons. The World's Fair [Committee of the American gas industry have done their best to ascertain the disposition of the Gas Companies of the United States with regard to their project of action; and it is nobody's fault if the result is a negative one. It would be a pity if the Committee, carried away by their enthusiasm, were to embark upon a venture for which they have but poor means, and were so to exhibit to the world an unworthy result of half-hearted co-operation. A job such as they have taken in hand should be either well done or left alone. It will be no more a disgrace to the American gas industry to be excluded by the Executive from participation in the great show, than it is to the equally important national industry of petroleum, which is similarly treated. Our counsel to the World's Fair Committee, therefore, is to drop the matter without making any more noise about it, unless they receive better assurance than has yet been given that they will be supported by the whole strength of the industry which they desire to represent at Chicago.

An Unexpected Witness of Truth.

SOMETHING must have happened to the editorial staff of the *Workman's Times*. It is not at all a bad paper, as so-called "Labour" papers go. The management are perhaps too prone to rely upon padding out their serious matter with what are popularly known as selections of "American humour," most of which have a sad, old flavour; and they do not dare to tell the working man when and how he has blundered under the leadership of Trade Union officials. They are virtuously trying, however, to persuade him to spend a penny a week for a paper that does not give sporting tips, nor purvey scandalous law news; and to this extent the editing is respectable. The reason why we presume that something has occurred at the head-quarters of the organ in question is simply the appearance in the current number of a rational statement respecting the wages paid to workmen in the United States, which goes counter, in the most uncompromising fashion, to the usual Trade Unionist fallacy that the measure of the happiness of the workman is the amount of the wages he receives. We say that this is a usual fallacy of the Unionist workman; but it would be possible, without sacrificing truthfulness, to go further, and call it a commonplace of Labour politics, as these have been understood by the ordinary run of British demagogues. "Money—more money—and yet more money!" is the cry of the agitator from mass-meeting platforms; and the chances are that when writers upon industrial matters who are not agitators, essay to compare the condition of the workman of one age with that of his predecessor or successor of another, it is the rate of wages paid which first engages their attention. This is quite natural and right; but error arises when the comparison stops there, and does not go on to inquire as to the purchasing power of the money received as wages at various times or in different countries. The Protectionist manufacturers' press of the United States incessantly tells the American workman that he is vastly better off than his brother in England; but here we find the *Workman's Times* deliberately telling its readers that, "bad as is the condition of the British workman, we think that he is much better off than his American brother, notwithstanding the fact that the American receives more money in wages." The explanation of this is, of course, the high cost of living in America, due principally to the Tariff. The information upon which his statement is based is contained in a report of Consul Sadler upon the condition of the wage-earning classes in the Central and Western States of the Union. With reference to Chicago, Mr. Sadler states that a good deal of poverty exists there—poverty, too, which receives apparently very high wages. Thus, while a carpenter gets 54s. per week, which would be enough to enable him and his family to live with comfort in England, in Chicago he is just able to exist. And as with the carpenter, so with men of other trades. "They draw good wages; but they pay high prices for the necessities of life." Moreover, employment in the

States is reported as being at the present time by no means regular. "When men get out of work, it is difficult for them to get in again—more so than in this country." Indeed, the only class of workers for wages who appear to "have the call" in America are domestic servants; all others are strongly advised to remain at home rather than trust themselves to the tender mercies of M'Kinleyism. These observations are to be pondered by those whom they most concern. And it must not be forgotten that, while the cost of emigration to the States is put very low by those who have an interest in the traffic, it is by no means so easy to get back again. The *Workman's Times* will deserve to succeed if it will only persevere in seeking out and publishing truths, whether or not these agree with conventional notions.

Society of Arts Medals.—The Council of the Society of Arts have awarded a silver medal to Professor Vivian B. Lewes, F.I.C., F.C.S., for his paper on the "Spontaneous Ignition of Coal and its Prevention," read during the past session.

The Managership of the Rugby Gas-Works.—Our readers will remember that, at the recent meeting of the Midland Association of Gas Managers at Rugby, Mr. Peter Simpson, the Engineer and Manager of the Rugby Gas Company, announced his intention of retiring. We learn that, in response to the invitation of the Directors for applications from candidates for the position, which appeared in our advertisement columns a few weeks ago, 75 were sent in; and that Mr. C. Meiklejohn, of Oldbury, has received the appointment.

The Late Mr. C. Nettleton, of New York.—The *American Gaslight Journal* of the 9th ult. contained a brief announcement of the death, in his 73rd year, of Mr. Charles Nettleton, of New York; and in a more recent issue some particulars are given of his work, furnished by his son, Mr. C. H. Nettleton, of Birmingham (Conn.). The early life of the deceased was passed on his father's farm at Washington, in Litchfield County (Conn.); but he took up the study of the law, and qualified himself for the legal profession. He established himself as an attorney in New York in 1851, and obtained a large practice, from which he retired two years ago. His active connection with the gas industry commenced with his purchase, in 1870, of the Mount Vernon (N.Y.) Gas-Works; and in the following year he was elected President of the East Chester Gas Company of Mount Vernon, and held the position till June, 1890, when the concern was purchased by the American Gas Company. In 1871 he became interested in the erection of the gas-works at Derby (Conn.), which were established for the supply of that town and the adjoining manufacturing villages of Ansonia, Birmingham, and Shelton; and the concern is now under the control of the deceased's only surviving son. The late Mr. Nettleton was, however, most widely known among the members of the gas industry of America from his connection with the American Gaslight Association, of which he was Secretary from 1873 to 1879; the office of Treasurer being combined in 1875. For several years he undertook the representation of the JOURNAL in America.

Society of Engineers.—Last Tuesday afternoon, a party composed chiefly of members of this Society, accompanied by the President (Mr. J. W. Wilson, jun.), paid a visit to the East Greenwich station of the South Metropolitan Gas Company and to the Tower Bridge works; a special steamboat being chartered for the purpose. The visitors were received at the jetty by Mr. J. Tysoe, the Resident Engineer; the Chief Engineer (Mr. Frank Livesey) and the Chairman of the Company (Mr. George Livesey) being unavoidably absent. Luncheon was served in the lower deck of the jetty; and at its conclusion, opportunity was taken to thank the above-named gentlemen, and also Mr. C. C. Carpenter, Manager of the Company's Vauxhall station, for their courtesy towards the Society in facilitating the arrangements for the visit. The inspection of the works commenced with the coal-hoisting machinery on the jetty. From the viaduct by which the coal-waggons are run into the retort-houses, the visitors had a view of the general plan of the works; the carbonizing portion being to the left, and the purifying plant on the right—the big gasholders rising in the distance. Descending to the ground level, the exhauster-houses were inspected; and then the visitors passed through the retort-houses, where West's wire-rope machinery and Foulis's hydraulic retort-drawer were shown. Crossing the vacant land, the new six-lift gasholder in course of construction—a description of which appeared in the JOURNAL for the 17th ult., p. 911—was reached; and, as on the occasion of the recent visit of the Incorporated Institution of Gas Engineers, it was the great feature of interest. Most of the visitors went down into the tank, the construction of which was fully explained. The washing and purifying arrangements were then inspected; and the visit closed. On the return journey a call was made at the Tower Bridge works, over which the party were courteously shown by Mr. E. W. Cruttwell, the Resident Engineer, and Mr. J. E. Tuit, representing Sir W. Arrol and Co., the contractors for the bridge. Westminster was reached soon after seven; the programme prepared by the Secretary of the Society (Mr. G. A. Pryce-Cuxson) having been excellently carried out.

WATER AND SANITARY AFFAIRS.

THE ferment of political excitement may probably account for the neglect of the Daily Press to notice the two sittings held by the Metropolitan Water Supply Commission at the commencement of last week. The evidence of Dr. Frankland on Tuesday was particularly important. Had it been of a sensational character, directly condemnatory of the existing water supply, very probably it would have been paraded in the columns of some of the papers, and made the basis of editorial articles hostile to the Water Companies. Dr. Frankland has ever been an earnest adherent of the purist school; and, in years gone by, he has expressed views by no means of an encouraging nature in reference to the water supply of London. One of the most striking features in the evidence given by this long-practised authority last week was that, at the time of the Rivers Pollution Commission, the efficiency of sand filtration of water was under-rated. Asked whether, if the facts had been better understood, the report of the Royal Commission in 1874 would have been quite so severe as it was, Dr. Frankland replied: "No, I do not think it would." This was followed by a very candid acknowledgment which ought not to be overlooked. In our report of the proceedings, Dr. Frankland will be found saying: "The recent discoveries in connection with filtration have very considerably modified my own opinion, and I have no doubt that of others also, with reference to the value of filtration and its security." One incident which apparently contributed to this change of opinion occurred recently, when Dr. Frankland found, on testing the water issuing from the filter-beds of the various London Water Companies drawing from the Thames and the Lea, that, instead of getting hundreds of microbes per cubic centimetre, he obtained in some cases only four, and the maximum was only twenty-four. Dr. Frankland confessed that he was "somewhat astonished" at the result. This distinguished chemist clearly acknowledges that he is a learner in respect to phenomena concerning which there has been a large amount of mistaken dogmatism in the past. He now states that he is engaged in a series of observations which, he hopes, will throw "more light upon the subject;" the point at issue being as to the probability of pathogenic germs existing in the water delivered in London. This question we are told is one which "still requires a good deal of investigation." The effect of a running stream on the lifetime of the organisms has long been a matter of dispute; and Dr. Frankland now says that in a flowing river, where the environment is never constant, the conditions "would be very fatal to the life of the organisms." But again we are told: "The amount of knowledge on the subject is very contradictory, and very incomplete; and people are only just beginning to know something definite about these organisms." One thing is certain, that Dr. Frankland's evidence on the subject would have been very different twenty years ago, independently of the fact that the water supply has been greatly improved in quality during that period.

Dr. Frankland is still apprehensive with regard to germs, be they few or many, and has a dread of their multiplying power. But there is reason to believe that the harmless germs are very largely in the majority, and help to kill the bad ones. There is a striking statement by Dr. Frankland, where he says: "I find that water, which contained a large number of microbe organisms when it came out of the river, would be almost sterile in the course of a week or ten days." This bears on the question of storage. In common with other witnesses, Dr. Frankland was pressed as to whether the supply taken from the Thames and the Lea was really a "safe" supply. Of course, it was too much to expect that Dr. Frankland would reply absolutely in the affirmative. Here, we think, a distinction should be drawn between the theoretical and the practical. Theoretically it is not safe to cross Chertsey when the street traffic is at its greatest height. But practically the venture is safe enough. Dr. Ogle used an argument of this kind, when showing that, if every fatal case of typhoid fever in the Lea Valley was a source of pollution, the germs would have to encounter in each instance "a body of water three miles long, two miles wide, and six feet deep." This would also have to be coupled with the fact that 98 per cent. of the bacteria would be removed by filtration. Dr. Ogle asked whether, under such circumstances, the risk of infection would not

be so much diminished that it might be "practically" disregarded? Dr. Frankland hesitated; but it was clearly on theoretical grounds.

While the microbes are at vanishing point, there is a further consideration. If the river supply is defective, and if it is thought worth while to abandon it at a certain cost, it does not follow that London has need to draw a supply from some remote source. Dr. Frankland errs somewhat when he says that deep wells in the chalk and the oolite contain no organisms. The microbes are everywhere; and we have no doubt they exist in the Elan and the Claerwen, as they do in the deep wells of the Kent Company. But no one will fear infection from such a source; and there is every reason to believe that, if the Thames and the Lea were abandoned, an abundant and unexceptionable supply would be found in the watershed of these rivers. With regard to this matter, Dr. Frankland is not called upon to cancel anything in the report of the Rivers Pollution Commission. He now expresses his belief that "for the next hundred years" there would be no need to go outside the Thames basin for a good supply of water. The mode of obtaining this supply was explained by Dr. Frankland in his evidence, and it coincides with the full account in the report of 1874. Associated with this subject, we have the manifesto of the County Council, requiring a supply of 35 gallons per head per day, to be provided for a population estimated to amount to at least 12,500,000 fifty years hence. The reckoning is speculative in the extreme; and several members of the Council have been sensible enough to demur to such a calculation. Alderman Beachcroft could only understand it as an attempt to cry down the shares of the Water Companies, and characterized it as "an alarming statement" to put before the public. Yet the document containing this extravagant statement has just been adopted for presentation to the Royal Commissioners, as affording "some indication of the views of the London County Council on the subject of the inquiry." The Commissioners will doubtless know how to value it. With respect to the part played by Sir William Harcourt in the defeat of Lord Cross's scheme for the purchase of the Metropolitan water-works in 1880, a letter from Mr. A. J. Balfour in *The Times* of yesterday fully confirms our previous remarks on the subject.

The Wanzer and Defries Lamp Company.—A private meeting of the proprietors of the Wanzer and Defries Patent Safety Lamp Manufacturing Company, Limited, was held last Friday, to pass a resolution to wind up the Company. As the proceedings were conducted with closed doors, the result was not made known; but on the following day a compulsory winding-up order was made by the Court.

Electric Lighting Scheme for Islington.—At a recent meeting of the Islington Vestry, the Special Electric Lighting Committee presented a recommendation that a Provisional Order authorizing the Vestry to supply electricity in the parish should be applied for. The Committee arrived at this decision after exhaustive research, and on the advice of an eminent engineer; and they came to the conclusion that it would be possible to give the supply at 5d. per unit, as against 6d. in St. Pancras and 8d. as mentioned by other promoters.

A New Form of Gas Battery.—The remarkable way in which one branch of physical research leads to another is illustrated by the statement that has recently been made that Mr. Ludwig Mond has found a means of utilizing his discovery of the chemically active character of carbonic oxide by making nickel and cobalt separate this gas from the hydrogen with which it is mixed in the ordinary production of water gas. When the separated hydrogen is applied to strips of platinum, as in Grove's classical experiment, a powerful gas battery is constituted, which returns in the form of electricity, as is reported, 50 per cent of the total energy of the absorbed hydrogen. If the same gas were burnt under a boiler for raising steam, and the steam so made used in a first-class engine driving a good modern dynamo, the yield of electricity would not exceed 8 per cent. of the fuel-energy of the gas consumed, under the most favourable conditions. It thus appears that Mr. Mond has advanced another step in the way of economizing energy, not by improving the steam-engine, but by going round it. Bearing in mind the admitted superiority, from the economical point of view, of the steam-driven dynamo to any form of galvanic battery yet devised, it would be a strange turning of the tables if it were to be demonstrated, as a practical result of Mr. Mond's discovery, that the gas primary battery and the water-gas producer together form a more economical apparatus for getting out the heat-value of fuel into some useful form, than any arrangement which has a combustion process for its starting-point.

THE INCORPORATED GAS INSTITUTE.

PROCEEDINGS AT THE TWENTY-NINTH ANNUAL GENERAL MEETING,

HELD AT THE

INSTITUTION OF CIVIL ENGINEERS, JUNE 14, 15, & 16, 1892.

Mr. W. A. VALON, Assoc.M.Inst.C.E., President.

DISCUSSIONS ON THE PAPERS.

In the JOURNAL last week we gave the papers read at the above meeting by Mr. F. G. Dexter, Professor Foster, and Mr. T. Newbigging. Those of Mr. W. R. Chester and Professor Lewes will be found in another part of the present issue; the communications of Mr. A. T. Walmisley and Mr. W. Gadd being held over till next week. We give below the discussions on the three papers which have already appeared.

MR. DEXTER'S PAPER ON THE USE OF STEAM IN THE REVIVIFICATION OF OXIDE OF IRON *in Situ*.

Mr. N. H. HUMPHRYS (Salisbury) said he was considerably interested in the paper, because there was much in it with which he agreed. They all knew the importance of having the materials in the purifiers properly moistened; and he might say that he was still continuing the mode of operation he described some three or four years ago. With regard to the over-heating of the material, and the consequent driving off of the moisture, there were two things concerned—one was the sizes of the boxes used, and the other the quantity of sulphuretted hydrogen dealt with. In this question of revivification, the chief thing overlooked was the question of the relative percentage of impurity which had to be removed. Some might have 0.5 per cent. of sulphuretted hydrogen to remove, and might have fairly large boxes to do it in; while others might have 1 per cent. to remove, and have smaller boxes, and would, therefore, be trying to do the same unit of work in one-fourth of the space, which, of course, had an important effect on the heating of the material. His experience had been rather favourable in this respect. At Salisbury they had large purifiers, and a comparatively small percentage of sulphuretted hydrogen to remove. The result was that the extent of heating was not large; and consequently the amount of moisture he had since he used air was very slightly different from what he had before. In talking about extracting moisture, it should be remembered that, in any combination of oxide of iron with sulphur, one molecule of moisture was liberated, and was absorbed again in the revivification; so that the process remedied itself in that respect. Altogether, he quite agreed with Mr. Dexter that, if means were devised to prevent the moisture from being exhausted or reduced too low, the greatest benefit would result. In his case, the moisture did not leave at so rapid a rate; but there was plenty left at the conclusion of the process, when the oxide became spent. It swelled and caked not so much on account of the extraction of moisture, as from the accumulation of sulphur. These experiments, showing that by the use of steam there was a large increase in the duty obtained from oxide, were extremely interesting; and they seemed to show the importance of further experiments in the same direction. But he had no experience of his own on this point.

Mr. G. ANDERSON (London) said he thought Mr. Dexter was on the right track. Some forty years or so ago, when managing his first gas-works under the late Mr. Croll, he made him put the waste steam from the high-pressure engine which worked the exhauster into the condenser (which was a horizontal one) round the retort-house. It was not put in for the purpose Mr. Dexter now indicated; but they found that the gas was considerably purified from sulphuretted hydrogen in going through the condenser, because most of the water from the steam was recovered at a drip, and it was nearly as black as ink. The purifiers had their connections about 3 inches above the bottom, and they were always filled with water as high as these; so that there was moisture throughout the whole purifier. If gas were passed through dry lime or dry oxide, it would not be purified. He was much interested

in the remarks as to the effect of driving air through the purifiers. The oxide was purified above instead of below, which would be contrary to one's first expectation. Doubtless this was due to the top being more moist than the bottom, on account of the air having driven the moisture forward. All these things went to show how necessary it was to rigidly investigate these little instances. By having the material in a proper condition, one might double the length of time a purifying-box would last. He could state as a fact that he had hardly ever gone to a gas-works where they were purifying with lime and had not found it being put in too dry. He supposed the reason was that, in old books on gas manufacture, they were told to wet the lime until, if a handful were taken up, it would just hold together; and he presumed a great many men worked on this rule. He believed strongly in moisture; and he always advised his men to make the lime as wet as they could, provided it did not run into mortar. He had often been told that by so doing they doubled the time the purifier would last.

Mr. W. R. CHESTER (Nottingham) said he noticed that Mr. Anderson did not say he would recommend the use of steam now. The addition of steam in the condenser seemed to him (Mr. Chester) a very contradictory way of working, inasmuch as the object of the condenser was to cool the gas, whereas the steam would warm it up again; and, in addition to that, it must have a very detrimental effect, from an economical point of view, in abstracting and wasting a large quantity of ammonia which, in the ordinary mode of purification, would be recovered. He had carefully gone through the paper, and he noticed the absence of certain statistics which would enable one to form an opinion as to how far the presence of moisture was beneficial or otherwise. Mr. Dexter did not give the area of the purifiers, the quantity of gas purified per ton of oxide used, or anything as to the point to which it was desirable to reduce the moisture in the oxide, in order to obtain the greatest efficiency in purification. His own experience was that where they commenced to use oxide highly charged with moisture—say, 50 per cent.—they obtained a very small efficiency, and that the efficiency increased as the moisture was reduced—the highest point being reached when the oxide contained about 4 per cent. of moisture. He had not had any experience in the use of either air or oxygen for the purpose of revivification; believing that a large area of purifiers would give a much more satisfactory and economical result than could be obtained by such artificial means as the addition of air or oxygen for the purpose of revivification *in situ*. It seemed to him that it was merely a question of degree as to the area of the purifiers in proportion to the make of gas, and the percentage of moisture necessary to render the oxide practically workable. If they had a small area of purifier, and the moisture of the oxide was down to about 10 per cent., this was probably about the extreme limit at which they could work; but as the area was increased, the percentage of moisture could be reduced to something lower, and the efficiency of the oxide itself be thereby greatly enhanced.

Mr. W. HARDIE, jun. (Tynemouth), said that it seemed to him to be a most extraordinary thing that there should be so much better results in the winter than in the summer, as, in his experience up to the present time, he found their cost for purification per 1000 cubic feet in the summer was about half what it was in the winter. A short time ago he doubled his purifying power by passing the gas through two sets of four purifiers each, instead of only one set, and he found the cost was reduced exactly one-half. Therefore he could not understand the reason for the result obtained in this particular case being so much better in the winter. Again, the details in the paper did not seem to be quite sufficient. Mr. Dexter had given the number of cubic feet of gas per box changed at 3 million cubic feet; but this afforded no idea whatever of the work that was being done. In his own case, he had passed perhaps ten times this quantity of gas through purifiers without changing them. It all depended on the size of the purifiers.

The PRESIDENT said the paper was a very interesting one; and the subject deserved more attention than it had received. He should say also that the paper was produced at very short notice, and that Mr. Dexter had not had time to give so much statistical information as he would have liked. At the next meeting he would, no doubt, be prepared to complete what was in reality a very interesting communication. Mr. Chester had referred to the

economy of using air or oxygen with oxide of iron; but he (the President) presumed he did not extend this remark to lime. If he did, he could not agree with him. He thought Mr. Hardie must have misunderstood what was said about summer and winter. If he looked at Nos. 1, 2, 3, and 4,* he would see that this was so.

Mr. HARDIE said he saw he had made a mistake; but what led him into it was the passage lower down about the greatest increase of efficiency being obtained in winter. He found his purifiers worked much more effectually in the summer.

Mr. DEXTER, in reply, said it would perhaps have increased the value of the paper if he had added what statistical information he had already obtained. But it was not by any means complete; and he should prefer to give all the particulars together. Mr. Humphrys agreed with him that the question of moisture was of great importance; and he inquired as to the size of the boxes he used. They measured 24 ft. by 12 ft. There were two layers of oxide, from 1 foot to 15 inches deep; the amount in each box being roughly 15 tons. The quantity of sulphuretted hydrogen dealt with necessarily varied at different times of the year; but, taking the four analyses which had been made, he found the quantities ranged from 450 to 500 grains per 100 cubic feet. This was rather small, and showed they had not very much difficulty. The important point was this (and that was the reason he had put it in the form he had, of a comparison of working steam and air, as against air alone, under identical conditions), that the efficiency of the boxes, whether in summer or in winter, was doubled. Whatever percentage of sulphuretted hydrogen might have been present in the gas under one condition and time, winter or summer, would be equally there at the corresponding time in the second year, working under similar conditions. Therefore, for the present, he thought the fact was clearly indicated, that, by keeping the oxide thoroughly damped, a great increase of efficiency resulted. Mr. Humphrys referred to the fact that he did not experience much difficulty with the heating of the oxide, on account of the boxes being larger in area. He (Mr. Dexter) did not quite follow that, because it appeared to him that, whether the boxes were large or small, the heating effect would depend on the amount of chemical reaction going on in a given time. If it were a large box, and the oxide were as deep as in a smaller box half the size, there would be twice the quantity of material. But it was a common practice to have oxide of less depth where the boxes were of sufficient area; and one might have no more actual bulk of material in a larger box than in a smaller one. The chemical action going on would, if anything, be greater in large boxes than in smaller ones, because they gave better results, and therefore did more work; and the more work they did, the greater would be the heat produced. Mr. Humphrys also referred to the question of the water formed by the chemical reactions themselves, which was understood to be sufficient to supply the moisture the oxide required. This depended on whether the heating effect was sufficiently intense to drive off the moisture, or whether it allowed it to remain in the oxide. This was the turning-point of the whole thing. If the percentage of air admitted—and that depended on the condition of the oxide as well—were such that the chemical reaction going on was sufficient to drive away the moisture as it was formed, it necessarily followed that the oxide would become dry. He felt sure that some of the gentlemen present had experienced the fact that oxide treated with air came out of the boxes in a dry, hard state. The moisture had disappeared somewhere; and the chances were that it had gone out of the oxide and into the gas. By admitting moisture in the way he had described, that deficiency was made good, and the oxide was better enabled to carry on the revivification. Mr. Anderson had referred to the fact that it was bad to have the material too dry; and he also alluded to steam having been introduced into condensers many years ago. This was a similar practice to that of Mr. Cleland. Mr. Anderson had likewise mentioned the fact that moisture was found collected at the bottoms of the boxes; and he attributed to this their increased life, and the better result he obtained from the purifiers. Mr. Cleland's idea was to get rid of the whole of the water; but as (as in Mr. Chester's case) he was not using the air process, the heating

effect referred to in the paper was not going on, or at any rate, not to anything like the same degree, as in the air or oxygen process. If the chemical re-action of revivification were carried out inside the boxes, it increased the heat; and this heat must do some work. It would to a certainty drive off the moisture. There was nothing else to go, unless the heat was sufficiently intense to set fire to the material. With regard to Mr. Chester's question as to the likelihood of the ammonia being lost, Mr. Cleland distinctly claimed an increased yield by the use of steam. He (Mr. Dexter) did not know where the ammonia was to go to if the lids were kept close, and the liquor not allowed to attain too high a temperature. But the distinction between this idea and the one with which he was dealing was this: In that case the steam was applied to get rid of the ammonia, as well as the sulphuretted hydrogen, as an impurity; and the whole of the moisture was removed before reaching the purifiers. In this case, however, the ammonia was taken out first; and it was clean gas, or gas with only a trace of ammonia, which went forward to the purifiers, *but in a humid state*. Very weak liquor was obtained from the condensing apparatus. He might mention that, before trying the effect of moisture, in the form of exhaust steam, in the oxide boxes, he tried passing exhaust steam into the scrubber. This was before the scrubbing plant was increased to its present capacity; and the yield of ammoniacal liquor was very nearly doubled. The steam did no harm there. If it was introduced and allowed to mix with the gas, as it condensed in a subsequent stage, it necessarily brought out the ammonia. The work of a scrubber or washer was essentially to so split up the particles of gas as to cause them to come into intimate contact with the water. Both the gas and the water had to be in a fine state of division. The gas was in that condition already; and if they had the water like it by being in the form of steam, a better mixture was necessarily obtained. With regard to the quantity of moisture required, it was quite out of the question to determine this at present. It would need a long series of experiments to determine it thoroughly; and he was not at present in a position to give the information, though he hoped to do so at some future time. Mr. Chester had also referred to the introduction of air as being an artificial means; but he (Mr. Dexter) could not agree with that. One might as well say that taking the oxide out of the box and exposing it to the air was artificial. It was exactly the thing they wanted to do; and if the life of a box could be prolonged, nuisance abated, and labour saved by passing in a small percentage of air—so small as not to interfere with the illuminating power of the gas—this was the important point. With the aid of steam, the quantity of air might be *decreased*. At any rate, it was certainly worth trying. In Winchester it was very important. Their purifiers were arranged some distance above the coal-shed, right in the middle of the town; and if there was the slightest smell, a great nuisance was created. Everything therefore, that could be done to prolong the life of these boxes should be carried out. Mr. Hardie had stated that he was unable to account for the increased work of the purifiers in the winter as compared with the summer. It was ordinarily understood to be more difficult to maintain the efficiency of purifiers in the colder than in the warmer weather. One of the chief advantages he claimed for the introduction of exhaust steam in the way he had described was that the hardening or caking process was stopped, and therefore the oxide gave better results. Keeping up the temperature of the material enabled more work to be done by the purifiers. If they became thoroughly cold, the oxide would not do anything like the work it would perform under similar conditions on a warm, humid day. The increase of efficiency was partly to be attributed to the fact that the temperature was raised, and the oxide was in a better condition to go on purifying the gas, or revivifying, as the case might be. He hoped to be in a position to give further particulars next year.

PROFESSOR FOSTER'S PAPER ON THE LIGHTING VALUES OF ENGLISH COAL GAS.

Mr. W. CARR said he could not compliment Professor Foster on the clearness of his paper; but he thought this might be on account of the fact that he had been sequestered for some time in a heathen land, and had lost the habit of

* See *ante*, p. 1173, col. 2.

following a scientific communication. However, as others seemed loth to commence the discussion on such an important paper, he was led to believe that the fault was with the writer in not having made himself understood. He did not comprehend such figures as 62 per cent. of carbonic acid in illuminating gas of 21-candle power, or those of 122 per cent. in the table; they rather confused him. He regretted this all the more because he took a great interest in the paper—the ground covered being perhaps of greater importance than anything to be submitted to the meeting. If half the attention had been devoted to this subject which had been given to the construction or decoration of gasholder columns, the cause of the gas industry would have been very much farther advanced than it was at the present time. They all seemed to be floundering about as to what constituted the illuminating properties of gas. Some people tried to determine it in one way, and some in another. Certain authorities framed rules by which they were to be guided; and if the gas did not fulfil these conditions, they said it could not be what it was supposed to be. For example, there was the specific gravity test, and also the bromine test; but they did not help to clear up the matter at all, but only to confuse it. When they tested gas in a photometer, they knew what illuminating power it had. But they were very far from knowing why it had this light-giving property; and any effort on the part of Professor Foster, or anyone else, which would at all help to remedy this want of knowledge, would be very useful to those who had to deal with the manufacture of illuminating gas. He hoped, in any further efforts made in this direction, Professor Foster would try to come down to the level of their understanding, and make the matter more plain. It used to be argued that any attempt to raise the production of gas from 9500 cubic feet per ton was simply throwing money away, because what was gained in quantity was lost in quality. He had heard eminent gas engineers make such statements as these with a great deal of confidence; but it was unnecessary to say that this idea was now thoroughly exploded. It was found that one could increase the production without lowering the illuminating power, and might even increase the illuminating power at the same time; but no one had been able to say exactly why it was so. It was simply want of knowledge which led him into many difficulties in discussing a paper of this kind. He remembered some years ago remarking to Professor Foster that he would like to know what the alteration in illuminating power would be if the heavy hydrocarbons were converted into acetylene and hydrogen. In his opinion, the illuminating power of the gas would be greatly increased, and yet the specific gravity would be less. But this point was, he understood, not yet determined; and there was evidently a large field in this direction that was thoroughly well worth working.

Mr. N. H. HUMPHRYS (Salisbury) said the members were much indebted to Professor Foster for bringing forward these analyses. They could all, with great advantage, give more attention to the actual composition of the gas supplied, than it was their custom to bestow upon it. The analyses had been made on the plan adopted by Dr. Percy Frankland; and, like his, they presented some peculiarities. Dr. Frankland published in 1884 his analyses of some 20 or 30 samples of gas; and a strange feature about them, which he noticed in the JOURNAL OF GAS LIGHTING at the time, was the varying quantities of nitrogen. They ranged from 2.5 up to 10 per cent. with gases of about the same illuminating power; and, so far as one could judge from the other constituents, there was nothing to show any compensation for the quantity of nitrogen. In the analysis Professor Foster had placed before them, they had the same thing. For instance, take Nos. 1 and 3 in the first table [*ante*, p. 1174]. The heavy hydrocarbons in Sample No. 1 were 4.35 per cent.; and in Sample No. 3, 4.62 per cent. But one had to consider not only the proportion of these heavy hydrocarbons, but their quality, so to speak; and it had been said that one obtained a better idea of the relative value of the hydrocarbons if the percentage were multiplied by the carbon density, than by taking the percentage only. The carbon density in No. 1 was 3.2; and in No. 3, 2.53. By multiplying the 4.35 by 3.2, a larger quantity resulted than if the 4.62 were multiplied by 2.53. In No. 1, the proportion of nitrogen was 2.52 per cent.; and in No. 3, 7.1 per cent. Yet the illuminating power of the gas was half a candle better in the case

of Sample No. 3. Again, take Nos. 5 and 6, the proportion of heavy hydrocarbons multiplied by the carbon density, came out about the same; but there was a difference of no less than 10 per cent. in the proportion of nitrogen. The difference in the illuminating value, however, was only about 0.6 of a candle. Going to the second table, and taking the quantity of nitrogen present, Professor Foster arrived at the result that the nitrogen lowered the specific lighting value of the carbon. But they had to look at the gas in the condition in which it was supplied and sold to the public, as represented in Table I.; and really from that table it seemed to him that the presence of nitrogen was an advantage. It was stated that in none of these analyses was air admitted for purification purposes, but that it must have been drawn into the retorts by the exhaustor. No doubt this appliance was worked as hard as it could be, without lowering the illuminating power. In No. 4, again, the nitrogen went up to nearly 14 per cent.; yet there was an illuminating value of nearly 17 candles. Against this, however, there was no large proportion of heavy hydrocarbons, and no extra quality, as shown by the carbon density, to compensate. In discussing the subject of air purification, he ventured some three years ago to say that he did not object to the presence of 2½ per cent. of nitrogen in gas. It was thought then that even this was a great extent to go to; but here they found that only one of these analyses showed less than 2½ per cent. of nitrogen, and they went up to 7, 9, and even 13.89 per cent. According to the experience of a great many as to the deteriorating effect of 7 or 8 per cent. for each percentage of air, the Sample No. 4 ought to have practically no illuminating power at all; yet it held its head among the rest, and was better than some of its neighbours. He should be glad if Professor Foster could give some further information on this point, because it really seemed that the addition of 10 per cent. of nitrogen was the best plan to follow. It did not cost anything. They were all interested in working as cheaply as they could; and if they could add this 10 per cent. of nitrogen without reducing the illuminating power or the heating value of the gas, which was supposed to be somewhere proportionate to the quantity of oxygen required for its complete combustion and to the carbonic acid given off, it really seemed to be best to adopt this plan.

Mr. B. H. THWAITE (Liverpool) said there were two items in the table which he did not quite understand—viz. Nos. 5 and 6, in which the hydrocarbons were practically the same, and yet the actual illuminating value of the former was 18.5 candles, and of the latter 19.1 candles—a difference of 0.6 in favour of No. 6. He thought the results now given were of enormous value; and they practically corroborated some of his own experiments. He had been working on the enrichment of generator gas; and, according to the ordinary ideas, he introduced enough nitrogen to destroy the illuminating value altogether. But he might say that, with an ordinary generator gas, having 20 per cent. of nitrogen, he had been able to obtain an illuminating power of 20 candles. His results had thus been partially corroborated by Professor Foster's paper.

Mr. W. W. HUTCHINSON (Barnsley) hoped Professor Foster would add to the obligation under which he had placed the members by giving them his method of calculating the results in Table II. from the experiments recorded in Table I. He did not quite understand what value the author placed upon the hydrogen density given in the second table. He should also like to know particularly at what value Professor Foster rated the effect which the density as well as quantity of the heavy hydrocarbons had on the calculation.

Mr. C. S. ELLERY (Bath) said he hoped Professor Foster would supplement the valuable results he had given by adding at some future time a few tests made with samples of gas manufactured where the air purification process was employed. It would be very interesting to compare the analyses of such gas with the gases now dealt with. He might be wrong in his way of reading the figures; but it appeared to him that there had been introduced into certain of these gases something over 2 per cent. of air. If this were so, it rather corroborated his contention that one could advantageously add a considerable percentage of air in the process of purification. If a sample of gas would be useful to Professor Foster, he should be pleased to supply him with it, in order that one might really see how it would compare with the figures before

them. It was evident they ought to make some allowance for cases where air was introduced; and the ultimate composition of the gas would probably be different, if the air were put into a heated retort, from what it would be if put into the gas at some subsequent part of the process—say, in the condensers, or in the hydraulic main. At any rate, he was strengthened in the position he had taken up, notwithstanding some remarks contained in the President's address, that a certain percentage of air might be used with considerable profit in gas purification. He (Mr. Ellery) did not quite understand how the illuminating power of the nitrogen-free gas had been arrived at. He could understand how the illuminating power could be estimated by taking the quantity of oxygen required for perfect combustion of the gas. With regard to the samples of Dinsmore gas referred to towards the close of the paper, assuming that No. 1 was 21·8-candle gas, and the percentage of carbonic acid produced 63·12, the proportion of the next sample should be, not 22·3, but 23·6 candles. He had divided 21·8 by 63·12, and multiplied by 68·44, which worked out to 23·6. The proportion did not run by the oxygen test, as it did with the photometer.

Professor FOSTER said the figures were published in 1889, and were the subject of much criticism; the President having had something to say on the matter of the specific gravity. He had never publicly answered these criticisms, because he was not in a position to produce satisfactory experimental evidence. However, the lighting values, as determined by the Sugg "G" Argand burner, were unquestionably as represented. He now showed that 100 volumes of these Dinsmore gases, exploded with an excess of oxygen, produced a given quantity of carbonic anhydride, and therefore they had so much carbon vapour in them. As Mr. Sugg had on one occasion said, no one had yet been able to make a large flame without using a considerable amount of carbon vapour. The man who could produce coal gas of high lighting value without putting carbon vapour into it had an invention. A sample of coal gas yielding on combustion 68 per cent. of carbonic anhydride was a rich gas, and would indicate about 21 candles when tested in the "London" Argand. They were also of very low specific gravity. One could scarcely call them ordinary coal gas; and therefore Mr. Ellery's computations, based on these samples produced by special processes, and tested by means of an Argand different in some particulars from the "London" Argand, were scarcely admissible.

Mr. ELLERY said he thought his point was not quite clear. If, exploding gas with oxygen, 63·12 per cent. of carbonic acid was produced, and the illuminating power corresponded to 21·8 candles, then the gas on the next line, producing 68·44 per cent. of carbonic acid, should be of 23·6-candle power, whereas, with a "G" Argand burner, it only showed 22·3 candles. One was evidently wrong—either the Argand burner or the method of calculation.

Professor FOSTER, replying to the discussion, said that he was in a rather awkward position. He was told that he nearly killed the Institute last year by giving a paper too far above the heads of the members; and for this he sincerely apologized. When he presented the substance of the present paper to another learned society, he was told that it was not sufficiently scientific, and too technical. So that he was neither scientific enough on the one hand, nor technical enough on the other. He really thought Mr. Carr's absence in South Africa had not kept him in touch with gas manufacture; and he was sorry to see he was not now so apt in discussing some of these questions, which he had so well dealt with before. The figures referred to were these: If one took 100 volumes of gas and exploded them in a eudiometer with excess of oxygen, a certain quantity of oxygen was required to complete the combustion; the carbonic anhydride produced being a measure of the lighting value. The latter was a function of the carbon vapour present in many forms in the gas. Whether it was proportional or not, was a matter under debate. There was no question about nitrogen being in these samples. It was doubted in the case of Dr. Percy Frankland's analyses; and one eminent engineer, having first expressed great doubt as to there being 10 per cent. of nitrogen in his gas, turned round and said: "What does it matter, so long as the public get their value?" But this was not the way in which he (Professor Foster) had approached the question in his paper. They were not at present concerned with the statutory obligations of any gas company. All the samples of gas referred to in his communication

were of statutory quality. Each was determined at the time by a skilled operator, and confirmed by the speaker. In this respect the observations supplied information which was not given by Dr. Frankland, who knew nothing, from direct photometrical measurement, of the lighting values of the gases he analyzed. That three or four gas-works should be making gas containing these large quantities of nitrogen, purely by accident, and yet supplying gas of statutory quality, was certainly unexpected. It was the finding of certain figures, in connection with these matters which he could not understand, that led him to go more deeply into the question. The bromine test (Dr. Fyfe's) had been referred to; also Dr. Frankland's and Mr. Hartley's experiments with the heavy hydrocarbons. These were all attempts to determine the lighting value by means of such small volumes as 4·35 and 5·84 per cent., and so on. The variations in the heavy hydrocarbons were never great; and all these chemical tests had so far, he believed, disregarded the fact that one had marsh gas to the amount of 35 per cent., non-luminous in itself, but playing a very important part in all illuminating flames. Let anyone try to carburet a gas like hydrogen or air, and then try marsh gas, and he would find the difference. There was in the case of marsh gas a latent value in the carbon which made a remarkable difference. He did not exactly know the chemical changes which took place in consequence of the presence of marsh gas—probably no chemist did. He merely advanced views founded on his own experiments, in which account was taken of the presence of these quantities of 7 per cent. by volume of carbonic oxide, and 35 per cent. of marsh gas, which indirectly contributed very largely to the lighting value. He never had a fancy for determining the lighting value by bromine or fuming sulphuric acid, because of their vagueness; but he had found, as he thought, a very simple connection between the total volume of carbon vapour and lighting value. In fact, if any member would give him a sample of gas of which he had determined the illuminating power, he thought he should be able to predict, within a quarter or half a candle, what it would be by this method. He, of course, meant a legitimately-made coal gas, not a gasoline vapour put into nitrogen, carbonic anhydride, or anything of that sort, which, of course, would be disclosed on analysis. The specific gravity test, he believed, would be found entirely fallacious with reference to any gases other than legitimate coal gases made in a definite way. He could not say why a sample of coal gas should have a certain lighting value, and so he only reasoned from such data as he now brought before the Institute. To assert that one could put nitrogen into the gas without depreciating its lighting value was absurd. He only stated what he had found; and it was the extraordinary fact of these large percentages of nitrogen being there that led him to put these things together in this way. The richer the gas, the more carbonic anhydride was produced. He disregarded all the various forms of carbon vapour, and found that certain values were given; and then he estimated the nitrogen, calculating its effect as a diluent on the basis of Dr. Frankland's observations. He could quite understand that, diluting the gas with nitrogen beyond a certain amount would seriously lower the illuminating value; but, at any rate, that gentleman's experiments showed that, up to a certain point, well within his (Professor Foster's) own figures, the depreciation was proportionate to the amount of nitrogen. If, therefore, gas containing 90 per cent. of combustibles and 10 per cent. of nitrogen had a certain illuminating value, as 90:100 so was the observed value to the value of the gas free from nitrogen. This was how Table No. II. was compiled, and how the diagram (see p. 1174) was drawn up on the basis of Table No. II. A curve was obtained which was very characteristic. In three cases, where little or no nitrogen was present, the points on the diagram representing percentages of carbonic acid, if joined, formed a straight line. In three out of the four cases where nitrogen was present, the percentages of carbonic acid were to the right of this straight line; showing a diminished lighting value for a given percentage of carbon vapour. This was an explanation of his statement that the lighting value of the carbon had been lowered by the admission of air. He was unable to prove that air had entered the retort. If Frankland's observations were accepted, this was the only intelligible explanation at present

possible. However, he was quite sure that a knowledge of these three points—the carbonic anhydride produced, the amount of oxygen used, and the amount of nitrogen present—would give results far more in accordance with the actual facts, as determined by the photometer, than anything with which he was acquainted. Of course, the lighting value must always be determined by the photometer; but there were occasions when one would like to know what the composition of a gas was, and also its lighting value, so as to ascertain what was being done in the retort. He had no doubt that those works which were producing gas with a variable amount of nitrogen were not being all carried on at the same temperature. Increased temperature split up the paraffins into non-saturated bodies like olefines. Dr. Frankland had clearly shown that, if one took 5 cubic feet of a gas called ethylene (C_2H_4), a certain lighting value of (say) 70 candles was obtained when it was consumed in an Argand burner; but with 5 cubic feet of the paraffin C_2H_6 which would be found in rich gases, though its specific gravity was higher, its lighting value was only one-half that of the ethylene. This was a paradox; and it was an appreciation of these differences that enabled one to understand some of the very wide discrepancies which had recently been noticed between the illuminating value and the specific gravity of a gas.

The PRESIDENT said they thanked Professor Foster for his very valuable technical paper, which he confessed it would take him some time to study before he felt at all able to criticize it. He only wished to remark that he did not intend to convey, by anything he had said in his address, what Professor Foster now seemed to suggest. His experiments were not on "all fours" with those of the Professor, nor were they founded on any hypothesis whatever, but on facts. Professor Foster and he might have an opportunity of settling this point of specific gravity, and the difference between the values of constituents; but this was an entirely different matter.

MR. NEWBIGGING'S PAPER ON TANK CONSTRUCTION.

Mr. J. HEPWORTH (Carlisle) said he was not able to add much to the value of the paper. As it was being read, he could not help thinking that really there appeared (as, indeed, Mr. Newbigging said at the conclusion) to be no difficulties when he had to deal with them, for he always found some easy method of overcoming them. The difficulties which had been referred to, however, were very serious in the hands of a man without much experience, and such persons, at all events, should be very grateful for the paper. He had been much impressed with the observation with reference to the use of puddle; and he believed the explanation of the failure of a great many tanks was that the condition of the puddle had not been carefully watched. He had constructed several tanks, and was just trying to remember what difficulties he had met with. He recollected, in the case of a large concrete tank, when he thought he had overcome every difficulty, and provided for taking away the whole of the water from the springs (which were very considerable), just as it was nearly completed, some very unexpected springs showed themselves in the bottom of the cone; and the problem was how to deal with them at that time. Of course, he resorted to additional pumping, to keep down the extra pressure; but there was a difficulty in dealing with the small springs, which even pumping did not seem to overcome. At the very last, when the tank was about to be filled with water, they had recourse to some preparation of red lead and fine cement, and insisted upon the springs being closed. This was a substance which easily set; and immediately after this, the water was introduced into the tank, and he was glad to say the difficulty was overcome, because the tank, though it had been in use from 12 to 14 years, had never had any water put into it since it was first filled, except what the clouds supplied. He remembered being very much perplexed with a tank constructed of cast iron. The excavation was supposed to be free from water; and the contractor evidently thought it was, for he had ceased pumping for a few hours. Then a telegram came saying that "the tank had ripped right across the bottom from the pressure of the water." It was simply a question of pumping. If the contractor had kept the pumps in action, the difficulty would not have arisen. The pumps had to be set to work again; and the cast-iron plates which had been cracked were taken out and renewed. The members were

much indebted to Mr. Newbigging for this second paper on the subject of tank construction, which would do a great deal to minimize the difficulties which might arise in their ordinary practice.

Mr. J. WEST (Manchester) said they always expected something practical from Mr. Newbigging; and this paper reminded him of difficulties that he met with years ago, in the construction of tanks, which would have been avoided had they been foreseen; or if they had done as Mr. Newbigging suggested, and bored beforehand, they would then have known the strata they had to deal with. In one case in the South, about five-and-twenty years ago, he had to overlook the construction of a tank designed and arranged by an eminent engineer; and when they commenced operations, they found a bog on three parts of the area of the excavation for the tank, and rock on the rest. He need hardly say they met with many and various difficulties; and the whole construction had to be re-designed at very considerable cost. Had they made previous investigations in the way suggested, this would have been avoided. The great point was to know whither they were journeying, and what kind of material they had to excavate. In another case, some twenty years ago, at Northampton, a tank was erected, and everything seemed perfect. He was not living there, but went down to see it from time to time; and when it was completed, the engineer and everyone connected with it was very proud of it. It was exactly cylindrical, and appeared to be perfect in every way; but within three or four days, they heard that the tank had completely collapsed. The whole thing had fallen inwards, through what Mr. Newbigging had indicated. They had continued to pump, and had drawn away the sand from under the brickwork or foundations of the tank, and also from under the embankment near the bed of the river. It was very fine, soft sand; and the whole thing fell to pieces without any warning. In this instance, he could not imagine how it could have been foreseen. In no case did an engineer require to exercise so much care and foresight as in dealing with an excavation of this sort. There was no "royal road." One must use experience, and judge what course to take on the spot, after having bored to ascertain what was the nature of the ground. In another case in the South, he had to deal with a large quantity of water, gravel, sand, and clay, as he found from borings. There was a large quantity of clay at the depth of about 14 feet. The tank, when finished, was to be 30 feet; and he had to go down a depth of some 35 feet below the bottom—14 feet being of clay. It was at Maidstone, near the side of the River Medway; and the water in the river there sometimes rose 4 or 5 feet in a few hours, though during the summer time it sometimes remained in a normal condition for three or four months. He put down the sump in the usual way outside; but then he came to the conclusion that he would not allow the large volume of water to keep running down into the tank, but would intercept it. He therefore made a little trough all round the top of the clay, which was about 18 inches above the level of the river; and from this he laid an 8-inch pipe about 30 yards to the river. He put a valve on the end near the river, so that, if a flood-tide came, he could shut off the valve, and set the pumps to work. But fortunately it was not found necessary to set the pumps to work at all; for he ran off the whole of the water into the river at a very slight expense, whereas, had he allowed it to go down into the bottom of the tank, it would have cost many hundreds of pounds to pump it out again, besides impeding the progress of the work. [Mr. West drew a rough diagram on the black-board to illustrate the method adopted.] He was not aware that he could do this until he had reached a certain depth; and this showed the necessity for being very watchful in these constructions, and using one's brains, in order to save as much money as possible. He quite agreed with Mr. Newbigging that the water should not be put into the tank until the gasholder was constructed; and he never knew of such a thing being done. He thought it must be by someone who wished to test the stability of the contractors' work while green, and possibly inflict penalties upon them.

Mr. T. O. PATERSON (Birkenhead) asked if Mr. Newbigging had ever considered the question of the relation between the outside water pressure and the strength of the tank, especially in the lower portion of it. There were

many cases in which one-half the depth of the tank was supported by water when full; and it appeared to him that it might then be quite safe to considerably reduce the strength of the brickwork in the lower portion. If a tank were 30 feet deep, the bottom would have 30 feet head of water upon it, supposing the outside or ground water-line were at the bottom of the tank. But if it rose (say) 15 feet, and were maintained, the tank had only to support 15 feet head of water. The only counterbalancing consideration was the possibility of having the pressure taken from the tank by external means, such as other buildings, and so forth. He would also like to know if Mr. Newbigging considered it safe to put inside the tank a circular drain, carrying water from it up to the sump or stand-pipe, because he had in his mind a tank which was made with a rubble drain inside, and that drain was the cause of the tank giving way twice on the top of the drain. The puddle was affected below, and eventually it gave way to the internal pressure; and the tank had to be emptied.

Mr. R. MITCHELL (Edinburgh) said some time ago he had to construct a tank 145 feet in diameter and 37 ft. 6 in. working depth, so that the excavations were 43 feet. The adjoining tank was at a distance of only 23 feet, and was constructed entirely on a bed of rock. Before commencing operations, they sank three shafts, 6 feet by 3 feet, in the line of the excavations. They found on the west, north, and east sides that it was the same rock, according to samples which had been retained from the constructor of the first tank; and they therefore did not think it necessary to put down a fourth shaft on the south side. But this was where they made a mistake; for they found the rock dipped towards the south; and when the excavation was being carried out, instead of having rock on this side, as they expected, they had to take it to the depth of 4 ft. 6 in. below the other portions, and fill it in with strong concrete, so as to bring up the base. The operations of putting down the pump and pumping were carried out exactly as Mr. Newbigging had described; but there was this difficulty to contend with: There was a large public park on the south side, and the under stratum was nothing but peat. They drained the whole of the area, and lowered the level of a portion of it 2 ft. 6 in. Then on the west side were chemical works, where chloroform, ammonia, and other things were made; and these operations were also a cause of trouble. The difficulties attending water pumping, therefore, had to be met in each case according to the circumstances, so that the work might be carried out with the least inconvenience, not only to the contractor, but to adjoining property. As to cutting a trench round the side of the bottom, they had considerable difficulty in this way: In wet weather, having so large an area of spongy ground, the water came in in large volumes; and after the bottom was finished, they put in four stand-pipes about 3 feet above the bottom, and had several of them on the top of the cone. In filling the tank, they closed up these under stand-pipes, filled in as hard as they could, and then blocked up the stand-pipe on the top of the cone. There was no difficulty for a considerable time, until blasting operations were carried on by the adjoining proprietors; and then the tank was wrecked, and they had ever since had trouble. If there was not a good foundation, no matter what care the engineer bestowed on the plans, or the contractor in carrying out the work, difficulties would result; and, as he had pointed out, these might arise from circumstances subsequently occurring, over which one had no control, and which could not be foreseen.

Mr. W. W. HUTCHINSON (Barnsley) said the members were much indebted to Mr. Newbigging for laying stress upon the proper management of the water in dealing with the construction of a gasholder tank; for in that direction lay the main secret of success. He might say that at Barnsley they had a tank 122 feet in diameter by 30 feet deep, in which they had to contend with all the difficulties Mr. Newbigging had stated, with the exception of the sand. On both sides of the works, there were hills of (say) 250 feet elevation; and the valley was very fully charged with water. Near the tank ran a river, and the winding of it had deposited beds of leaves and other silt and rough stuff of an unstable nature, so that it was impossible to leave the usual mound in the middle. All the ground had to be taken out, and puddled, and concrete put on the top of it. The water was dealt with in the way indicated in the paper. Drains and pipes were laid round the tank, and

into a sump; and connected therewith, was a stand-pipe with holes in it at intervals of six inches, tapped for plugs, so that they could be made up afterwards as the water reached them in filling the tank. By these means the water was successfully dealt with. It was within his experience that, if care were not taken, the bottom would have been forced up by the pressure of water from outside. He knew this because, as it happened, the experiment was tried; and in this instance the lifting of the bottom was very distinctly observed. If a sump were made at a suitable level below the tank, and that was kept properly clear until the water was put in the tank at a higher level, all would go well. But there was often great danger of spoiling a tank; and it would most certainly have been so in this case, if it had been left entirely to the contractor, although he was specially charged, in the specification as well as verbally, to see that the operation of filling was properly performed. This tank was made in 1885; and it continued perfectly water-tight to the present time.

Mr. G. B. IRONS (Gosport) said there was one subject connected with gasholder tanks which had not been mentioned. One usually required to have attached to the tank a dry well for the inlet and outlet pipes; and he should like to ask Mr. Newbigging if he had ever managed to make such a well, and, if so, how he did it.

Mr. N. H. HUMPHRYS (Salisbury) said the difficulty to contend with in tank construction was, that it very seldom happened that anybody was fortunate enough to carry right through the programme with which he started. Some unforeseen difficulty arose—perhaps in the ground itself, or in unexpected springs, or some neglect by the contractor. It was therefore most important to give close attention to everything which such an experienced constructor as Mr. Newbigging could tell them about it, because they might at any time be called upon, at a day's notice, to contend with some unlooked-for difficulties. One point to which he would direct attention was the question of the section of the wall. A very common arrangement was to start with say 3 feet thickness at the bottom; then, some distance above, to make it two-thirds the thickness; while at the top it was reduced to one-third. He questioned whether this plan of constructing a tank in steps of so great a difference was correct; and whether it would not be better to have it more equalized, by making only two thicknesses, or, in the case of shallow tanks, to have the wall the same thickness throughout, especially when it was built in good ground, because in that case there was support behind the wall at the bottom, but at the top it often had to run 4 or 5 feet above the existing level, with a bank round it. In such a case, one really required almost as much strength at the top as at the bottom.

Mr. H. ASHTON HILL (Wallasey) thought the thickness of the wall depended to a great extent upon whether or not it was built in lime or cement mortar; and he was strongly of opinion that cement only should be used in tank construction. If they had a thick wall, it was slow in setting; and the pressure came upon it before it was properly set. But a smaller section, built in cement mortar, would cost about the same, and the result would be more satisfactory. With regard to the point raised by Mr. Humphrys, it had been pretty well established by water engineers, and the common rule was, to make the thickness of the wall 0·3 at the top, 0·5 in the middle, and 0·7 at the bottom, of the total height of the wall. Gasholder-tank walls were much reduced from this, owing to the nature of the backing, perhaps sometimes more than was wise. With regard to the difficulty of dealing with water, no reference had been made to the amount, which was very important. As a rule, the quantities met with were not what would be considered very large, and a comparatively small pumping plant would be sufficient, if suitable. He was now making a well, and had done 138 feet; there being at one part a bed of sandy rock, with harder rocks above and below. The strata were very soft; and at first he provided pumping plant sufficient to raise 40,000 gallons of water per hour. But he found this was becoming too small—having to pump sand and water; and he had now put down pumps to raise anything up to 100,000 gallons an hour. He mentioned this to show the importance of considering the relative quantity of water. Sometimes, if the pumping plant would raise 5000 gallons an hour, it was sufficient; but this was comparatively a teacupful.

Mr. G. ANDERSON (London) said on one occasion he had

to superintend the construction of a tank which had been undertaken by a man who was thought to have had considerable experience, as he had built the Town Hall in the place. It was on sloping ground; and soon after the operations commenced, he (Mr. Anderson) went down to see how they were getting on. He found the walls with 2 or 3 feet up, and a very small stream of water was coming in at the upper side of the slope. He told the contractor that he ought to lead this round outside the puddle, and get rid of it. However, no attention was paid to it; and, in about another week, he was asked to come down, because the contractor was in difficulties. He found the brickwork looking as if there had been an earthquake; the wall had gone in all directions. This was solely in consequence of the contractor not having attended to that little drop of water. The directors of the company asked him to take over the work and get it done. He took the whole thing out, preserved the puddle, cleaned the bricks, and prepared to begin again. The water was a very small stream—not so thick as a walking-stick; and by simply leading it round outside the puddle it flowed away of itself, and the tank was built without any trouble whatever. This showed how a small thing would cause disaster, if the physics of the question were not understood.

Mr. NEWBIGGING, in reply, said he was pleased with the discussion. In taking up the question of the difficulties associated with water in the construction of tanks, he had rather endeavoured to deal with general principles, not so much to accumulate examples, or he might have given a great many curious instances of troubles encountered and overcome if he had searched through the volumes of the JOURNAL OF GAS LIGHTING. But he was in hopes that members present would recount the difficulties they themselves had met with. Mr. Hepworth had given an interesting description of his trouble in constructing a cast-iron tank, which reminded him (Mr. Newbigging) of an accident to an annular tank at a works not far distant from London. The tank, if he remembered rightly, was being made on a gravel foundation, which he believed was considerably charged with water. The workmen had omitted to leave out certain plugs in the bottom of the tank to admit the water (because in that case it ought to have been admitted). The consequence was that one night the whole tank was lifted by the outside water—in fact, it was floated about in the trench just as if it were a vessel in mid-ocean; and when it came to be landed, it was found to be considerably tilted, and the restoring of it to its proper position was a matter of much difficulty and expense. Mr. West had not exaggerated the danger of pumping water out of sand where there were buildings near; and he had also given some interesting examples from his own experience. He (Mr. Newbigging) could assure him that some directors of gas companies and gas committees of local authorities insisted on tanks being filled before the holders were put in, which was a great mistake. A new tank should always stand for a time, to allow of the masonry becoming properly set. Mr. Paterson had inquired if he had ever considered the question of tank walls. Of course he had done it often enough; but it scarcely came within the purview of the present paper. Besides, in "King's Treatise on Coal Gas," ample rules were given for calculating the strength of tanks of different depths. Something depended upon the character of the outside soil, as to what the strength of a tank wall should be. But whether or not there was water in the outside soil, in his opinion the section of wall should always be strong enough to resist the inside pressure, assuming the absence of water outside to act as a counterbalance. Circumstances might easily arise to drain off the outside water. Mr. Mitchell, recounting his own experience, remarked that there were circumstances over which an engineer and contractor had no control. This was so, no doubt, at the beginning of the work. But as it proceeded, the engineer ought to bring his judgment to bear to grapple with the difficulties that arose; and before the tank was completed, there should be no circumstances hidden from him which he could not control, however it might be at the beginning—he should have been able to provide for them all. If, for example, there was danger at any future time of water being removed from below the bottom of the tank, the engineer was to blame for not either piling it, or going down to a solid foundation. Mr. Hutchinson had referred to the necessity of seeing that the pressure below the tank bottom

was kept down until the tank was filled. That could only be accomplished by pumping; and it was most important to see that this was done, if the tank was not to be permanently injured. In case it could not be done, there should be an opening made to allow the water to rise until everything was finished and the stand-pipe put in. Mr. Irons asked his (Mr. Newbigging's) opinion as to whether it was possible to make a dry-well tight. Honestly, he had met with a tight dry-well; but the instances were very rare. By far the best method of dealing with this matter was to dispense with the dry-well altogether. There was no necessity for it; it was an obsolete construction entirely. What was the use of it? Assuming there was a leakage in the inlet or outlet pipe, it was impossible for anyone to go down into the well to remedy it. Anyone venturing down would scarcely return; and the presence of a light would cause an explosion. There was no necessity whatever for a dry-well, no matter what might be the size of the tank. It was entirely abandoned by gas engineers; and therefore the question was really not worth discussing. He could quite agree with what Mr. Humphrys had said about the "stepping" of the tank wall; but, after all, a great deal depended on the circumstances. There were well-known rules for calculating the strength of walls. Mr. Hill, who had had large experience in hydraulic works, could, no doubt have given some interesting instances of difficulties overcome, if there had been more time. He spoke of the trouble in dealing with water in the construction of tanks as not being of a formidable character. The members were indebted to Mr. George Anderson for his description of the ingenious means he adopted in dealing with the water in the excavation of a tank in the course of his practice. It must be remembered that, in building a tank, the object to be attained was a water-tight structure. There was a lot of work for an engineer to do, where he had water to contend with. But then his special construction when finished, might not have to contain water; so that it did not matter how much difficulty he had in the course of the work, he would get rid of the water undoubtedly by some rough means. The thing was to deal with it effectually, and still make a water-tight structure. Building a tank was not like making a long line of railway, or even a reservoir, because they were necessarily limited to a confined space. There was not much elbow-room; and that increased the difficulty. This was also the reason why a tank was more costly, in proportion to its size, than almost any other kind of engineering work.

PAPERS READ AT THE MEETING.

(Continued from p. 1177)

STRUCTURAL CAPACITY AND COST OF GAS WORKS.

By WILLIAM REGINALD CHESTER, of Nottingham.

The subject I have chosen for my paper is one of perpetually recurring interest to gas engineers; and yet it is one which, in its entirety, has never to my knowledge before been dealt with at our annual meetings. Why, I do not know, unless it may have been considered too wide a subject to be adequately dealt with in the brief time at our disposal for the reading and discussion of a paper. Only once in a presidential address to one of the District Associations, in 1887-88, has it received the consideration its importance and general interest deserve. Mr. V. Wyatt then dealt with it in a very able manner; and from his wide and exceptional experience as former Chief Constructing Engineer to The Gaslight and Coke Company, his tables of cost and capacity have stood as a text-book for comparison and reference to all engineers interested in the design and construction of gas-works. As, however, the basis of his calculations has reference to the construction of a works exceptional both as regards site and capacity, and as since the construction of the Beckton works immense strides have been made in the production, purification, and storage of gas, I have ventured to bring the subject forward again; and as I deal with a works in most respects of modern design and of more ordinary capacity, I trust the figures will be found to have a more general interest, and to be of wider application.

In the table at the end of the paper some of the figures

refer to works not executed or designed by the author, but which are in actual existence and form part of a whole which it is the object of the paper to describe. The other figures relate exclusively to works designed and carried out by the author, and which may be taken as representing approximately the proportions deemed best suited for the work to be done. I have preferred to give, in all cases where possible, the actual capacities and costs of existing work, rather than to describe a hypothetical or ideal works, which may never have an existence. I am dealing with a works which constitute one branch of a gas undertaking, and which during the winter months are worked up to their full capacity—the yearly increment being provided for at another station.

The works have a maximum daily output of 3½ million cubic feet of gas, and carbonize 336 tons of coal per day, or a yearly output of 686 million cubic feet of gas from (say) 66,000 tons of coal carbonized.

Land.—The area of the land is 25,848 square yards, or 77 square yards per ton of coal carbonized, or 1·53 acres per million cubic feet of gas per day. This is too small an area for comfortable working; and the coal and coke storage space is consequently limited. Two acres per million per day would be a more satisfactory area for works of this magnitude. The present site of the works being in the heart of the town, is very valuable, and would if carried out at its present actual value constitute too large a proportion of the cost of the undertaking. I, therefore, for the purpose of this paper, take it, including the boundary-wall and drains, at about £1000 per acre, or (say) £5500, which gives £16·4 per ton of coal carbonized as capital under this head.

Retort-Houses.—The retort-houses, two in number, were constructed many years ago. The ground-floor is 196 feet in length, 50 feet in width, and 24 feet high, from floor to top of walls—235,200 cubic feet each. They have been adapted for regenerator furnaces by excavating the interior to a depth of 9½ feet below the floor-line; underpinning the walls; and providing them with a new floor of cast-iron plates supported on wrought-iron rolled joists. The cost of the conversion is included in the cost for the regenerator settings. In each house there are sixteen settings of eight 18 ft. 6 in. through retorts, regenerator fired, provided with self-sealing mouthpieces and lids; 6-inch ascension-pipes; and wrought-iron hydraulic mains, having separate divisions and a combined weir and flushing-out valve to each bed, as well as a relief main on each side of the stack. The coal carbonized is 168 tons per retort-house per day, which gives 17·14 cwt. per foot lineal of house, and 13·12 cwt. per mouthpiece (5-hour charges).

The cost is as follows:—

		Per Ton of Coal Carbonized per Day.
Retort-house	£5,000	.. £29·76
Chimney	900	.. 5·36
Regenerator settings complete with all fittings }	8,100	.. 48·21
	£14,000	.. £83·33

The houses are too narrow to be worked by machinery, or even comfortably by hand. The conversion from ordinary direct-fired settings to regenerator settings increased the output 78 per cent.

Coal-Stores.—The covered-in coal-store is equal to 180,000 cubic feet, or about 14 days' maximum consumption; and another 14 days' consumption is stacked in the open. The area of land covered and uncovered, used for stacking purposes is 2666 square yards, or about 8 yards superficial per ton of coal per day. The shedding consists of wrought-iron slated roof, supported on columns and open all round. The cost of same at 40s. per yard superficial is £2666, or about 12s. per ton of coal stacked, the interest on which at 5 per cent. adds 7¼d. per ton on the coal stacked under cover. The capital outlay per ton of coal carbonized per day is £7·93.

Coke Storage.—The coke storage is all under cover. The sheds consist of wrought-iron roof, slated, supported on cast-iron columns, 11 feet high; and they are open at the side. They have a capacity of 246,000 cubic feet, and will hold about 2000 tons of coke or 14 days' maximum make. The sheds cover an area of 2489 square yards, which gives 7·40 yards superficial per ton of coal carbonized per day. The cost of same, at 36s. per yard superficial, is £4480, or £13·33 per ton of coal carbonized per day.

Siding accommodation inside works.—The siding accommodation inside the works consists of 533 yards lineal of single line of rails, including three turntables and three weighing machines. This gives 1·59 yards run per ton of coal per day. The cost, including turntables and weighing machines, is £1200, or £3·58 per ton of coal per day.

Condensers and Coolers.—The condensers are all atmospheric; part under cover and part outside. I include as condensers all pipes from the mouthpiece to the outlet pipes of the condensers, where the same enters the ground *en route* to the exhausters.

	Surface exposed to Atmosphere.		Cubical Contents.	
	Sq. ft.	Per 1000 c. ft. per day. Sq. ft.	Cub. ft.	Per 1000 c. ft. per day.
Ascension-pipes, bends, &c.	16,256	4·63	2,200	0·63
Hydraulic mains, and relief main . .	8,240	2·35	3,248	0·92
Internal pipes, chiefly wrought iron .	5,976	1·70	2,984	0·85
External pipes, cast iron	16,216	4·63	6,008	1·72
	46,688	13·31	14,440	4·12

The surface area of the internal and external condenser pipes proper is 6·33 feet superficial per 1000 cubic feet of gas passed per 24 hours; but for the purposes of comparison it is necessary to include also the surface area of the ascension-pipes, hydraulic main, and relief main too; and this brings the total condensing surface up to 13·31 square feet per 1000 cubic feet of gas passed per day. The time contact, including the whole of the above pipes, is about 6 minutes—a period I consider barely sufficient to allow of the adequate deposition of all tarry matter. The cost of condensers proper—*i.e.*, the internal and external pipes, together with wall brackets, valves, foundations and tar troughs—is £4000, or £11·90 per ton of coal carbonized; the cost of the other pipes being included in retort-settings.

Steam-Boilers.—There are two steam-boilers, each 28 feet by 7 feet, Lancashire type, fitted with Perret's patent dust-fuel furnaces, and dry-air fans. The boiler-house forms part of a large block of buildings 48 ft. 10 in. long, and 26 ft. 6 in. wide; room being left for a third boiler of similar type. The cost is as follows:—

		Per Ton of Coal Carbonized per Day.
Boiler-house	£1000	.. £2·98
Chimney	765	.. 2·28
Boilers, steam-pipes, & setting	1325	.. 3·94
	£3090	.. £9·20

Engines and Exhausters.—There are three sets of engines and exhausters; each exhauster being coupled direct to a separate engine. Two exhausters are of 100,000 cubic feet per hour capacity, and one of 60,000 cubic feet per hour capacity. Any two of these working together at a moderate speed of (say) 100 revolutions per minute, will deal with the maximum make of gas. In the engine-house are placed the tar, liquor, and water pumps, and also an engine and dynamo for incandescent lighting for the whole block of buildings. This latter is provided for lighting purposes, in preference to gas, on account of its greater safety; this being a matter of considerable importance, especially in the purifier-house.

Engine-house	£1200
Engines, exhausters, &c.	1500
Pumps	200
Engine and dynamo	200
	£3100

This works out to a cost of £9·22 per ton of coal carbonized per day.

Scrubbers and Washers.—There are two tower scrubbers, each 12 feet diameter and 60 feet high, filled with 7-inch by ¾-inch deal boards placed on edge; and one Kirkham "Standard" washer 21 ft. 6 in. by 9 ft. by 9 ft. 6 in. with twelve chambers. The two scrubbers are used with ammoniacal liquor, and the washer with clean water for finishing the ammonia purification. These are ample for the complete elimination of the ammonia.

<i>Normal Capacity</i> —	
Scrubbers each	80,000 cubic feet per hour.
Washer	100,000 " " "
<i>Cubical Capacity</i> —	
Scrubbers	13,570 cubic feet.
Washer (1560 cubic feet) half gas space	780 " "
	14,350 cubic feet.

This gives 4·10 cubic feet per 1000 feet of gas made, per

day, or time-contact slightly under 6 minutes. The items of cost are :—

Scrubbers and connections	£2700
Washer „ „	1950
	£4650

or £13·84 per ton of coal carbonized.

Purifiers.—The purifiers consist of eight boxes of a total area of 8568 square feet, and of a cubical capacity (boxes only) of 49,682 cubic feet. This gives an area of 2·44 square feet and a capacity of 14·19 cubic feet per 1000 cubic feet of gas per day—the time contact being 20 minutes. The purifiers are arranged in two sets of four each. The whole number of purifiers in each set are worked together, except during the short period of charging and discharging. The purifying material is lime and oxide in alternate boxes; and in this way the sulphur compounds are kept down to an average of 14 grains per 100 cubic feet without difficulty. The lime is almost completely carbonated, and is removed from the purifiers in an innocuous and inoffensive condition. I mention this in some detail as the process of working is simplicity itself, and gives rise to no anxiety as to results. The low average of sulphur compounds is maintained from week's-end to week's-end with a variation of not more than 2 or 3 grains; and the lime, being almost inodorous, gives rise to practically no nuisance, though the working is in the heart of the town. The purifier-house in one set consists of an open shed composed of a wrought-iron roof, slated, and carried on cast-iron columns, on which the travelling crane runs. The other purifier-house is a brick building forming part of a large block. The purifiers are placed about 10 feet above the ground-line; and the floor below is used for lime and oxide preparation. The area of the purifier-houses is—

Open shed	5,742 sq. ft.
Brick building	7,980 „
	13,722 = 3·92 sq. ft. per 1000 c. ft. of gas per day.

In addition to the purifier-houses there are two sheds for the storage of new and spent lime, having a combined area of 3850 feet superficial, or 1·10 feet superficial per 1000 cubic feet of gas made per day. The cost is as follows :—

		Per Ton per Day.
Purifier-houses and oxide floor.	£5,700	= £16·96
Purifiers complete with "Goliaths"	8,300	= 24·70
New and spent lime stores	1,400	= 4·17
	£15,400	= £45·83

Meters and Governors.—The station meters and governors are placed in the same room as the engines, exhausters,

and pumps. There are two station-meters each of 100,000 cubic feet per hour capacity; and four station governors. The cost is—

Meter and governor house .	£1,200
Meters	2,000
Governors	400
	£3,600 = £10·71 per ton of coal carbonized.

Gasholders.—There are four gasholders of a total capacity of 1,430,000 cubic feet, equal to 0·4 day total production. They were formerly two-lift, now converted into four-lift holders, with a total capacity of 2,740,000 cubic feet, equal to 0·78 day production. The upper lift goes out beyond the guide-framing; being supported by the Pease wire-rope arrangement.

The cost of gasholders and tanks is as follows :—		
Original storage	£42,900	= £30 per 1000 c. ft. capacity.
New „	13,100	= £10 „ „
	£56,000	= £20·07 „ „

The total cost of gasholder storage equals £166·66 per ton of coal per day. This is a very high figure—due, firstly, to the small capacity of the original holders; and, secondly, to difficulties met with in the construction of the tanks, the bottoms of which are carried some 10 or 12 feet below the surface level of the water in the adjoining river. Storage capacity of equal dimensions could now be provided at probably half the above cost.

Tar and Liquor Wells.—The tar and liquor wells are placed beneath the revivifying floor of the purifier-house. They are 91 feet by 87 ft. 8 in. by 11 ft. deep; giving a total available storage capacity equal to about four weeks maximum make. The cost was £2400 = £7·14 per ton per day. In addition to the above there are overhead tanks for water, tar, and liquor, placed above the boilers. These cost £1250 = 2s. 2d. per cubic foot (nearly), or £3·72 per ton of coal carbonized.

Store-Rooms and Workshops.—The store-room is above the engine-house; and the smiths, and fitting-shops adjoin the retort-houses. The cost is £1340 = £4 per ton of coal carbonized.

Stabling for five horses, including two loose-boxes, is provided at a cost of £500 = £1·48 per ton of coal carbonized.

Works Superintendent's House and Offices.—Cost £1000 = £3 per ton of coal.

Mains and Connections between various apparatus. Cost £1000 = £3 per ton of coal.

Tools, Implements, Horses, Carts, and Rolling Stock.—I estimate these at £6720, or £20 per ton of coal carbonized.

TABLE showing Cost per Ton and per 1000 Cubic Feet of Various Parts of Gas-Works, and Ratio of Parts to the Total Capital.

	Total Cost.	Cost per Ton of Maximum Daily Consumption of Coal.	Cost per 1000 c.ft. of Maximum Daily Make of Gas.	Cost per Ton of Annual Consumption of Coal.	Cost per 1000 c.ft. of Annual Make of Gas.	Ratio. Percentage of Total.
	£	£	£	£	£	
Land, drains, and boundary-wall	5,500	16·37	1·571	·0833	·0080	1·73
Retort houses and benches	28,000	83·33	8·000	·4242	·0408	8·80
Coal-stores	2,666	7·93	0·762	·0404	·0039	0·84
Coke-storage	4,480	13·33	1·280	·0679	·0065	1·41
Siding accommodation, including weighing-machines and turntables	1,200	3·57	0·343	·0182	·0018	0·38
Condensers and coolers	4,000	11·91	1·143	·0606	·0058	1·26
Steam-boilers and boiler-house	3,090	9·20	0·883	·0468	·0045	0·97
Engines, exhausters, pumps, and house	3,100	9·23	0·886	·0470	·0045	0·97
Scrubbers and washers	4,650	13·84	1·328	·0705	·0068	1·46
Purifiers and house	15,400	45·83	4·400	·2333	·0225	4·84
Meters, governors, and house	3,600	10·71	1·029	·0545	·0052	1·13
Gasholders	56,000	166·67	16·000	·8485	·0816	17·59
Tar and liquor wells	2,400	7·14	0·686	·0364	·0035	0·75
Overhead tanks—tar, liquor, water	1,250	3·72	0·357	·0189	·0018	0·39
Store-rooms and workshops	1,340	3·99	0·383	·0203	·0020	0·42
Stabling for five horses	500	1·49	0·143	·0076	·0007	0·16
Works Superintendent's house and offices	1,000	2·98	0·286	·0151	·0015	0·31
Mains and connections in yard	1,000	2·98	0·286	·0151	·0015	0·31
Tools, implements, horses, carts, and rolling stock	6,720	20·00	1·920	·1018	·0098	2·11
Mains and services	91,000	270·83	26·000	1·3788	·1327	28·59
Meters	35,700	106·25	10·200	·5409	·0520	11·22
Floating capital	23,520	70·00	6·720	·3564	·0343	7·39
Engineering and parliamentary expenses	22,184	66·02	6·338	·3361	·0323	6·97
	318,300	947·32	90·944	4·8226	·4640	100·00

REMARKS.
Land.—1·53 acres per million, 77 yards superficial per ton. *Retort-Houses.*—17·14 cwt. per foot lineal. *Coal-Stores.*—Covered space 4 yards superficial per ton of coal per day (maximum). *Coke-Stores.*—Covered space 7·4 yards superficial per ton of coal per day (maximum). *Siding Accommodation.*—1·59 yards lineal per ton of coal per day. *Condensers.*—13·31 feet superficial, 4·12 cubic feet per 1000 cubic feet per day; time contact, 6 minutes. *Boilers.*—Boilers, 43 per cent.; house and chimney, 57 per cent. *Engines.*—Machinery, 61 per cent.; house, 39 per cent. *Scrubbers.*—4·1 cubic feet per 1000 cubic feet per day; time contact, 6 minutes. *Purifiers.*—House, 37 per cent.; apparatus, 54 per cent.; sheds, 9 per cent. Area = 2·44 feet superficial; 14·19 cubic feet per 1000 feet per day; time contact, 20 minutes. *Meters and Governors.*—House, 33½ per cent.; apparatus, 66½ per cent. *Gasholders.*—0·78 day maximum make, £20 per 1000 cubic feet capacity. *Tar and Liquor Wells.*—Four weeks' maximum make; £6·38 per 1000 gallons. *Mains and Water Tanks.*—2s. 2d. per cubic foot. *Mains and Services, and Meters.*—£711 per mile, 139 consumers per mile for each item. *Floating Capital.*—7s. per ton of coal (should be 10s.). *Engineering, &c.*—7½ per cent. on previous items.

Meters.—The number of meters in use, corresponding to the number of tons of coal carbonized, is 17,800, the cost price of which fixed would be £35,700. This gives £106·25 per ton of coal carbonized per day.

Mains and Services.—There are 128 miles of mains, the cost of which (including services) is £91,000, or £711 per mile of main. This gives a capital outlay of £270·83 per ton of coal carbonized per day. The number of consumers per mile of main works out at 139—reckoning one consumer to each meter. Each consumer takes, on an average, the gas from 3·70 tons of coal, and pays for about 36,000 cubic feet of gas per annum.

Floating Capital.—The floating capital employed is £23,520, or £70·00 per ton of coal carbonized per day. This works out slightly over 7s. per ton on the total quantity of coal carbonized; and it is scarcely sufficient for the proper working of a gas undertaking. In the writer's opinion, it ought to be equal to 10s. per ton of coal carbonized per day.

Engineering and Parliamentary Expenses are estimated at 7½ per cent. on the previous items = £22,184, or £66·02 per ton of coal carbonized per day.

The structural cost of the undertaking now under consideration works out at £4·82 per ton of coal carbonized; and this figure represents as near as possible the actual cost of a works of 3½ million cubic feet per day capacity.

The capital charge of the whole undertaking at Nottingham is £6·35 per ton of coal carbonized; but this includes a large portion of reserve land and buildings provided for future extension, a considerable sum paid for goodwill, the provision of handsome show-rooms and workshops, and the whole of the capital expended on chemical works, which deal with the residual products (tar, liquor, and spent oxide), provide sulphuric acid, and manufacture all the requirements of new oxide.

If a new works were being laid out, it would be possible to economize in some of the items; but a substantial works of this magnitude—built for posterity, and not merely to serve the purpose of to-day—I consider, could be provided fully equipped for £4 per ton of coal carbonized, the interest on which at 5 per cent. would be covered by a charge of a little less than 4¼d. per 1000 cubic feet of gas sold.

Although I cannot pretend that the capacities referred to herein are in all respects best suited for the work, or the costs the most economical that can be attained, I have, in dealing with this subject, throughout endeavoured to avoid speculation, believing the record of an actual fact to be of infinitely more value as a guide than any hypothetical figure which may vary with the vividness of the imagination or with the bias or momentary self-interest of the individual; and this must always be borne in mind when referring to the table annexed.

The author exhibited a series of drawings referring to work actually in process of construction.

NOTES ON THE CARBURETTING OF GASES.

By VIVIAN B. LEWES, F.I.C., F.C.S.

I have on several previous occasions given my experimental results and views on the subject of the enrichment of coal gas by carburetting materials other than cannel; and the wide-spread interest which is now being taken in the subject, encourages me to believe that some further notes on the subject may not be unwelcome.

From the gas manager's point of view, the great end and aim is to enrich a 15 to 16 candle coal gas up to 17 to 22 candle value. But in the experiments I have made, I have gone beyond this, and have tried how far it is possible, within the limits of price necessary to compete with coal gas, to endow non-luminous gases with the illuminating power required to make them available for either enrichment, or for consumption by themselves.

It is manifestly useless to discuss the use of such substances for enrichment as could not be obtained in sufficient quantity to render them available at a cheap rate, in the event of experience teaching us that good results could be obtained from them; as the increased demand, consequent on the opening up of a large market for them, would at once send up the price to a figure which would render their use impossible. This consideration, I fear, limits our carburetting materials to Russian and

American petroleum; and the cost of carriage points clearly to the former as being the chief factor in our calculations. In a series of experiments, the results of which I gave a short time ago, I found that the Russian crude and "distillate" oils gave the best results as far as the manufacture of an illuminating gas was concerned; and that the Scotch intermediate oils were nearly as good, and did not give as much trouble from deposition of carbon. But, unfortunately, the native product could not be obtained in sufficient quantity to meet any very large demands; and the present condition of the Scotch oil industry does not encourage much hope of an increase in this direction.

The enrichment of a poor coal gas, or the rendering of a non-luminous gas capable of giving light during its combustion, may be brought about either by charging it with the vapours of highly volatile hydrocarbons, or by admixture with rich oil gas made by decomposing oil by means of heat into a mixture of permanent gases rich in hydrocarbons; and it is with certain points in these two methods that I wish to deal in this paper.

Taking first the case of enrichment of a poor coal gas by means of a rich oil gas, the question which occurs at the outset is how much of the enriching gas must be added in order to raise the illuminating value to the desired point. The general idea which prevails is that the illuminating value of the mixture will be directly proportional to the quantity and quality of the enriching gas added and the value of the gas enriched. But this by no means follows, as the composition of the gas employed to dilute the oil gas exercises a very distinct influence upon the illuminating value obtained.

In a paper read last month before the Incorporated Institution of Gas Engineers, by Mr. A. F. Browne, he gives a formula for calculating the percentage of rich gas which must be added to a poor sample of coal gas in order to raise it to the desired value, and a second formula for finding the volume of enricher to be added for 1000 cubic feet of the coal gas. These formulæ he verified by making mixtures of coal gas and oil gas; and on testing the resultant illuminating values, he found that they were "very fairly in agreement with theory."

Coal gas is a mixture of many gases and vapours; and if the constituents of the coal gas be taken separately and be enriched with oil gas, or with a rich hydrocarbon gas of definite composition—such as ethylene—it will be found that some of the constituents require a far higher percentage of enricher for a given rise in value than others. Taking the illuminating gas supplied by the South Metropolitan Company (which I presume was used in Mr. Browne's experiments), an analysis made last month gave as its composition—

South Metropolitan Gas—May 16, 1892.

Hydrogen	52·22
Unsaturated hydrocarbons—ethylene, benzene, &c.	3·47
Saturated hydrocarbons—methane, ethane, &c.	33·76
Carbon monoxide	6·23
Carbon dioxide	0·60
Nitrogen	3·23
Oxygen	0·49
	100·00

Of these constituents, the unsaturated and saturated hydrocarbons alone are of value as giving illuminating power; the other gases being merely diluents. The hydrogen and carbon monoxide, however, being combustible, have a definite part to play in the flame, whilst the non-combustible diluents, carbon dioxide, nitrogen, and oxygen, are the gas manager's worst foes, and simply reduce the illuminating value of the gas.

In the following experiments, I have first tried the effect of enrichment by known percentages of oil gas upon the original coal gas, and then upon the combustible diluents separately. The oil gas for this purpose was made by decomposing Russian distillate oil at 1600° Fahr. in a Patterson oil-gas plant; collecting the gas in a 400 cubic feet holder; and running the right proportions into experimental holders into which the diluting gas was afterwards passed, and the mixture allowed to stand all night to ensure thorough mixing. In testing the various mixtures, the gas was burnt at the burner which suited it best; and the rate of flow was regulated to give the most perfect obtainable flame, and the consumption of gas calculated to 5 cubic feet per hour. The whole of each mixture was burnt; tests being taken every half hour, so as to ensure the detection of imperfect mixing—the mean of the tests being taken as representing the illuminating value of the

gas. All tests were taken on an Evans-Sugg photometer with the usual precautions and corrections.

Taking first the coal gas, and enriching it with oil gas, the following results were obtained :—

Illuminating power of the original coal gas		13.43 candles	
Illuminating power of the oil gas		48.90 "	
Percentage of Coal Gas.	Percentage of Oil Gas.	Illuminating Power of the Mixture.	
		Found.	Calculated.
95	5	16.2	15.20
90	10	17.5	16.97
75	25	23.2	22.29
50	50	32.3	31.16
25	75	44.5	40.02

The coal gas used was rendered poor in illuminating value by standing for some time; and the results clearly show that a considerably higher result is obtained than would be expected from calculation.

Having determined the result of diluting the rich oil gas with coal gas, the next step was to find out how the chief diluents acted towards the enricher. Hydrogen being the most abundant constituent of the coal gas, was tested first; the same methods of testing being observed as in the case of the coal gas. The hydrogen used contained 99.6 per cent. of the gas; and, as before, the oil gas was first put into the test holders and the hydrogen then added, the same precautions being taken to ensure mixing as before :—

Set I.

Illuminating value of the original oil gas		49.6 candles.	
Percentage of Hydrogen.	Percentage of Oil Gas.	Illuminating Value of the Mixture.	
		Found.	Calculated.
33.3	66.6	34.2	33.0
50.0	50.0	25.5	24.8
66.6	33.3	18.2	16.5

Set II.

Illuminating value of the original oil gas		42.8 candles.	
Percentage of Hydrogen.	Percentage of Oil Gas.	Illuminating Value of the Mixture.	
		Found.	Calculated.
25.0	75.0	32.8	32.1
50.0	50.0	23.9	21.4
60.0	40.0	21.0	17.1
66.6	33.3	12.4	14.2
71.4	28.5	9.0	12.2

These experiments show that, with hydrogen gas, the illuminating value of the mixture is higher than one would expect from calculation for candle powers higher than 18; but that when diluted below that value, the excessive dilution causes a loss of illuminating power, and so necessitates a larger addition of the enriching gas than that calculated.

Some years ago, Dr. Percy Frankland read a paper before the Chemical Society* upon the effect of diluents upon ethylene; and his figures reveal the same fact—

Illuminating value of the ethylene		68.5 candles.	
Percentage of Ethylene.	Percentage of Hydrogen.	Illuminating Value of the Mixture.	
		Found.	Calculated.
77.55	22.45	54.58	54.28
68.39	31.61	49.37	47.87
53.58	46.42	39.21	37.50
35.47	64.53	30.85	24.82
26.08	73.92	22.84	18.25
13.37	86.63	6.73	9.35

The next combustible diluent experimented with was carbon monoxide, which has an interest for us as being not only the cheapest combustible gas but also the most poisonous; the numerous accidents which have arisen from the use of water gas being due to its presence.

Illuminating value of the original oil gas		54.7 candles.	
Percentage of Carbon Monoxide.	Percentage of Oil Gas.	Illuminating Value of the Mixture.	
		Found.	Calculated.
90	10	unreadable	5.4
75	25	8.94	13.6
50	50	21.50	27.3
25	75	38.40	41.0

These experiments show that even when only a small percentage of carbon monoxide is used, it has a tendency to reduce the illuminating value of the mixture; whilst in order to make a 17 or 18 candle power gas with carbon monoxide as the basis, a very large excess of hydrocarbon gas would have to be used.

In Frankland's experiments with ethylene and carbon monoxide the results obtained were—

Illuminating value of the original ethylene		68.5 candles.	
Percentage of Carbon Monoxide.	Percentage of Ethylene.	Illuminating Value of the Mixture.	
		Found.	Calculated.
18.35	81.65	55.27	55.93
32.25	67.75	47.73	46.40
53.70	46.30	33.09	31.71
62.06	37.94	26.52	25.97
71.27	28.73	13.26	19.64
76.11	23.89	6.56	15.86
80.00	20.00	0.00	13.70

* See JOURNAL, Vol. XLIV., p. 17.

Showing an even greater loss of illuminating value in the more diluted mixtures.

Having seen that admixture with hydrogen gives higher results than would be expected, whilst the carbon monoxide seriously detracts from the illuminating value, it might be expected that with water gas—a mixture of the two, theoretically in nearly equal proportions—the one would neutralize the other, and that the results obtained would be nearly proportional to the amount of oil gas used. Experiment, however, shows this not to be the case; the loss in illuminating value being as great as with the carbon monoxide alone.

Illuminating value of the original oil gas		54.7 candles.	
Percentage of Water Gas.	Percentage of Oil Gas.	Illuminating Value of the Mixture.	
		Found.	Calculated.
90	10	unreadable	5.4
75	25	11.9	13.6
50	50	21.6	27.3
25	75	35.6	41.0

These experiments not only show the fallacy of supposing that it is possible to calculate the amount of enriching gas which it is necessary to add in order to attain a given illuminating value without first taking into consideration the composition of the gas to be enriched, but also give interesting information on the important subject of the carburetting of non-luminous gases.

In a paper read before the Incorporated Institution of Gas Engineers last month, I showed by experiments that it was impossible to obtain the same illuminating value from oil "cracked" by itself, as could be got by decomposing it in an atmosphere of an inert gas such as hydrogen or water gas; and these further experiments show the great superiority of hydrogen over water gas for this purpose.

Up to the present time, the price of water gas has rendered it the only one available for carburetting and using either for enrichment or by itself; but by a process which I have devised and shall shortly be working on a small manufacturing scale, I believe I can make hydrogen as cheaply as, or indeed a shade cheaper than, water gas; and as the use of this would do away with all the objections urged against water gas, with its high percentage of deadly carbon monoxide, and would be more economical to carburet, I am in hopes that it will play a very important part in the near future.

The varying effect exercised upon enriching gases by the different diluents, is not due to one cause only, but to several acting in unison. In the first place the illuminating power of a flame is to a great extent governed by temperature. The hotter the flame, the more readily are the hydrocarbons broken down and carbon liberated; and the light which this emits being entirely governed by temperature, the hottest flame will always give the most light from any given quantity of hydrocarbons. If we take two flames of equal size, the one obtained by burning hydrogen and the other carbon monoxide, it will always be found that the former is the hottest. Taking a jet of hydrogen, 3 inches in height, and a similar one of carbon monoxide, and testing their temperature with a Le Chatelier thermocouple, the hydrogen flame was found to have a temperature of 1488° C. or 2610° Fahr., whilst a carbon monoxide flame of the same size gave a temperature of 1419° C. or 2554° Fahr.

Another cause, however, is, I think, to be found in the fact that, as a carburetted carbon monoxide flame burns, a large proportion of carbon dioxide is produced and drawn into the flame; and this in the luminous zone of the flame attacks the liberated carbon, combining with it to form carbon monoxide again, and so uses up some of the carbon upon the presence of which luminosity depends, whilst the high specific heat of the carbon dioxide tends to cool the flame.

The cause of the increased effect produced by enrichment upon a poor coal gas is to a great extent the methane, which forms a very large proportion of the saturated hydrocarbons, and which, although it is practically non-luminous when burnt alone, yet adds considerably to the luminosity of a mixture; also to the hydrogen, more than 50 per cent. of which is present, and which increases the temperature, and by so doing the luminosity also, whilst carbon monoxide is only present in coal gas in quantities varying from 3 to 8 per cent., so that its effect upon the luminosity of the flame is entirely overshadowed by the increase due to hydrogen and methane.

The enrichment of coal gas and other diluents with the vapours of volatile hydrocarbons has been tried from a

very early period of the history of coal gas; and the late Dr. Letheby made many experiments upon this method of carburetting gas. There is no doubt that, by using an extremely volatile hydrocarbon of definite composition—such as pentane or benzol—it is quite possible to enrich gas to a very great extent; whilst if the gas takes up the hydrocarbon vapour at a temperature below that which it will afterwards encounter, there is no fear of its again depositing. But if gasoline (such as is obtained as the first distillate from American petroleum) is used, the hydrocarbon being a mixture of many compounds, will yield up its more volatile portions first and gradually lose its enriching power; whilst if the vapour is driven off from the hydrocarbon by heat, care must be taken to only supply a small percentage of the vapour. Otherwise it will again be deposited in the gasholder and pipes.

My own experience is that 6-candle power is about the limit it is wise to add to the gas; as, although I have succeeded in carburetting hydrogen with '680 gasoline up to 14 candles, yet the illuminating value rapidly falls again on standing or passing through any great length of pipe.

The amount of volatile hydrocarbon vapour which will remain as a gas without depositing, is purely a question of vapour tension; and as this increases with a rise of temperature, and falls with diminution of temperature, it is manifest that for a gas to retain its illuminating value, it must be a long way from its point of saturation.

Gas engineers have got into the habit of speaking of the "carrying power" of various gases, and of looking upon one gas as a good carrier of vapours and another gas as a bad one; but this is, I think, an entire mistake, as a volatile liquid will evaporate into other gases at the same rate and practically without reference to the properties of the gas. I have made a series of experiments upon the point, which I think show this fairly clearly.

The gases to be experimented with were carefully prepared and as pure as possible. They were stored in graduated glass gas-jars; and after being carefully dried by passing through three bottles filled with ignited pumice-stone moistened with strong sulphuric acid,* were made to bubble slowly through potash bulbs containing pure benzol. The loss of weight in these, after each experiment, gave the weight taken up by the gas. The temperature, rate of flow, and amount of benzol in the bulbs, were kept as constant as possible during the experiments; and a second set was made, in which the gases were saturated with moisture by passing through water before entering the bulbs containing the benzol.

Gas Used.	Grains of Benzol taken up by a Cubic Foot of the Gas.	
	Dry.	Moist.
Nitrogen	114'71	101'92
Hydrogen	113'85	119'78
Oxygen	114'64	109'64
Air.	112'64	108'92
Coal gas	106'07	103'78
Carbon monoxide	103'00	109'42
Carbon dioxide	107'85	103'92
Mean	110'39	108'19

Showing practically the same rate of absorption for each gas; the differences being no greater than would arise from slight and unavoidable alterations in the rate of flow, temperature, and barometric pressure.

In another experiment, in which the pentane supplied for use in Mr. Vernon Harcourt's standard pentane air-gas flame was used, the same thing was found, although the discrepancies were rather larger—

Gas Used.	Grains of Pentane taken up by a Cubic Foot of the Gas.
Hydrogen	961'17
Air.	965'60
Oxygen	961'17
Carbon dioxide	912'68

The idea that the quantity of vapour taken up varies with the properties of the gas, is due to the wide divergence in the illuminating power obtained from the carburetted gas; but this is due, not to the quantity of carburetter, but to the action of the diluent gas. Taking equal volumes of ethylene and the following diluents, the results obtained were—

Diluent.	Illuminating Power in Candles per 5 Cubic Feet.
Nitrogen	22'0
Air	28'0
Hydrogen	36'2
Carbon monoxide	34'0
Methane	37'0
Carbon dioxide	15'0

* Calcic chloride was used in the case of the coal gas.

And the results obtained with hydrocarbon vapours vary in almost exactly the same ratio; so that in carburetting hydrogen and carbon dioxide, although each gas would take up the same amount of the enricher, the enriched hydrogen would give more than double the illumination obtainable from the carburetted carbon dioxide. There is another point in enriching with volatile hydrocarbons which must not be lost sight of, and which was experimentally dealt with by Mr. George E. Davis in 1884 and 1886, and again by Mr. T. S. Lacey in a paper read at the May meeting of the Incorporated Institution of Gas Engineers. It is that if a rich coal gas be carburetted with volatile hydrocarbons of high vapour tension, they are quite capable of displacing other vapours which are present in rich coal gas, and which have a lower vapour tension, and are often more valuable as illuminants than the vapours which take their place. If, also, a coal gas is enriched by hydrocarbon vapours—especially those derived from American petroleum—and a fall in temperature causes condensation, the condensing members of the paraffin series bring down with them and dissolve ethylene, benzene, and other of the most valuable illuminants of the unsaturated hydrocarbons; so that condensation means not only the removal of the enricher, but also very serious deterioration of the original value of the gas.

The Engineer of the Wolverhampton Water-Works.—In consequence of his advancing years and state of health, Mr. Lyons Wright, who has for a great number of years been the Engineer of the Wolverhampton Corporation Water-Works, will shortly resign that office, and be engaged as Consulting Engineer at a remuneration of £300 a year. A successor to his present position is to be appointed at a salary of £200 per annum.

Meeting of the German Gas and Water Works Managers' Association.—The thirty-second annual meeting of the German Association of Gas and Water Works is being held during the present week in Kiel; beginning yesterday morning. The President for the year is Herr C. Kohn, Manager of the Frankfort Gas Company, with whom are associated Herr E. Kunath, of Dantzic, and Dr. H. Bunte. The programme of the gas portion of the technical work of the meeting contains the following titles of papers to be read: "The New Charlottenburg Gas-Works, and the Mechanical Working of Retorts," by Herr A. Müller, of Charlottenburg. "Retort Charging and Drawing Machinery," by Herr Borchardt, of Remscheid. "Settings of Sloping Retorts," by Herr J. Hasse, of Dresden. "Water Gas, and the First District Water Gas Heating in Europe," by Herr Blass, of Essen, and Herr Schendler, of Görlitz. "The Auer Incandescent Gas-Burner," by Herr G. Fähdurich, of Vienna. "The Carburation of Illuminating Gas," by Dr. H. Bunte, of Carlsruhe. "The Estimation of the Heating Value of Gaseous Fuel," by Dr. Bueb, of Dessau. "Electrical Distribution in Towns for Lighting and Power Purposes," by Herr Hohenegg, of the firm of Siemens and Halske, of Vienna. "Sulphate of Ammonia as a Manure," by Professor P. Wagner, of Darmstadt. Besides these there will be the reports of Commissions upon Light Measurement, Heating by Gas, and Gas-Meters. The meeting is arranged to terminate with an excursion to Copenhagen.

Foreign Sewage Precipitation Works.—At the meeting of the Society of Engineers on the 13th inst.—the President (Mr. J. W. Wilson, jun.) in the chair—a paper on "Foreign Sewage Precipitation Works" was read by Mr. A. Wollheim. In the introduction to his paper, the author compared and traced the development of sewage precipitation works, and stated that as yet there were only very few works of the kind in existence abroad. Then, taking for the first part of his subject the works of Germany, he reviewed and detailed the existing legislation for the prevention of river pollution. The most important precipitation works in that country are those at Frankfort-on-the-Maine (population 160,000). They are situated upon the left bank of the river; the sewage from the right bank being conveyed across by two wrought-iron syphons, 2 ft. 6 in. diameter, with a total discharging capacity of 800,000 gallons per hour. The tanks are covered in, and will consist of two groups of six subdivisional tanks each; but only four subdivisions are as yet constructed. They are each 270 feet by 17 feet average width, and 6 ft. 10½ in. average depth of water. Each subdivision holds 250,000 gallons; and as the present daily dry-weather flow is 6,000,000 gallons, the existing tank capacity is 16 per cent. of the total daily flow. The Roeckner-Rothe system of circular upward-flow tanks, as distinguished from the rectangular longitudinal system, was next described; and the author concluded his paper with a brief *résumé* of what has been done in the United States to prevent river pollution. That country is just beginning to stir in the matter; and three precipitation works have been constructed—the largest being those at Worcester (Mass.). They were designed by Mr. Allen, the City Engineer; and well-known English types have been followed—the tanks having been planned somewhat after those at Coventry. Only a portion of the city drains to the works at present; the daily flow being about 3,000,000 gallons. The paper was illustrated by a large number of diagrams.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1254.)

THE past week was more than ordinarily quiet in all the Stock Markets. The revival in speculative activity, so long looked for, and which was thought a little while ago to be fairly under weigh, still hangs fire somehow or other. Many would attribute this to the approaching General Election; but it is questionable whether political affairs are justly chargeable with any such responsibility. It must be remembered that public confidence has been rudely shaken for some time past; and that it will take a long while before the loosened foundations are consolidated again. So that, in the meantime, a small but untimely jolt arrests the setting. Perhaps sensitiveness in this respect may be accountable for some of the dulness of the past week. Everything was dull and listless. The Money Market shows no change to record. The minimum rate of discount fixed by the Bank of England—2 per cent.—has now been running for two months, and will hold good for some time yet, bar accidents. The Gas Market, which so frequently chalks out a line for itself, has been much more active, especially when compared with the general run of the markets. But while dealings have been more frequent, changes in value have been extremely restricted and slight. There has been more doing in Gaslight "A" than has been the case in recent weeks, with the result that the stock closed firm on Saturday at the opening price of the week—say 210. The secured issues (debenture, preference, and limited) have not been so much dealt in as of late; but they show no sign of falling off in favour. South Metropolitan issues were left alone, except the "B," which made a slight further fall of $1\frac{1}{2}$. Commercial were quite neglected, and remained unchanged. The Suburban and Provincial undertakings are only noticeable as furnishing the sole other change in quotation—a fall of 1 in British. The Foreign Companies were entirely without any feature; and not a single variation in value is apparent in the entire array. The Water Companies show much more animation; and a firm disposition towards higher prices is apparent. Lambeth leads the way with an advance in all its issues; and Grand Junction has made a 4 per cent. improvement.

With alterations in value so few and far between, it is superfluous to recount daily operations at the same dead level. Be it, therefore, noted that the changes were as follows: On Monday, Lambeth rose $1\frac{1}{2}$; and Grand Junction, 1. On Tuesday, South Metropolitan "B" fell $1\frac{1}{2}$; while Lambeth Water rose $1\frac{1}{2}$. On Friday, British Gas fell 1; and Lambeth 10 per cents rose 2; and ditto, $7\frac{1}{2}$ per cents, $1\frac{1}{2}$. On Saturday, Lambeth $7\frac{1}{2}$ per cents; and ditto, debenture, rose 1 each.

ELECTRIC LIGHTING MEMORANDA.

The Electric Lighting of the Thames Embankment—The Utilization of the Power of the Niagara Falls—The Electric Lighting of the City of Sophia—Parliament and the Electrical Tramways.

If the recommendation to that effect, of the Highways Committee of the London County Council, is acted upon, as will in all probability be the case, the electric light will blink once more on the line of the Victoria Embankment, which has been (nominally) lit by gas ever since the final collapse of the Jablochhoff Company. In accordance with the ordinary policy of the principal street lighting authorities of London, no attempt has been made during all these years to show what gas could do for this fine line of river frontage. We know not if The Gaslight and Coke Company have tried to do anything to retain this conspicuous piece of lighting—almost the only one, by the way, at the disposal of the County Council—but, at any rate, nothing has been done; and accordingly, in a few months, the electricians will have this capital advertisement of their progress to show. The Council propose to spend £10,000 upon the installation, which is very liberal on their part. It is hardly necessary to remark that not one-half, nor one-quarter, of this sum would have been voted for gas lighting. Well, it is to be hoped the Council will be happy after the money has been spent. A cynic might say the Council are bent upon damaging the most conspicuous relic of their much-abused predecessors, the Metropolitan Board of Works; and so, having been defeated in the attempt to spoil the western end of the Embankment by running an utterly superfluous tramway across Westminster Bridge and along the thoroughfare as far as Charing Cross, they now contemplate the suppression of the picturesque, if insufficient, gas-lamps by flickering arc lamps spaced too far apart to produce anything but a "spotty" effect. We only say it is a pity that the lighting of such a conspicuous part of London—one of the show places, indeed, of the Metropolis—should be lost to gas, which is able to do the work much better and at less cost than the electric arc.

An interesting experiment, the result of which will be watched with the greatest curiosity from all parts of the world, is in preparation at the Niagara Falls. At last a serious attempt is being made to utilize for the service of man a portion of the enormous energy liberated at this spot by the falling water, which has been estimated as equivalent to 4,500,000-horse power. Professor George Forbes is the moving spirit of an

enterprise intended to take, by means of turbines, 100,000-horse power of the energy now wasted, from the engineering point of view, at Niagara, and to transmit most of this power to a new manufacturing city in the neighbourhood, where it is to be used in the production of alarm clocks, sewing-machines, and other American contributions to the general stock of accessories of civilization. A few protected factory-owners will make money; a number of factory hands will earn a living suitable to their station in life; and thus the power of Niagara will be utilized. A sublime prospect! Meanwhile, however, the mechanical arrangements for tapping the strength of Niagara are cleverly conceived. They comprise a canal 1500 feet long above the Falls; a vertical shaft in the rock 140 feet deep; and a discharge tunnel 6700 feet long at the lower level. In the electrical section of the work, which remains to be carried out, Professor Forbes's ideas are to prevail. These comprise the employment of the alternating current; and, as motors, either the alternating dynamo or the multiphase machine which attracted so much attention at Frankfort last year. This is an innovation on previous practice; and it is a striking illustration of the mutability of opinion, and the fallibility of "authority" in matters electrical, that only in 1890 an international committee of experts, appointed to advise as to the best way of electrically transmitting to a distance the power derived from the turbines, were unanimous (with one exception) in desiring to pass a resolution condemning as impracticable the alternating system which is now to be relied on exclusively.

The negotiations for the provision of a complete electrical supply plant for the city of Sophia, as reported in the *Electrical Review*, are very interesting, and in no small degree instructive. Here was an example such as the writer of technical manuals loves, of a virgin district, to be occupied in any manner and at any cost deemed suitable and necessary by the contracting parties. After two years of preliminary "studies," which do not seem to have amounted to much in the practical way, the Municipality of Sophia opened negotiations with a selected number of electrical firms of European reputation, and gave to them a free hand for the preparation of a complete scheme for which a concession could be granted. The result was a crop of some half-dozen tenders, so divergent and irreconcilable, that the Commission charged with the duty of examining and comparing them could not educe from the available data any trustworthy comparative statement of their merits. Consequently, a fresh start was decided upon; and this time a prospectus of what the city desired was prepared by the Commission for the guidance of the contractors. The result was more satisfactory, inasmuch as the same firms tendered once more; and it was possible to compare the various specifications upon a uniform basis. The competition for the concession was a truly international one; and, in the event, the tender of Messrs. Ganz and Co., of Buda-Pesth, was accepted. The successful firm were, however, run very closely by Messrs. Crompton and Co. It seems only fair and natural that the Hungarian competitors, being nearest the spot, should send in the lowest tender. The driving power is to be water; the generating station being at a distance of 7 kilometres from the city.

Parliament has been very busy lately with various electric tramway schemes for London—all subterranean, of course, and more or less closely following the example of the City and South London Company's lines. There seems to be a tenderness for this class of schemes on the part of Parliamentary Committees which we venture to think is misplaced. The typical example is as yet far from successful in the commercial sense; and when any undertaking is financially weak, it is impossible to regard it as technically strong. In the circumstances, it would be preferable to keep all fresh electrical subterranean tramway schemes, whether for London or the provinces, in abeyance for a year or two; and this would doubtless be done in any country where statutory facilities for such ventures happened to be dealt with logically, and with reference to the subject as a whole. In England, where everything of the kind is done piecemeal, it is quite possible for electric tramways to be sanctioned for different places, without reference to one another or to the fact that the only example of the kind has its £10 shares quoted at something less than one-third of their nominal value.

Petroleum in Peru.—Attention is being drawn to the petroleum districts of Peru. The deposits are said to extend over wide areas. The geographical position of the petroleum fields of Peru is latitude $3^{\circ} 25'$ to $6^{\circ} 5'$ south, and longitude $81^{\circ} 8' 4''$ to $3^{\circ} 40'$ west, which is almost on the same parallel with Australia, China, and other countries on the western border of the sea between them and Peru.

A New Standing Order Relating to Water Reservoirs.—Among some amendments to the Standing Orders of Parliament which came before the Houses for confirmation last week was one relating to the construction of reservoirs. It specified that, in cases where it is proposed to make, vary, extend, or enlarge any reservoir, the plan shall describe the embankment or retaining wall; and where it is the intention of the promoters of a Bill to apply for powers to make any lateral deviation from the line of such embankment or retaining wall, the limits of deviation are to be defined on the plan, and all lands included within these limits must be marked thereon.

THE IMPROVEMENT OF GAS-BURNERS.

THE "Murdoch Lecture" of Professor Vivian B. Lewes, which constituted such a striking feature of The Gas Institute meeting, has been heard of outside the hall of the Institution of Civil Engineers, and has formed the text of several more or less apposite moralizings and reflections in town and country newspapers. It has been a surprise to some of the writers upon this subject to learn that the application of coal gas to illuminating purposes is only a hundred years old, while others wonder at its having being known so long; for, judged by its record in discoveries and inventions, the last century has been longer than any thousand years that preceded it. For instance, there has appeared in the *Daily Telegraph*, a cloudy, pretentious article on the Murdoch Centenary which tells the reader that "wood and coal, when distilled in retorts, give off combustible exhalations;" but after retailing more information of the same vague character, the writer is good enough to express the opinion that, having regard to "the value of artificial gas, and its application to the thousand uses and necessities of daily life into which it now enters," the name of William Murdoch deserves to take place side by side with those of the greatest discoverers and inventors of the century. Of course, this writer finds it necessary to say that "it would be a bold prophet who asserted that, upon the second centenary of Murdoch's invention, gas would retain the commanding position it now occupies as an illuminant and motor." It may be observed upon this that not gas, but another means of lighting, is usually the subject of prophecy. Nobody can profess to know anything reliable of what the next hundred years may be expected to bring forth; and, therefore, the less said about matters at such a long range, the better. Those practical workers and philosophical theorists who are interested in gas, at any rate, prefer to take shorter views, and to attend to problems nearer at hand than that of artificial lighting a century hence.

This consideration brings us to a thought which, arising out of Professor Lewes's recent remarks, and also out of experimental work now in progress in other hands, reinforces the impression that many observers must have already received, that, instead of lighting by combustion methods being a thing of the past, the world is only beginning to learn how the light of this order of sources is really produced. Professor Lewes had much to say about the cause, or causes, of the luminosity of flames, especially flames of coal gas; and just before these statements were made public, Mr. Ludwig Mond had shown, by some striking experiments with nickelized carbonic oxide, how the Davy hypothesis respecting the cause of the luminosity of flames is borne out by the behaviour of ignited nickel carbonyl. These things are suggestive; and the lessons to be drawn from them bear directly upon the most immediate solicitude of the worker in gas lighting, which is, to obtain the highest possible illuminating effect from ordinary coal gas by simple means. As Professor Lewes has stated the problem, it is merely that of the improvement of the popular flat-flame burner—the burner of the people—which, whether in church, market-place, or home, is responsible for by far the greatest bulk of the gas burnt for lighting purposes in the world. We, however, do not confine the question to this. It is possible that the flat-flame burner may be improved by more intelligent treatment in the light of the principles enunciated by Professor Lewes in his Murdoch Lecture. It is nevertheless not to be taken for granted that this burner is the only thing of the kind that can ever become popular. If a short tulip-shaped or globular flame could be obtained by simple means, without the troublesome addition of a chimney, it might become even a greater favourite than the union-jet. Only it is essential that the new-fashioned appliance should give a briskly-burning, steady flame. There is much to be said for the kind of flame of which the "Lucigen" type of high-power lamps supplies the example—a flame of equal radiation in all directions, and not liable to be blown out. A gas-burner of moderate intensity which should give a flame of this character, and silent withal, would be a great acquisition.

It was good of Professor Lewes to mention the once well-known platinum "perfecter" burners, for these deceiving little arrangements, with their promise of economical lighting which was never long maintained, embodied a principle which has hitherto rested in obscurity. If the lecturer had desired to enlarge upon the history of mechanical or physical attempts to improve the luminosity of burning coal gas, he might have mentioned other devices besides that of Scholl. A very instructive example of such appliances was a burner which had below the point of ignition a chamber intended to contain a store of lampblack; the idea being that if it is carbon in a fine state of subdivision which constitutes the illuminating quality of coal-gas flames, an extra supply of carbon dust carried into the flame by the current of gas must improve the luminosity. As a matter of fact, the result was not according to the expectation of the inventor of the device. The current of gas betrayed a disappointing reluctance to take up any discoverable proportion of carbon particles from the store of lampblack through which it rose to the burner; and when impatiently tapped, in the same spirit that instigates to the tapping of a barometer which fails to move in accordance with the observer's wishes, the effect was merely to fill the flame with red specks, as of burning dust.

This example, like that of the failure of added acetylene to improve the luminosity of a flame of which it is (when naturally produced in it) the prime cause of the resulting light, shows how Nature resents the action of those who, inspired with a little knowledge, would make short cuts through her domain, and take her hidden benefits by storm. We may satisfy ourselves, by chilling a luminous gas-flame, and so getting solid carbon out of it, that it is solid carbon which imparts to the flame the luminosity of which we stand in need; but we cannot reverse the operation. The illuminating power of a coal-gas flame may be due to the presence, in a nascent stage, of acetylene; but with a separate store of acetylene and a non-luminous gas, we can do nothing. Not in our way, but in Nature's, must we work, if we would solve these riddles. However roundabout the course may appear to our narrow perception and impatient desire, the way of Nature is the only path that leads anywhere in these investigations; and the remarkable character of this route is that on either hand lie all manner of incidental surprises, so that, even if the persevering and observant traveller never reaches his journey's end, he may pick up something on the road more valuable perhaps than the reward he originally sought.

Granting we certainly know that carbon particles are the source of luminosity of flames, it is a crude suggestion that the simplest form of carbon in powder that we have at our disposal should serve to enhance this luminosity when injected mechanically into a flame. The suggestion supposes, in the first place, that the carbon particles formed and consumed in a flame are of the same dimensions and character as the lampblack which we can get from the flame by interfering with its processes. There is, however, no good justification for this assumption, which is, moreover, disproved by the result of acting upon it. If the nascent carbon of luminous flames was in particles like those of lampblack, then the two might be interchangeable; but the fact that the particles of the latter, minute as they are, burn in flames like red specks of any other heavy kind of dust, whereas the former in the same place attain a high degree of incandescence, shows that these must be transcendantly small. In order to dimly understand the office fulfilled by nascent solid particles of carbon in a luminous flame, it is therefore necessary to realize the fact that these must be extremely minute—perhaps the very smallest things in the way of solids of which we can have any knowledge. The particles of lampblack are very minute, as has been found by observing their great effect in tinting solutions; but we cannot get them separated sufficiently to burn completely, as the nascent carbon particles do, in the course of their transit through the luminous part of a flame.

The problem of the improvement of gas-flames is the problem of burning the nascent carbon particles to better advantage, or supplying their place with something even more radiant at the temperature afforded by the flame. The regenerative burner does the former to the extent of about 25 per cent., measured upon the spherical distribution of the light. The limit of the capability of the heat-recuperation of gas-flames in this regard has been reached, having respect to the practical limitations of apparatus. To the question whether anything can replace or supplement the luminous carbon of free-burning flames, no conclusive answer can be given. The experimental success of the Clamond and Welsbach burners indicates the existence of unexplored possibilities in this direction, taking the carbon substitute in the solid form of an incandescent cap or mantle. Mr. Ludwig Mond's experiment with nickel carbonyl goes to show that means may be found for charging a gas with a metallic compound which shall resume the solid form in the process of combustion and so radiate light, which may be more or less brilliant than that radiated in similar circumstances from nascent carbon. In the latter line of research, it is important to take account of the products of combustion; for a bright light might be dearly purchased at the cost of polluting the atmosphere with something worse than carbonic acid. Are there any earths, unalterable by exposure to the heat of an atmospheric gas-flame, which become, under such conditions, more brightly incandescent than carbon, and are not so fragile when mounted for use as the Welsbach preparations; or is there anything of the sort which can be introduced into a current of coal gas, and be perfectly and innocuously consumed in the open air? This, as it seems to an observer, is the line which research into the development of light from coal gas must take in the immediate future. The prospects of gas as an economical illuminant do not altogether depend upon the successful solution of the problem herein discussed; but they would be immensely enhanced by a triumph in this new and most attractive region for experiment.

It is a peculiar characteristic of researches into the principles and methods of burning gas for illuminating purposes, that anyone possessed of a supply of gas and a photometer can engage in them. Very little apparatus of an expensive nature is required; and the labour incidental to the pursuit is no more than can be given by a gas engineering student in his spare time.

Professor Emil Fischer, of Würzburg, has been appointed to the Chair of Chemistry in the University of Berlin, in succession to the late Professor Hofmann, whose death was announced in the JOURNAL a few weeks ago.

NOTES.

A New Decorative Building Material.

A good deal of attention is being paid to a peculiar kind of building material termed "staff," which is largely employed for the external and internal finishing off of the principal structures intended for the Chicago Exhibition. It is not an American invention—having been brought into notice in connection with the Paris Exhibition buildings of 1889; but it has been largely employed in the provinces of Germany for the last fifty years. Its chief recommendation to engineers consists in the fact that it adapts itself very readily to combination with iron framework, and is possessed of respectable lasting qualities. The ingredients required for the fabrication of "staff" are simply plaster of Paris, hemp fibre, and water. Hemp is used to bind together and so strengthen the cast—the New Zealand fibre being preferred. The plaster for the "staff" is thoroughly stirred in water, and the hemp, cut into lengths of 6 or 8 inches, is bunched loosely, saturated with the plaster, and put into the moulds in a layer about 1 inch thick. More hemp is added until the mould is full, when the mixture is allowed to set, and is then withdrawn. The advantage of the "staff" is that, as moulded, it can be nailed to wood or screwed to iron; thereby imparting an appearance of solidity to, as well as protecting from the weather, light structures that would otherwise look naked and bare. It also furnishes a cheap and easy way of applying decoration to coke-breeze houses, &c., which, in the absence of some such material, appear very flat and crude.

The Metallic Carbonyls.

Mr. Ludwig Mond recently brought the subject of metallic carbonyls before the Royal Institution. In the course of his lecture, Mr. Mond pointed out that the nature of carbonic oxide, as a chemical radical, was made known by Justus Liebig so long ago as 1834; but it was only two years ago that the lecturer, in conjunction with Drs. Langan and Quincke, was able to announce the successful preparation of a compound of carbonic oxide with nickel, which is not only a well-defined compound, but possesses remarkable properties. Mr. Mond showed his audience how a highly luminous flame may be obtained by passing a slow current of carbonic oxide through a gently-heated tube containing metallic nickel in a state of fine division. The luminous effect was due to incandescent particles of metallic nickel separated in the body of the flame from nickel carbonyl. When the nickel carbonyl is caused to impinge upon any solid heated to only 200° C., the result is a deposition of bright metallic nickel; and carbonic oxide is liberated. The analogy with the deposition of soot from a flame of hydrocarbon gas is obvious. Again, Mr. Mond passed the nickel carbonyl through a tube surrounded by a freezing mixture, and condensed the compound into the visible form of a clear colourless fluid. A mixture of the vapour with air explodes readily, but not with violence. The vapour of nickel carbonyl possesses a characteristic odour, and is poisonous; but not more so than carbonic oxide gas—which, indeed, it could hardly be. Professors Dewar and Liveing are investigating its absorption and flame spectra. They have found that it is opaque for all the rays beyond the wave-length 3820. Its flame gives a quite continuous spectrum. Within a short time after the existence of iron carbonyl had been made known, Sir H. Roscoe found it in carbonic oxide which had been stored in an iron cylinder; and he expressed the opinion that it is the cause of the red deposit sometimes found upon steatite gas-burners. The industrial future of the carbonyls, particularly nickel carbonyl, is expected to be very wide, and advantageous in many ways.

German Coke-Oven Residuals.

Herr Fritz W. Lürmann, of Osnabruck, has reported to the Society of German Ironmasters on the position and prospects of residual-recovering coke-ovens in Germany. He stated that this new branch of industry has developed notably during the last ten years, especially on the Continent. Efforts to recover the bye-products of coke manufacture have been viewed with considerable suspicion, which even to-day has not been wholly dissipated. Doctor Otto and Herr Hüssener were the pioneers of this industry in Germany; building a number of Hoffman-Otto ovens on their own account as well as for different mines and factories. At present the firm of Dr. C. Otto and Co., of Dahlhausen, contract to erect a set of 60 ovens, with all appliances for the recovery of bye-products, for 720,000 marks, of which the ovens stand for 300,000 marks. Such a set produces annually about 50,000 tons of coke, from 2000 to 3000 tons of tar, and from 500 to 800 tons of sulphate of ammonia, according to the coal used. The Semet-Solvay is another popular description of the same class of coke-oven; and the Coppée plant for the same purpose is also being introduced into Germany. Three years ago the first steps were taken for the recovery of benzol from coke-oven gases. Herr Franz Brunck, of Dortmund, is the inventor of the process used for this purpose, which is kept as a trade secret. It is claimed that from 3 to 7 kilogrammes of benzol are obtained per ton of coal coked. Notwithstanding the low values ruling for tar and sulphate, the coke makers manage to do well with their residuals-recovery processes, and hope for better times as the demand for tar by the briquette-fuel manufacturers

increases. The field for sulphate is practically limitless; for of the total nitrogen contents of the fertilizers sold last year, which amounted to nearly 57,000 tons, only the equivalent of 6800 tons was in the form of sulphate. It cannot be fairly assumed that all this class of fertilizers—the nitrogenous—can be supplanted by sulphate of ammonia, because the latter does not, under all circumstances, serve the purpose as well as nitrate or guano. If this were the case, however, 285,000 tons of sulphate per annum would be required in Germany; whereas at present only 17,500 tons are recovered from coke-ovens, and all the coal coked in Germany would not yield more than 120,000 tons.

COMMUNICATED ARTICLE.

GAS WASTED AT GAS-WORKS.

By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S.

I have been interested in reading the article, on "Gas Consumed in Works and Offices," appearing in the JOURNAL for the 10th ult., in which the writer directs attention to the large quantity of gas consumed, or estimated to have been consumed, on the ordinary gas-works. Some years ago, I was struck with the magnitude of this item, and gave some attention to the quantity of gas actually necessary for the operations of gas manufacture. But before making any deductions from the published reports, it is necessary to inquire in how many works the quantity said to be consumed is actually ascertained by meter. Is it not the common practice to estimate this quantity by simple guesswork? And further, is it very unusual to take care that the estimate is a liberal one, in order that the unaccounted-for gas may appear as low as possible? There is a story told of a manager of a business (not a gas-works) who produced his books to the accountant in order that the latter might prepare the official balance-sheet for the year. "I see," said the man of figures, "that you have not put down your stocks on hand at the end of the year. I must have them before I can prepare the accounts." But the manager replied: "You tell me the balance available for profit, and then I will tell you the value of the stocks." Is it not the case that the gas-works manager sometimes says, "You tell me the total difference between the quantity of gas sent out and that actually paid for, and then I will tell you the quantity of gas used in the works?"

So, before proceeding to make a few suggestions on this subject, I wish to insist strongly on the importance of passing all the gas used on the gas-works through a meter or meters, so that if any waste is going on, it may actually be proved from fact. The cost of maintaining a meter (or three or four, if necessary) will be well repaid by the gas saved, when it is known that attention is being directed to the quantity actually used. For it must be remembered that, after every possible care has been taken, the gas-works will remain a large consumer. The retort-house and other parts of the works must be lit up throughout all the hours of darkness—some 4300 hours per annum. Any waste due to defective or extravagant burners is, therefore, greatly accentuated, as compared with gas used on the premises of an ordinary consumer, between the hours of dusk and 9 or 10 o'clock at night. If it is important for a gas consumer to have thoroughly good burners, to be used for perhaps an average of four hours a day, how much more is it so when the burner is to be used for ten or twelve hours?

Of course, this will be met by the argument that a gas company does not pay for its own gas at retail price; and that there is no cost for distribution or office expenses as regards the gas used on the works. But it must be remembered that the gas so consumed costs just as much to put into the holder as that actually sent out; and, therefore, its cost to the company may be taken as the same as the cost delivered into the holder. This is easily (or should be easily) ascertainable from the accounts; and it may be taken at about 2s. per 1000 cubic feet under ordinary circumstances. Even putting it as low as 1s. 6d., there is room for using it in the most economical manner. At present prices of coal and labour, no gas engineer can allow even a pound's worth of coal, lime, or sundries out of the stores to be wasted; and a pound saved in the consumption of gas is a pound added to the balance available for profit, quite as surely as if it had been earned in any other way.

It is no common thing, in a small country gas-works making (say) two millions per annum, to leave a large batwing burner full on in the retort-house throughout all the hours of darkness, and occasionally in the daylight, or possibly never put out at all, but only turned down in the daytime. Such a burner, consuming 10 cubic feet per hour, would get rid of 40,000 to 50,000 cubic feet of gas per annum—2 to 2½ per cent. of the total make—or an actual money cost to the company of £6 or £7. Here, then, is room for an economy equal to a reduction of 1s. or 1s. 6d. per week in the wages of the stoker, which would probably be considered a matter of some importance by the directors, if put in the light. During a considerable part of the year the burner need not be lit at all, and might be used in connection with a pilot jet for the remainder; being only turned up during the time that it is actually required. Go to a larger works, and frequently the same thing is repeated on a corresponding scale. The whole of the retort-house is brilliantly lit up by means of large batwing burners during

the whole term of darkness, although the time during which it is tenanted by workmen is only one-half.

Some years ago I had to do with a small gas-works making about 6 millions per annum. It was usual to put down the gas used on the works as a quarter of a million feet in each year; the gas being burned away direct from a service off the outlet main in the usual manner. By way of an experiment, the works' supply was completely metered—a 10-light meter being fixed for the retort-house, coal-shed, and lamp outside, with a 3-light meter for the meter-house, and a 5-light one for the offices. The latter two included gas-heating stoves. The total consumption indicated by the three meters for the first year was about 280,000 cubic feet, of which more than 200,000 cubic feet went through the 10-light meter, which supplied four batwing burners. This illustrated first the importance of checking the pressure, and secondly of periodical attention to the burners; and I think these two matters indicate a remedy for a large proportion of the gas wasted on gas-works. By attending to them in this case, the total consumption was reduced to less than 200,000 cubic feet; and it has since averaged about 180,000 cubic feet per annum. Here there is a clear saving of 100,000 cubic feet of gas, representing at least £12 in money, secured by the use of three gas-meters and a little occasional attention. The cost of the meters was saved in the second year of use alone. The manager of that gas-works would think that he did well if a saving of £10 on the cost of the lime used was secured.

For naked burners fitted in the retort-house itself, nothing better than ordinary iron batswings can be used, on account of the dust, smoke, and draught; and they must be burned at a good pressure, to keep the flame steady. But the pressure need not be excessive; and the burners may be frequently cleaned or renewed. This, however, only applies to the retort-house. There is no reason why the most modern improvements in the way of gas-lighting should not be introduced in the exhauster house, the meter and governor houses, and the lamps in the yard. Yet somehow, the iron batwing seems to reign supreme in these places, and even in the offices also. And this notwithstanding the fact that, in addition to the advantages already pointed out, it would pay to use the best burners. In one instance, three regenerative burners, consuming 11 cubic feet per hour each, replaced ten batwing and union-jet burners, which flared away more than twice as much gas. Not only was there a substantial saving of gas, but a much better lighting effect; and the lights were available for use as an advertisement. At the same time, the company's gasfitter was able to acquire practical experience in the working of the new burners, which has since proved of immense value in the district.

At many of our railway stations, a bye-pass tap is used on the main supply from the platform; and it is so placed that the platform inspector can conveniently turn the lights down to a glimmer between the trains. As soon as a train is signalled, he turns up the lights; and as soon as the platform is again clear he turns them down again. Something of this kind might be adopted in the retort-house, the exhauster-house, and indeed every other room in which gas is used. The tap could be arranged in a convenient position, close to the entrance door, and turned up when the man enters, and reduced again when he leaves. In small works, the foreman stoker visits the exhauster room for a few minutes, perhaps once in an hour, and the meter house for a similar short period, throughout the night. The aggregate time he spends in these places would not be an hour throughout the shift. Why should one or two large burners be continually flaring away in each room? So with the men's mess rooms and offices. Nobody thinks of turning the lights down when the rooms are left.

To every gas manager who is looking round for ways and means of economy in regard to working expenses, I suggest that the means above noted, if nothing has already been done, afford fair ground for working that is not to be despised. First find out how much gas is really being used; then see that none is burnt at excessive pressure, or through unsuitable burners; and lastly, see that the gas is not burning at times when it is not required.

Mr. D. Ford Goddard.—In our editorial columns to-day, reference is made to the candidature of Mr. D. Ford Goddard for a seat in the new Parliament, to represent Ipswich, the town with which he and his family have been so long associated, from their connection with the gas undertaking. Before going to the electors, however, he resigned his office of Mayor, in accordance with the understanding come to when he took it last November, that he would have to relinquish it in the event of a General Election. This he formally did at the meeting of the Town Council on the 17th inst.; at the same time paying the fine of £50 imposed by law. The new Mayor (Alderman Cowell) proposed a vote of thanks to Mr. Goddard for the able manner in which he had discharged the duties of the office, and for the generous hospitality he had displayed during his tenure of it. In acknowledging the compliment, Mr. Goddard said the enjoyment he had experienced in the seven months of his mayoralty had been largely heightened by the uniform kindness and courtesy shown to him by all the members of the Council, and indeed by everyone in the town. In conclusion, he asked to be permitted to add his portrait to the gallery of Mayors in the library of the Town Hall.

TECHNICAL RECORD.

TESTING THE ILLUMINATING POWER OF COAL GAS.

At a Recent Meeting of the Manchester Section of the Society of Chemical Industry, Mr. GEORGE E. DAVIS, F.I.C., read a paper on the above subject.

The author began by remarking that as a Committee was now sitting, having for its object an inquiry into the subject of a standard for photometric purposes—the sperm candle not having for a long period been considered satisfactory—he could not enter into a discussion upon the matter of a standard light; but there were many other points open to consideration, such as contrasting the basis upon which physical tests were made with that upon which chemical examinations were founded. He went on to say it might be taken for granted that, if coal gas was always of the same quality, there would be no need for a trial to be made of its illuminating power. But it was not a simple gas, as it consisted in a great measure of non-illuminating hydrogen and feebly illuminating marsh gas made luminous by partial saturation with the vapours of benzol, toluol, crotonylene, and other hydrocarbons, the excess of which were found in the tar which was condensed from the crude gas. The gases further did not come off from the coal in regular and even proportions; the composition of the gases given off during the first half of the period of carbonization yielding greater luminosity than those given off during the latter half—in fact, towards the end of the charge, little else than pure hydrogen was given off, having very small, if any, luminosity when burned. He was fully aware that the gas leaving the hydraulic main in a well-regulated gas-works was of fairly constant composition—its illuminating power would vary in different works, according to the length of time (and the temperature) the gas was allowed to remain in contact with the tar; and this was brought about by the regular and alternate system of charging the retorts. But it was possible that a variation of quality from this source might have to be considered in the future, as it would be quite easy to arrange the charging so that gas of 20-candle power could be collected from the anterior portion of the charge, and gas of 10-candle power from the posterior.

It was next pointed out by Mr. Davis that the quantity of gas yielded per ton of coal affected the illuminating power (as might be learnt by studying the paper read before the London Section of the Society, in 1884, by Mr. Lewis T. Wright).^{*} In the gas-works he was instrumental in establishing near Sheffield, it was his aim to secure a large quantity of illuminants; and as the result of many experiments, working the same quality of best fresh-wrought gas coal, he obtained 9060 cubic feet of 18-candle gas per ton, 10,100 feet of 16-candle gas, or 11,400 feet of 14-candle gas. In the first case the coke was too soft for sale; and in the last case it was hard and saleable. The tendency was nowadays to run the production up to the highest possible limit; and without more benzol was volatilized from the tar than formerly, the result would be a debased gas. There was also another reason why coal gas should have trial made of its illuminating properties. A process was introduced some years ago, better known perhaps as the Hawkins process, for introducing carburetted air into the gas before the oxide purifiers, in order to prevent the necessity of so frequently changing the contents. The oxygen of the air introduced acted upon the sulphuretted hydrogen in the presence of oxide of iron, forming water and free sulphur, while the nitrogen remained in the gas, diluting its illuminating power.

Directing attention to the apparatus used for testing gas and the regulators governing its use, the author remarked that, though the Gas Acts were so stringent with respect to the testing of meters, there were at present no compulsory powers for the public testing of photometers. A photometer might be perfectly accurate when first purchased, but a disarrangement or displacement of the scale, the candle-balance, or the standard burner, was quite enough to give the most fallacious results; and there was no compulsory provision for verifying these instruments. The suppliers of coal gas could legally object to the use of any other apparatus than that specified; but this, of course, made no difference whatever in the accuracy of the results. In fact, various details of photometry had been greatly perfected since 1871; and he doubted, if a Gas-Works Clauses Amendment Act were passed to-morrow, whether the apparatus and methods would be the same as specified in the Act of 1871.

The photometer used by the author was designed not only for examining ordinary coal gas, but for all-round uses, one of which was a thorough examination of the illuminating power yielded by the vapours of different hydrocarbons. This instrument might be called a 60-inch enclosed "Evans;" but it differed from the "Evans" in that the scale was divided into inches and tenths, instead of being graduated for "candles." This made a calculation necessary for each experiment; but as a table had been calculated for each possible position of the screen index, a simple inspection of it gave the candle power direct. The apparatus was fitted with an experimental meter, reading to the one-hundredth of a cubic foot; it was also fitted to burn either the prescribed pair of sperm candles, or a 10-candle Methven light prepared with great care for him by Messrs. Sugg

^{*} See JOURNAL, Vol. XLIII., p. 535.

and Co. The gas to be tested was burned in one of Sugg's "London" Argands as prescribed. Nearly 1000 tests of Salford gas had been made with the apparatus. The reason a 10-candle standard was adopted was, first, because it was a very convenient standard having regard to the experiments in which he was engaged; secondly, because the screen was thus brought nearer the centre of the graduated bar, thus ensuring greater accuracy than when a 2-candle standard was employed; and, thirdly, there would only be the same absolute error in adjusting a 10-candle standard as in making a 2-candle standard, in which latter case the error (if any) was five times greater than with the 10-candle standard. This 10-candle standard was presumably made and standardized with London gas. When tested with Salford gas against sperm candles burning 120 grains of sperm per hour, it yielded a light of 9.94 candles. Thirty separate tests were made to establish this, according to the directions given for testing gas by the Gas Referees. Of these tests, five were rejected owing to the abnormal rate of consumption (being below 144 or over 126 grains); while if the ten nearest tests to 120 grains were taken, the illuminating power came out exactly 10 candles.

When the testing was first established, Mr. Davis was surprised at the low results; and having satisfied himself that the 10-candle standard was absolutely correct, he carefully examined every point in detail, without finding any error. The testing was continued in this manner for something like three months; the average value coming out at about 15.7 candles. The apparatus was then altered by the substitution of a pair of sperm candles for the 10-candle Methven standard, and tests were made twice a day for upwards of three months. The average in this case worked out at 15.4 candles. The nuisance of using candles in place of the Methven standard was so obvious in these experiments, that they were abandoned; and, in continuing the experiments, the Methven standard was alone employed, and further experience had shown it was far more reliable than the candle, and much more convenient to use.

A few words as to the consumption of sperm in nearly 1000 tests the author thought would not be out of place. The consumption was most irregular, varying from 108 grains on the one hand to 137 grains on the other. The Gas Referees having prescribed that all tests in which less than 114 grains, or more than 126 grains were consumed should be discarded, this was done in all these tests; the proportion being 15 per cent. The tests retained, in which less than 118, or more than 122 grains were burnt, amounted to 55 per cent.; while the tests burning from 118 to 122 grains amounted to the remainder of 30 per cent. This was the boasted parliamentary standard; and, to do it as much justice as possible, the author stated that the candles were from a recognized leading maker. His experience in photometry led him to say most emphatically that the parliamentary "candle" was by no means a *standard* that analytical chemists would be satisfied with—it might suit gas engineers, but not a chemist with any idea of accuracy.

This led him to another point. Coal gas was usually tested at the gas-works, which, in his opinion, was a most unjust provision of the law. Consumers did not burn the gas at the gas-works, and sometimes there was a great difference between tests made in the works and those made half a mile away. His own tests were cases in point. Taking the Salford supply to his laboratory, on July 2 last year, the gas tested by his photometer (day supply) was 13.4 candles; on Nov. 16, 13.2 candles; Dec. 5, 13.6 candles; Dec. 22, 13.1 candles; Dec. 23, 12.3 candles; and Dec. 24, 12.5 candles. The two last tests were made during the very foggy Christmas week, when gas was being burned all day long, and when the consumers were complaining to each other very generally that "the gas was very bad."

The following is a summary of the whole of Mr. Davis's tests from July 1, 1891, to Feb. 27, 1892:—

Month.	Illuminating Power. Candles.	Grains of Sulphur per 100 Cub. Ft.	Carbonic Acid. Vols. per Cent.
July, 1891 . . .	14.70	16.81	0.56
August, 1891 . .	14.34	14.60	1.22
September, 1891 .	14.40	17.12	1.14
October, 1891 . .	15.20	20.01	1.13
November, 1891 .	15.16	21.92	1.05
December, 1891 .	14.72	24.88	0.98
January, 1892 . .	15.09	19.07	1.12
February, 1892 . .	14.75	19.86	1.07

The results of these examinations did not agree with the tests made at the gas-works; but why, the author did not pretend to explain. He convinced himself, however, that the readings of his photometer were accurate. The Salford Gas Committee said that the tests made by them (in the works) averaged, for 1891, 18.86 candles at one works, and 18.71 candles at another station. This was very poor consolation for those who had to burn the gas a mile away from the works; and he was of opinion that the subject was important enough for the Council to investigate over the heads of the Gas Committee. He also hoped that our legislators would consider whether the time had not arrived when testing-stations should be removed from the precincts of the producing works to some public office at a distance. Such a process would undoubtedly be more assuring to the consumer than the present system; and if the results should turn out identical with those obtained at the works, those in charge would not complain, while, if the results differed, the sooner the cause of it was discovered and remedied, the better for all concerned.

One thing struck Mr. Davis during these experiments; and that was the ease with which a special standard for each gas supply might be made and verified. It was simple, though somewhat tedious, to make a large number of tests with sperm candles, rejecting (say) all under 118 grains and all over 122 grains consumption. A Methven screen could thus be cut with very great accuracy; and this could be made of the minimum power the works were allowed to supply. Such a standard should not be put into use before verification by the Standards Department of the Board of Trade; and reverification should be made compulsory every six or twelve months, under heavy penalties for disobedience. At present he was not aware that the verification of photometers was compulsory; and referring to the serious differences between the results obtained with his photometer and that of the Salford Gas Committee, he asked whether they might not be due to the employment of an unverified photometer at the works. The Gas Act was faulty in many respects; and now that he had given the results of his experience, the author hoped the matter would be taken up, and the testing of coal gas for its illuminating power be put on a proper basis.

In the course of the discussion which ensued, Mr. Carter Bell said he had made some experiments with Mr. Davis's photometer, and he was bound to admit that the 10-candle standard as used by him and his method of graduation of the beam was an immense improvement on the ordinary method of testing coal gas; and he believed far more accurate than the photometer mentioned in the Act of Parliament. Dr. Grossman remarked that the difference in the illuminating power of gas, as shown by the photometer at the gas-works and by the time it reached the consumers, might be accounted for by the hydrocarbons deposited in the mains; but, in his opinion, the consumers had nothing to do with this, as gas companies and corporations should be compelled by their Act of Parliament to supply gas of a certain standard to all their consumers, however far they might be situated from the works. Dr. Dreyfus thought that, as gas contained certain hydrocarbons which produced the illuminating power, it was a question whether it could not be more accurately tested by chemical analysis than by the ordinary means of photometry. Dr. Carl Weber was afraid that the relation existing between the hydrocarbons and their illuminating powers was so complicated and exceedingly difficult of interpretation, that the photometric test was the best test of the illuminating power of gas, and that chemical analysis was not admissible. Mr. Stenhouse said it was generally acknowledged that the best time for making a test was during the night, when the largest consumption was taking place; but Mr. Davis's experiments seemed to have been made during the day. Dr. Bowman observed that it was usually considered that greater condensation took place in the daytime than at night, when the gas was more agitated by the increased consumption going on. He had found as much as 5 candles difference between noon and night. He was quite convinced, from experiments which he had made, that the mechanical means of testing were much better than any chemical method could ever hope to be. Mr. Wilson said that when, in consequence of complaints which had been made by consumers at Bury, the Gas Committee established a photometer some distance from the works, serious differences were found between the quality of the gas at the works and the testing-station; and this difference was at the time attributed to condensation. Dr. Bailey wished to call attention to a fact which might have been overlooked, and that was that very frequently low results were obtained simply through air having got into the pipes, and the gas not being allowed to burn before the test was made. Mr. Davis, in reply, said he did not consider that condensation in the mains was at all a serious matter. If condensation kept taking place, the condensed liquid should appear in the street syphons, where it was well known that nothing but foul water usually appeared. A deposit of hydrocarbon from the gas could only take place if the gas were saturated with hydrocarbon vapours; and he had never yet met with a sample of gas thoroughly saturated. He was also of opinion that the physical test of photometry was far more reliable than it was possible to make any chemical test. If the argument were a valid one, that hydrocarbons were deposited in the mains during the slow flow of gas, and taken up again in the equal rush by night, the candles lost in the daytime should increase the luminosity of the gas in the evening. He had never found such an increase, although there was a difference between the day and the night quality; but this was due to the greater percentage of nitrogen in the daytime than at night.

Association of Municipal and County Engineers.—A meeting of this Association (of which Mr. T. Cole, Assoc.M.Inst.C.E., Secretary of the Incorporated Institution of Gas Engineers, is the Secretary), was held at Scarborough on the 18th inst., under the presidency of Mr. T. de Courcy Meade, of Hornsey. Mr. G. Ball, of the Borough Surveyor's office, read a paper by the Surveyor (Mr. J. Petch) on "Scarborough—Its Progress and its Public Works in Recent Years;" and the Water Engineer (Mr. W. Millhouse) read another, describing the works under his control.

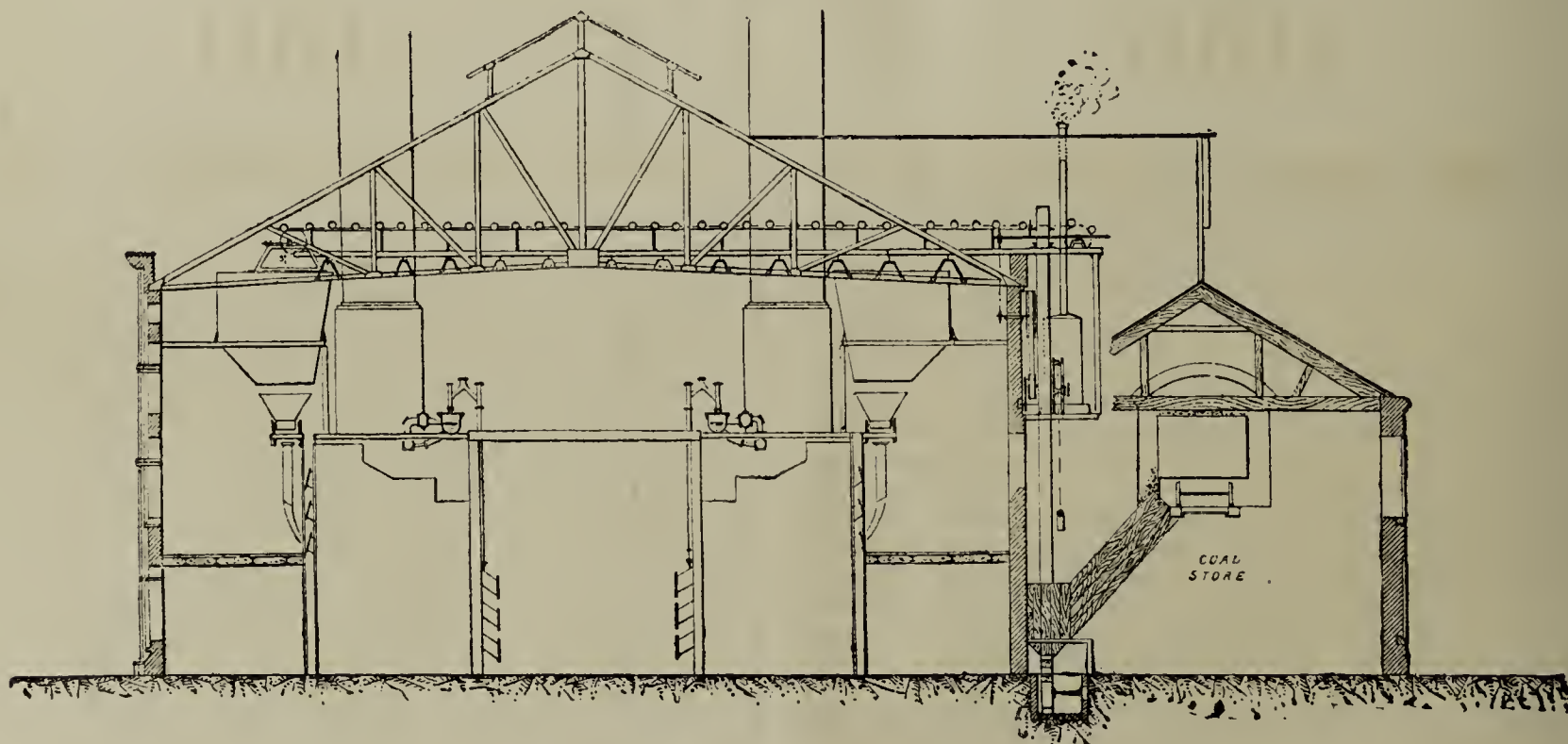
AN AUTOMATIC RETORT-HOUSE AND COAL-STORE.

It is a matter of common knowledge that every industry is occasionally visited with an outbreak of inventiveness on the part of those who are engaged in it. The gas industry is just now in this position; for it may be safely stated that, among gas engineers and managers there is, at present, almost a universal desire for improvement and economy in the retort-house. Their chief object is to obtain machinery to supersede the human hand, and, in the severe work of charging and drawing retorts, make the men merely attendants on appliances which produce results superior to their own. Our readers are familiar with the special activity which during recent years has been directed to the solution of the problem of the automatic charging and discharging of retorts, and the mechanical manipulation of the coal and coke by means of conveyors and elevators. But the accompanying illustrations of the new retort-house at the Coventry Corporation Gas-Works, designed and erected by Mr. Winstanley, with the feeding shoots to the inclined retorts fitted under the patents of the Automatic Coal-Gas Retort Company, Limited, and equipped throughout with conveyors and elevators by the New Conveyor Company, is perhaps one of the most complete automatic arrangements at present in operation in this country.

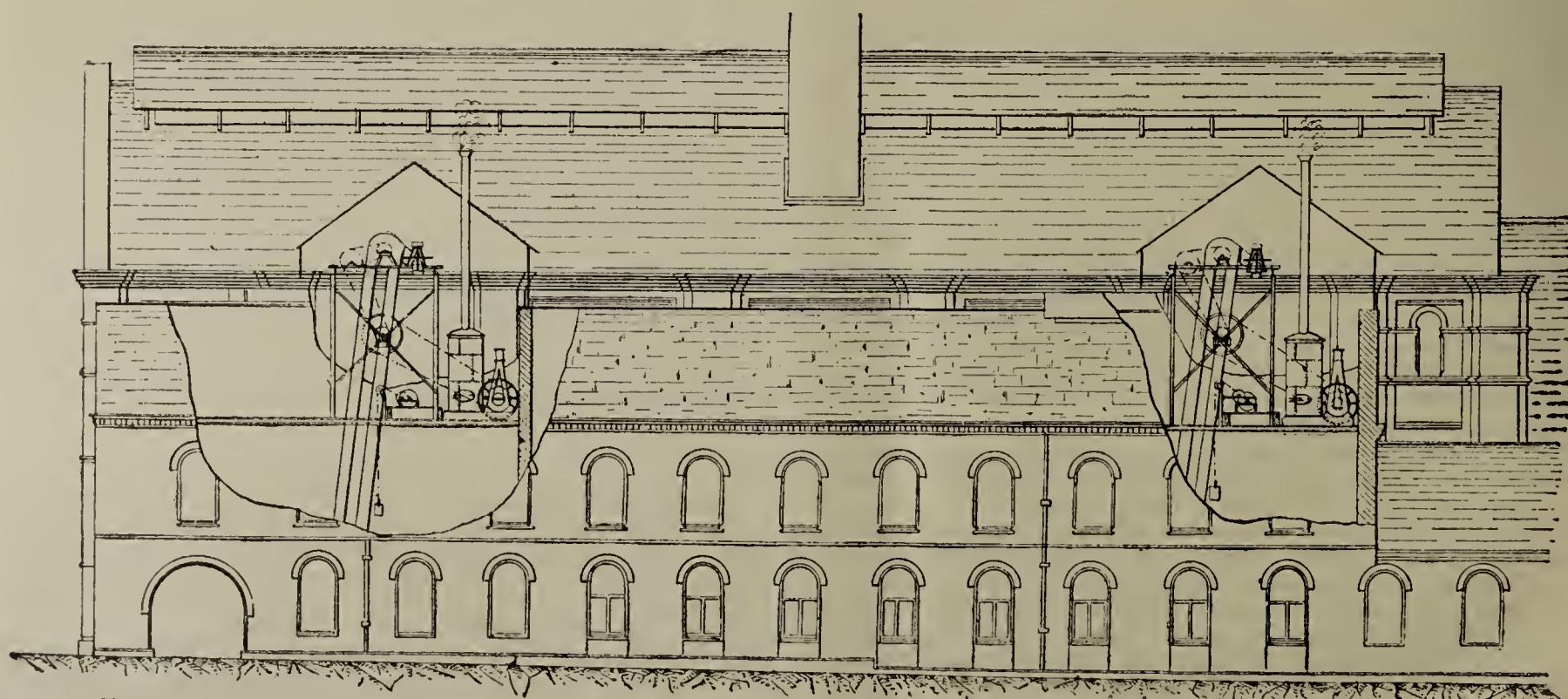
The retort-house buildings and the installation of the retorts were designed and carried out in every detail by Mr. George Winstanley, Assoc.M.Inst.C.E., Gas Engineer to the Coventry Corporation, for a special arrangement of twelve settings on either side, with the coal-stores running parallel with the benches on one side. Prior to setting out the new house, Mr. Winstanley carried out a series of exhaustive tests, on an experimental setting of six inclined \square retorts, each 21 in. by 15 in., and 15 feet long. During the tests with the trial setting, Mr. Winstanley made many changes, and tried various heats; and he eventually satisfied himself that, however the retort might buckle in the heating, the even distribution of the coal and the free

running out of the coke were effected without the drawbacks and the manual attention required in some of the prior tests made on inclined retorts at other works. This success was in a large measure due to the fact that the regenerative arrangement of heating adopted in the experimental setting was Mr. Winstanley's own patent system; and the advantages gained were that only 10 lbs. of coke were used per 100 lbs. of coal carbonized, and a uniform distribution of heat was obtained throughout the entire setting at a very high temperature. These advantages enabled Mr. Winstanley, during the trials, to carbonize 7 cwt. of coal every six hours; being 28 cwt. per retort per day, or 8 tons 8 cwt. per bench of six. With such results as these, it cannot be matter for surprise that Mr. Winstanley immediately decided to have the new house (which is shown in section in fig. 1 of the accompanying illustrations) fitted throughout with inclined retorts. The buildings are exceptionally handsome for a retort-house, and—a point which we think of more importance—they are particularly wide and lofty; thereby ensuring perfect ventilation. The house, which is of red brick, is 74 feet span and 127 feet long. The roof is in one span—the principals being 20 feet apart; and the trussing adopted is composed chiefly of flat iron.

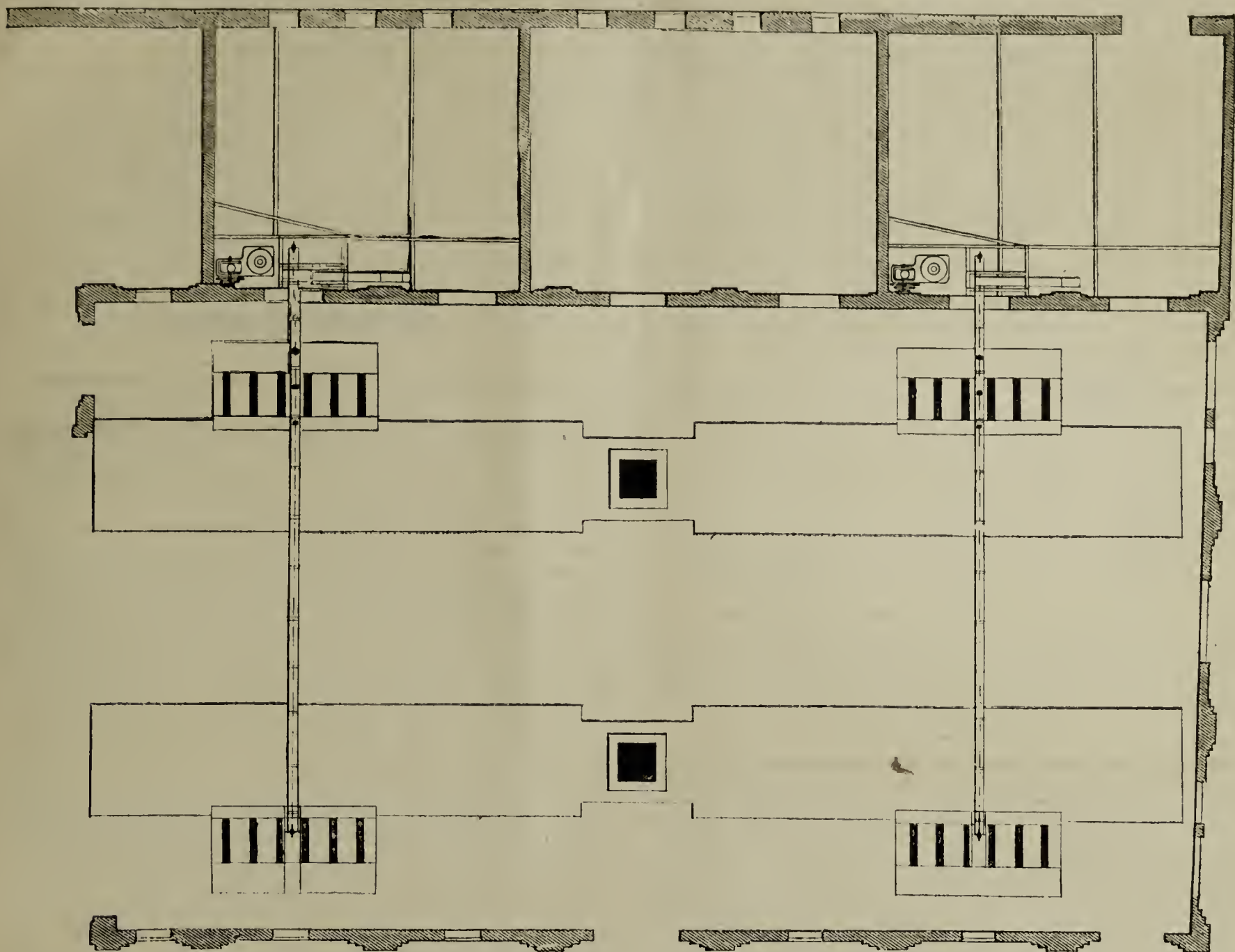
To enable our readers to clearly follow the illustrations, we now proceed to describe the manipulation of the coal, from the time it is shot from the waggon, as shown, into the receiving hoppers over the coal-crushers, until the coke is distributed automatically into the yard. Referring to the illustrations, it will be seen that a line of railway extends up the length of the coal-stores, in which two elevators are arranged with receiving hoppers, with coal-breakers fixed over the elevator boots. The coal is shot from the waggons into the hoppers, and is fed by the breakers into the elevators. The breakers are of very simple design, and suitable to regulate the feed of any size of coal. The elevators, which are of Mr. Gilbert Little's design, with flat and round steel links, and steel buckets enclosed in dustless steel casing, lift the coal to the two cross conveyors,



CROSS-SECTION OF THE NEW RETORT-HOUSE AT THE COVENTRY GAS-WORKS.



ELEVATION, SHOWING THE COAL-CONVEYING MACHINERY FROM THE COAL-STORES AT THE COVENTRY GAS-WORKS.



PLAN OF THE NEW RETORT-HOUSE AT THE COVENTRY GAS-WORKS.

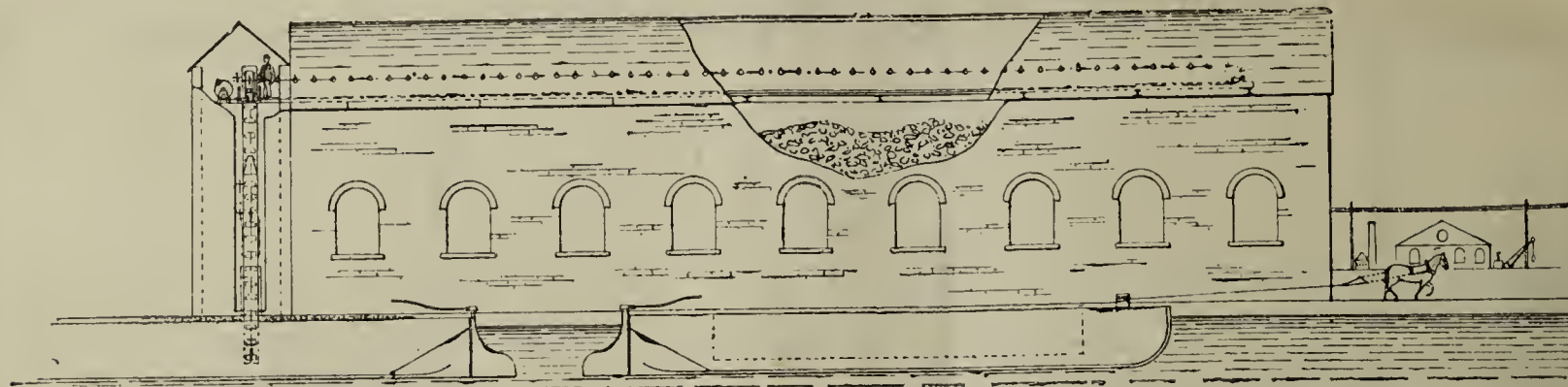
which in turn deliver it into the four large storage-tanks fixed at each corner of the house. The conveyors are also of Little's patent noiseless design, with steel troughs, and push-plates carried on guide-pulleys, so as to prevent the plates from touching the sides or bottom of the trough. The coal-tanks hold 40 tons each—being a sufficient quantity for the night supply; so that the machinery requires to be run during part of the day shift only. Both the elevators lift 15 tons per hour; and it will be seen from the illustrations that the engines, elevators, conveyors—in fact, the whole of the plant is duplicated, so that if one side is, from any cause, stopped, the entire retort-house can be supplied by the reserve machinery. The tanks are of special design, the sides being all of one steel plate, bent to position by heavy hydraulic machinery at the works of the New Conveyor Company. In the bottom of each tank are fitted six doors through which the coal passes to a portable charging tank, arranged to hold six charges of $8\frac{1}{2}$ cwt. each. This tank was designed by Mr. Winstanley. It is moved along the rails by means of a chain and chain-wheel pulled from the charging-stage. The doors in the bottom of the portable tank are opened and closed from the same stage; so that the labourer charging the retorts has everything at his hand. Under the tank three steel shoots run on rails, and conduct the charges to the three tiers of retorts. As the coal falls down the retort, it is checked by a plate inserted a little way up the retort. This plate prevents the coal from running down to the discharge mouthpiece; and at the same time it forms a stop for the flow of coal, so that an even depth of coal is distributed over the complete length of the retort. Large pieces of coal, as well as the dust, are deposited evenly in the retort. The velocity of the flow of the coal as it falls from the portable tank through the moveable shoots is regulated by means of a weighted swing flap; and after the coal passes this flap-door, it is further regulated in flow by a check fixed on the delivery point of the shoot. In the charging mouthpiece is placed a shield, to give a smooth face for the coal to flow over into the retort.

The charge having been put into the retort as described, the shoot is withdrawn, the mouthpiece with self-sealing lid is closed, and the portable tank moved to the next or any other setting; the whole operation of charging a retort not occupying more than five seconds by an ordinary labourer. When the coal is carbonized, which in this particular retort-house is done in about six hours, the lower mouthpiece is opened and the stop-plate removed; and the coke then slides out. The angle of the retorts varies from 30° to $31\frac{1}{2}^\circ$ in the different tiers; the top range of retorts being, of course, at the greater angle, to compensate for the shorter fall from the portable coal-tank. At present the coke slides into a truck which holds a charge; but Mr. Winstanley

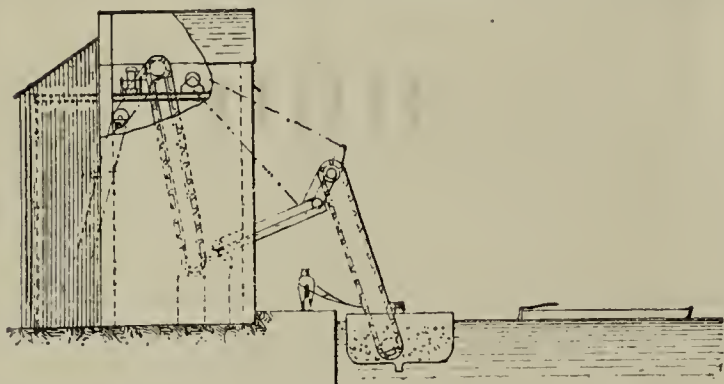
has had plans prepared showing an arrangement of Little's patent endless steel-rope coke conveyors with an inner trough, travelling in a fixed jacketed water-trough. The hot coke falls direct from the retort on to the moving trough, and thus wear and buckling are prevented. Besides this, the quenching of the coke is partly effected, as it moves along through the water trough. In the extensive arrangement of patent conveyors for Mr. Winstanley, the coke is carried by them along the passage, where the clinkers are also removed. On reaching the end of the passage, or tunnel, the coke under the discharging stage is shot by the fixed conveyor into an elevator, which lifts it to a conveyor at a height of 30 to 40 feet, and distributes it all over the yard. Mr. Winstanley is also arranging coke-screening plant under the conveyor, so as to deliver different sizes of coke direct to the carts of buyers. The tunnels or passages in which the coke conveyors are fixed are 10 feet deep and 20 feet wide.

The system of heating used is, as already stated, Mr. Winstanley's own patent regenerative furnace, with modifications and improvements made by him to suit the inclined retorts; and it may be mentioned that Winstanley's patent furnace has been equally successful in connection with ordinary horizontal retorts. His system is also in use at the Droylesden works of the Manchester Corporation; and there is no doubt that the marked success of the inclined retorts at Coventry is in a large measure due to the effective heating arrangement. We are also informed by Mr. Winstanley that the difference in the pressure of the gas at the top and the bottom of the retort is very slight; but he prefers putting the ascension-pipes at the lower end. We believe the carbonizing is so perfect, that there is actually no trace of tar deposit in the mouthpieces.

In conjunction with the new retort-house at Coventry, we also illustrate an automatic coal-store designed specially by Mr. Gilbert Little, the Managing-Director of the New Conveyor Company, for gas-works situated on a canal or navigable river. But a similar arrangement has also been designed to suit the most varied methods of taking the coal from waggons to the stores. It will be seen from the illustrations, that the coal is lifted from the barges by an adjustable elevator. When this is not in use, it is lifted by the crab-winch, as shown, by a steel rope, and placed against the wall clear of the towing-path. The coal, as it is lifted by the elevator from the barge, is shot on to a special form of conveyor, fixed between the jibs. This shoots the coal into the stationary elevator fixed inside the coal-store, which in turn delivers it into the conveyor arranged in the roof, so as to trim the coal all over the floor to any desired height. The long conveyor, which extends the entire length of the coal-store, is of Mr. Little's patent steel-rope noiseless design. It will carry



ELEVATION OF LITTLE'S PATENT COAL STORE, WITH NOISELESS STEEL-ROPE CONVEYORS.



END VIEW OF LITTLE'S PATENT COAL-STORE.

coal, coke, oxide, or lime, any distance up to 1500 feet, and is made in sizes to carry from 2 to 200 tons per hour.

The accompanying illustrations are from drawings specially prepared for the JOURNAL by Mr. Little.

The Clay Lane Local Board and the Water-Works.—The Clay Lane Local Board having offered the Water Company £14,000 for their property, the Directors have had the matter under consideration, and have intimated that they will not accept less than £16,500. The Board, at their last meeting, resolved not to increase their offer.

The Use of Gas-Stoves in Bristol.—The Directors of the Bristol Gas Company have resolved to reduce, by nearly one-third, the rentals of the gas-stoves they let on hire. They also intend to make a charge of 5s. for fixing, instead of at the old rate of 4d. per foot for the piping used. At the present time about 2150 stoves and fires are rented by customers residing in the city; 350 having been fixed this year.

Swinton Local Board and the Gas Supply.—A special meeting of the Swinton and Pendlebury Local Board was held on Monday last week, when a report on the gas question was adopted. It was also unanimously resolved that a deputation should wait on the Salford Corporation with a view to ascertaining what concessions they were prepared to make in supplying gas to the district.

New Water-Works for Wakefield.—Last Thursday, the first sod of the new Withens reservoir, on the Rishworth Moors, in connection with the Wakefield new water-works scheme, was cut by Mr. J. S. Booth, the Chairman of the Corporation Water-Works Committee. A beautiful barrow and spade, with silver mountings, were presented to Mr. Booth by the contractor (Mr. T. Oliver, of Horsham, Kent). The cost of the works is estimated at £120,000.

North Shields Water Company.—The report of the Directors of this Company, to be submitted to the shareholders at their annual meeting next Thursday, states that, as the result of the adverse decision in the action brought against the Company on the question of the basis of charging water-rates, the revenue has decreased, although some portion of it has been recouped by an increase in the consumption. The gross revenue for the year has been £9968 19s. 6d.; and the expenditure £8949 16s. 10d. (including interest on loans, amount paid to the Newcastle and Gateshead Water Company, law costs in both the recent actions, and amount paid on account of the costs of the Bill in Parliament), leaving a balance of £1019. The Directors feel that they cannot, in view of the liability remaining against the Company for the balance of the costs of promoting the Bill in Parliament, recommend any dividend. These costs have not yet been ascertained. His Grace the Duke of Northumberland's one-seventh share of the clear annual profits for the year ending April 30 last, amounts to £347; and after paying this, there will remain, including the balance of profit from the previous year, a sum of £1188 to the credit of the profit and loss account. The Directors formally report that, on July 7 last, the action brought by Mr. J. P. Spencer against the Company (as a test case) with reference to the basis of charge, was tried at Newcastle Assizes before Mr. Justice Grantham, who ruled that the net rental was the basis upon which to levy the water-rates. The Directors therefore, with the support of a Special Committee of shareholders who were appointed at the general meeting, deemed it expedient to reduce the water-rents as from May 1, 1891, by charging upon the rateable value as assessed for the poor-rate, as the most ready method of arriving at a sum to represent net rental. This was done; and the loss of revenue, as shown by the balance-sheet, is due to this action. With reference to the Bill promoted this session in Parliament, and which was sanctioned by the shareholders, the Directors report that it came before a Select Committee of the House of Lords in May, and was thrown out; the preamble not being held to be proved. The Directors recommend that a bonus of £25 be given to the Secretary as an acknowledgment of his extra services during the past seven years in connection with the legal and parliamentary proceedings. The Directors are endeavouring to make arrangements with the Newcastle and Gateshead Water Company for obtaining a further supply of water, which they trust to be able to bring to a successful issue.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

The Presence of Free Ammonia in Gas after Passing through Lime.

SIR,—It was not my intention to criticize Mr. Valon's very able address, and I would not now have written except for Mr. E. L. Pryce's letter which appeared in your last issue (p. 1186).

The point raised by Mr. Pryce occurred to my mind when I heard the address read. The idea of gas containing free ammonia at the outlet of lime purifiers, in consequence of the decomposition of fixed ammonium compounds by calcic hydrate, is certainly novel and very questionable. Mr. Pryce asks the question if Mr. Valon ever found any trace of fixed ammonium compounds at the inlet of the purifiers; and he suggests that the trace of free ammonia at the outlet is not due to the decomposition of fixed ammonium compounds, but to the decomposition of calcium cyanate, as set forth by Professor Foster in 1882. This, too, as a thorough solution to the problem, is very doubtful.

I am aware that the cyanides of the alkali metals, when fused in contact with air, absorb oxygen and produce cyanates. Such circumstance does not obtain in a lime purifier.

In my opinion, the presence of free ammonia at the outlet of a lime purifier is not due to the decomposition of fixed ammonium compounds, but to the decomposition of cyanogen by calcic hydrate—calcic oxalate being formed with evolution of ammonia. This was pointed out by me in a pamphlet on tower scrubbers issued by Messrs. Dempster and Sons in 1881, in which I gave the following equation:—

$$2\text{CN} + \text{CaHO}_2 + 2\text{OH}_2 = \text{CaC}_2\text{O}_4 + 2\text{NH}_3$$

Traces of ammonia can always be found at the outlet of a lime purifier, if the gas has been previously entirely freed from free and fixed ammonium compounds.

If the gas be first sent through hydrated oxide of iron, no ammonia will be found when it is afterwards passed through calcic hydrate; clearly showing that the cyanogen is absorbed by the oxide of iron.

Lancaster, June 24, 1892.

CHAS. ARMITAGE.

Herring's "Gas-Works Construction."

SIR,—My attention has been called to the fact that, in my remarks upon "Gasholder Construction" in the above-named book, I have made use of the writings of Mr. F. S. Cripps on the subject, without in any way acknowledging the source whence my information was obtained; and I hasten to correct such a serious omission, and tender my sincere apologies to Mr. Cripps for inadvertently using his labours without asking his sanction so to do. The omission, however, I may be permitted to explain, arose through my taking extracts from Mr. Cripps's articles as they were published in the JOURNAL OF GAS LIGHTING, &c., during the years 1887 and 1888; and when preparing my articles on "Gasholder Construction," which appeared in the columns of the *Gas and Water Review* in the spring of 1890, I made use of extracts which had been taken by me from time to time, and was not then aware who was the author of the articles in the JOURNAL.

When revising my articles for publication in book form, I had very little time at my disposal, and, amongst others, the chapters on gasholders went forward to the printer practically as they appeared in the columns of the *Gas and Water Review*; and through this, no doubt, I omitted to correct the former omission. I am nevertheless deeply grieved at this oversight; and will take the earliest opportunity of rectifying the same.

Huddersfield, June 25, 1892.

W. R. HERRING.

Electric Lighting at Burnley.—Last Tuesday, Mr. Arnold conducted a Local Government Board inquiry at Burnley relative to an application by the Council to borrow £29,000 for a scheme of electric lighting, which has been provisionally adopted. The inquiry also embraced borrowing powers for £11,000 for gas-works extensions.

Completion of the New Water Scheme for Pontefract.—The Roall water scheme to supply Pontefract and the district with an improved supply of water was completed yesterday week. The first sod of this undertaking was turned on July 25, 1889, by the then Mayor (Mr. W. Mathers); and the work has been satisfactorily carried out under the supervision of Mr. G. Hodson, the Engineer, by Messrs. Vickers and Son, of Nottingham. The mains from the pumping-station at Roall are laid for a distance of nine miles to the storage reservoir on the Park Hill at Pontefract. The cost of the works will amount to close upon £28,000. Since the completion of the work, the contractors have been encountering serious difficulties. Last Thursday morning, when pumping operations commenced, owing to an accumulation of air in the mains, the pipes burst in Teront Street, Tanshelf, and a large volume of water poured forth, and caused a suspension of traffic. The power required to force the water into the reservoir on the Park Hill is immense, and it is feared other difficulties may arise before the works are a thorough success.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bill read the first time: Ilkley Local Board Bill.
 Bills read a second time and committed: Bexhill Water and Gas Bill; Newcastle-upon-Tyne Improvement Bill.
 Bills reported: Bexhill Water and Gas Bill; Birmingham Corporation Water Bill; Exmouth and District Water Bill; Newcastle-upon-Tyne Improvement Bill.
 Bills read the third time and passed: Bexhill Water and Gas Bill; Birmingham Corporation Water Bill; Bournemouth Improvement Bill; Exmouth and District Water Bill; Lancashire (Middle Ward District) Water Bill; London Water Bill; Newcastle-upon-Tyne Improvement Bill.
 Bills Royal assented: Ashton-under-Lyne, Stalybridge, and Dukinfield District Water Bill; Airdrie and Coatbridge Water Bill; Blackburn Corporation Bill; Cleator Moor Local Board (Gas) Bill; East Grinstead Gas and Water Bill; Electric Lighting Provisional Orders Bills (Nos. 1, 2, and 3); Gas Provisional Orders Bill; Glasgow Corporation Water Bill; Ipswich Corporation Bill; Kilmarnock Corporation Water Bill; Mold Water Bill; Newport Corporation Bill; Ormskirk Gas Bill; Pontypridd Water Bill; Rhyl District Water Bill; Southend Gas Bill; Tredegar Local Board Water Bill.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Bills read a second time and committed: Electric Lighting Orders Confirmation Bills (Nos. 4, 5, and 6); Water Orders Confirmation Bill.
 Bills reported: Electric Lighting Orders Confirmation Bills (Nos. 4 and 6); Uttroter Water Bill.
 Bills read the third time and passed: Electric Lighting Orders Confirmation Bills (Nos. 4 and 6); Gas Orders Confirmation Bill; Uttroter Water Bill.

HOUSE OF COMMONS COMMITTEE ON POLICE AND SANITARY REGULATIONS BILLS (SECTION A).

Monday, May 30.

(Before Sir F. SHARPE POWELL, Bart., Chairman; Mr. HOBHOUSE, Mr. WILSON, and Mr. PHILLIPS.)
 ILKLEY LOCAL BOARD BILL.

This Bill—which, among other objects, is to empower the Ilkley Local Board to construct additional water-works and improve their existing supply, and also to purchase the undertaking of the Ilkley Gas Company—came to-day before the above-named Committee.

Mr. BALFOUR BROWNE, Q.C., Mr. FREEMAN, and Mr. WAUGH appeared for the promoters; the only opponents of the Bill—the Ilkley Gas Company—being represented by Mr. PEMBROKE STEPHENS, Q.C., and Mr. FORBES LANKESTER.

Mr. BALFOUR BROWNE, in opening the case, said the main object of the Bill was to provide for the compulsory purchase of the works of the Ilkley Gas Company. The Committee were no doubt aware that the Ilkley district was an exceedingly beautiful one, attracting a large number of people. The resident population was about 6000; but when the season was on, the number went up to something like 10,000. It was a most notable health-resort, as was obvious from the fact that the death-rate was only 11·4 per 1000; but leaving out the visitors who were in ill-health when they went there, and who died there, the actual rate fell as low as 9 per 1000. In 1851 the population was 811; in 1861, 1043; in 1871, 2511; in 1881, 4733; and in 1891, 5781. In 1851 there were 155 houses; now there were 1000. The rateable value in 1870 was £11,092; in 1891, it was £33,228. The water and the drainage were excellent; but one of the objects of the Bill was to increase the water supply, and this was unopposed. The Local Board was established in 1869. They were the owners of the water-works, and had also a cottage hospital and a cemetery. They had borrowed £40,663, of which £13,769 had been repaid; so that the balance owing was £26,894. Since his brief had been prepared, about £1000 more had been paid off. Altogether, therefore, the town was in a good financial position. The borrowing powers of the Board amounted to £64,000. Their proposal, shortly put, was to purchase the gas-works by compulsion. The Gas Company said that they did not want to sell; and, of course, under these circumstances, the onus was upon the Local Board to show that the Company should be compelled to part with their business. A gas company's property was no more sacred than any other. A landowner was often forced to relinquish his land at the demand of public bodies; and if he (the learned Counsel) could convince the Committee that it was in the interest of the public that the Company should be compelled to give up their undertaking, he should have substantiated the statement in the preamble of the Bill. The Company was formed in 1856 as a limited liability undertaking. They obtained statutory powers in 1869; and from that time until now they had various Acts of Parliament. Although they were under statutory restrictions devised for the benefit and protection of the consumers, the very last thing the Company had thought of was the interest of their customers. The proposal now was to take the works out of the hands of the people who were not managing them well in the public interest, and to place them in those of the Local Board, who unquestionably would carry them on for the public good, and give full compensation to the Company for their undertaking. Having adduced precedents in support of this proposal, the learned Counsel proceeded to deal with some of the complaints made against the Company. First of all, he said,

they refused to light certain public roads—notably the one from Ben Rhydding, one of the largest hydropathic establishments in the district; the reason assigned being that they did not see that there would be adequate remuneration for their outlay. Then the Company insisted upon keeping in their own hands the control of the lamplighters, who were paid by the Local Board, and who, it was reported, did not light the lamps early enough, or put them out too soon. At any rate, the Local Board thought that, as they paid these men, they ought to have some authority over them. Next there was the question of the quality of the gas. Its illuminating power was fixed at 14 candles, which was very low, seeing that throughout England it was 16 candles, while in some places it was 18. The fluctuations, both in pressure and lighting power, had been very great. Another cause of complaint was the inconvenient times chosen by the Company for breaking up the roads to do repairs; and therefore it was thought it would be better for the road authorities to have this matter in their hands. But the principal ground of complaint was that the Company had made very large profits, and that the price charged for gas was kept high. This was one of the strongest reasons adduced for the Company being made to hand over their undertaking to the Local Board. Their finances had been dealt with most unsatisfactorily; and the result had been that the consumers had suffered. For example, the amount raised on shares was only £16,466, while £21,638 had been expended. Where had the difference—the £5172—come from? Out of the profits, which really had been taken from the consumers. It had been obtained from what he did not hesitate to characterize as an illegal source. This amount should have been raised as capital; and then the shares would have been sold at a premium, which would have gone into the undertaking without bearing interest. But by taking the money from the profits, the Company had been able to declare very much larger dividends upon the £16,466 than they would otherwise have been able to pay. The learned Counsel next dealt with the figures in the Company's accounts for the year 1881, and said that in that year the net revenue was only £1819, though they managed to pay dividends to the shareholders amounting to £1271, and transfer £542 to the reserve and £151 to the insurance fund; making altogether £1964. How this was done he did not know. It was quite obvious that it did not come out of the "clear profits of the undertaking" in that one year, which it ought to have done by the Company's own Act. Then in 1884 the same thing took place again. They did not earn £636; but this sum was put away. In 1886, £151 was added to the insurance fund, though it was not earned in that year. This money came from the floating balances, which the Company had no right to have. These balances ought to have been divided between the consumers of gas and the shareholders. In 1879, at the passing of their Act, the Company had, in what they called the reserve fund £3239; but most of this money was, he contended, illegally theirs. It should have been given to the gas consumers. The total capital was £12,100, and according to the Gas-Works Clauses Act, under which they then were, their total reserve fund should have been 10 per cent. on that, and everything beyond had to go in reduction of the price of gas. Now, 10 per cent. upon £12,100 was £1210; and this was all they could legally put to the reserve fund; and yet they had then £3239. Therefore they had £2029 which, if properly employed, would have reduced the price of gas very largely indeed. This he called juggling with the finances in a way which was most inimical to the interests of the consumers in the district. At the present time, out of a reserve fund of upwards of £4000, they had £2873, or 61 per cent. to which they had no right at all. In 1890 the net balance on the year's working, after paying expenses, was £2406. With this they could have paid 14 per cent. upon their old, and 11 per cent. upon their new capital, and at the same time have reduced the price of gas by 4d. per 1000 cubic feet. In all the cases he had mentioned, he asserted that the Company had lamentably failed to carry out the duties entrusted to them by Parliament. Why, then, should they not sell? The Local Board were willing to let the whole matter go to arbitration; and as the price to be paid would be left to arbitrators, he thought probably the Committee would come to the conclusion that these gentlemen would do justice between the parties. The petition of the Company against the Bill was very short. They said that no complaints had been made to them in the matter of the gas; but he (the learned Counsel) would be able to show that this was not the case. All they said was that they should not be compelled to part with their undertaking; but he maintained that the time had come for them to part with it. He therefore asked the Committee to say they would pass it over to the Local Authority, with the hope and confidence that the consumers, managing the concern in their own way and for their own benefit, would in the future get as good gas as now at a much cheaper rate than that at which the Company seemed willing to supply it.

The following witnesses were then called in support of the Bill:—

Mr. M. HAINSWORTH, Clerk and Surveyor to the Local Board, examined by Mr. FREEMAN, gave particulars as to the increase in the population of Ilkley, and the generally improved condition of the town, during the past 30 years. He also explained the causes which led to the promotion of the Bill, which, he said, had the sanction of the ratepayers at a public meeting. The Gas Company having refused to sell their undertaking, the Board had to apply for compulsory powers of purchase. The Company worked chiefly under their Act of 1879, by section 52 of which they could contract with the Local Board for the public lighting. In the opinion of the Board, the Company had not properly carried out the powers entrusted to them; and there had been numerous deputations to the Directors on the matter. Witness gave details as to the movement set on foot for having the Ben Rhydding Road lighted. This road had, he said, been dedicated to the public; but it was not a Local Board road. The distance the mains would have had to be laid was something like 700 yards; and the cost would have been about £90. The Board were willing to erect seven lamps; and this would have given the Company a fair return on their outlay. All the land on one side of the road had been sold for building purposes; and the want of light there had, no doubt, interfered with the development of building along it. On some occasions the Board had had to refund to the Company the cost of laying the mains, in order to get them to supply the gas. The public lamps were not lit from the

middle of May to August. The Board desired to have the lamplighters under their own control. The lamps had been sometimes turned out before the prescribed period; and he had heard complaints of this in different parts of the town, and also as to the quality and pressure of the gas. At the public meeting there was a strong feeling in favour of the purchase of the gas-works.

Tuesday, May 31.

On the resumption of the proceedings to-day,

Mr. Hainsworth was cross-examined by Mr. PEMBROKE STEPHENS on the subject of the complaints made against the Company—the subject of the lighting of the public roads being taken first. Asked if there was any road he could mention where the Company had been requested to put down mains and had not done so, witness said there was only one case—that of Bridge Lane, for the mains in which the Local Board had paid £8, and then they had the gas. As to the private roads, the Board made a point of the Ben Rhydding Road, because it was really a public road, and Ben Rhydding itself was lighted by the Company. The length of this road and the Keighley road was 1200 yards together, and there were 500 yards of mains laid in the Keighley road portion. As a matter of fact, the Ben Rhydding Road was not vested in the Local Board, and they would not repair it.

Mr. PEMBROKE STEPHENS: If it is not a public, but a private road do you not know that the owners of a private road have perfect power, if they choose, to call upon the Gas Company to lay down a main?

Witness: No; I did not, at the time.

Your complaint is that the Board, who were not owners of the land, were calling upon the Company, who would have nothing to do with the road; and you did not know that the owners of the road had a statutory power, if they thought proper, of requiring the Company to light that road. What has been the complaint between you and the Company?—It was not so much between us and the Company; but the public complained as to the lateness of the hour at which the lamps were lit, and the early hour at which they were turned out.

Are the lamps lighted all the year round?—No; only during the winter months. They are not lit from the middle of May to the middle of August. The Board decide when the lamps are to be lighted.

Therefore, if there is any part of the year when there is no lighting at all, that is the act of the Local Board?—It is. I might say that that is not the complaint at all. The complaint was in connection with the turning out of the lights earlier than they were ordered to be extinguished. We said twelve o'clock; and on one occasion they were put out at half-past eleven. I never complained, in writing, to the Secretary of the Company; but on one occasion I did so to the Manager. It was just before last Christmas—a few weeks after the Bill had been deposited.

In further cross-examination, witness said that under the Act of 1869 the price of gas was 6s. per 1000 cubic feet, and that it was reduced to 5s. 6d. under the Act of 1871, and to 4s. under that of 1879. Since then the price had been successively lowered to 3s. 8d., 3s. 4d., and 3s. He acknowledged that any reduction in price must be a voluntary act on the part of the Company. He was not aware that the 4s. limit was fixed at the instance of the Local Board themselves.

Mr. PEMBROKE STEPHENS: You have made complaints that there have been all sorts of irregularities—"juggling" was the word used—with regard to our accounts. Now, having them before you year by year, and having gone back, I think, in one case to the year 1881, to try and pick holes in them, when did the Local Board first communicate to the Company, officially and in writing, that their view was that there was nothing wrong in those accounts?

Witness: I do not know that we made such a communication. I have never heard of it.

When did the idea first occur to you?—When the accountant went through the books on the 17th of August last year.

How did that gentleman come to get into relation with the books of the Company, and to overhaul them in August, 1891?—Through the permission of the Directors of the Company—as a matter of courtesy to the Local Board.

It is not the usual thing, is it, for the solicitors of a Bill for compulsory purchase to overhaul the books of a gas company whose works it was desired to acquire?—In the first place, the Local Board decided to send a deputation to the Company to consider the purchase of the gas undertaking.

The CHAIRMAN: We do not want to get involved in an investigation into these negotiations.

Mr. PEMBROKE STEPHENS: You may take this fact from me, sir, that, there being a power under the Public Health Act, as you know, for people to agree together, the Local Board, purely of their own motion, sent a deputation to the Company, and asked them to name a price for their undertaking. The Company told them they did not wish to sell, as they were perfectly satisfied with their business; but that, if the Board wanted to purchase, they might make an offer, which would be considered. The Local Board thereupon wrote: "Before we make an offer, we should like to have an opportunity of looking at your books." The whole thing was done in a friendly way; and the Company met the Board in an equally friendly manner, and said: "It is not a usual thing, but you shall have the opportunity of seeing our books." The Board were not satisfied with that, but said there were some books in a different place which they wanted to inspect; and they wrote for leave to go into these also. This led up to the discussions as to price, and so on.

The CHAIRMAN: It led to negotiations which proved abortive.

Mr. PEMBROKE STEPHENS: We never went into a negotiation at all, but, for their own satisfaction and guidance, the Board asked for this information; and what we feel to be the peculiar sting of this matter now is that the very opportunities we gave, as one body dealing honourably, and even extra-honourably, with another, are absolutely tortured into an attack upon the Company for having "juggled" with their accounts.

Further cross-examined, witness said the question of the cost to the town of the proposed purchase was discussed at the ratepayers' meeting; and he thought it was stated that it would add 1s. or 1s. 6d. in the pound to the rates. The Bill before the Committee was practically the one submitted to the meeting, and assented to.

Re-examined by Mr. WAUGH: The meeting was the largest I have ever known during the time I have been connected with Ilkley. The price of gas has upon three occasions been reduced since the 1879 Act was passed. In consequence of the reduction, there was an increase in the dividend to 13 per cent. upon the original shares, and 10 per cent. on the second issues. At the present time on the Ben Rhydding Road, they are in pitch darkness during the night. The fact that that road is unlighted has a detrimental effect upon the development of that part of the town. The Board would have ordered the lamps to have been lit for extra time had the gas been cheaper. The Company have persistently refused the applications of the Local Board as regards lighting generally.

By Mr. WILSON: There are about 982 houses in Ilkley, and there are about 1100 or 1200 ratepayers; so that the number of persons present—200—at the meeting on Oct. 21 was one-sixth of the whole of the ratepayers.

Mr. BALFOUR BROWNE said as the Ben Rhydding Road was a highway for all practical purposes, he submitted that it was a highway for the purpose of having gas-pipes laid down.

Mr. PEMBROKE STEPHENS said that if his friend relied on that case, he should want to have it proved in evidence.

Mr. Jabez Dobson, Chairman of the Ilkley Local Board, examined by Mr. WAUGH, said he was a large consumer of gas; his gas bill amounting to about £230 per annum. He had on several occasions complained to the Manager of the Company with regard to both the pressure and the quality of the gas supplied; and no attention had been paid thereto. As Chairman of the Local Board, he had had complaints made to him from other consumers of gas. He had applied to the Company, as being one of the largest customers, to be allowed a discount, in order to use gas for cooking purposes; and they had refused.

In cross-examination by Mr. PEMBROKE STEPHENS, witness said he could not give the dates of his verbal complaints; but it would be two to three years ago. He was told that his service-pipe was old, and required repairing. He attached great importance to the matter of the cooking-stove. In the Bill, reference was made to the supply of gas for cooking purposes, and as to the Local Board purchasing and letting on hire gas stoves and other appliances. This was not his suggestion.

Mr. Garside, a plumber carrying on business at Ilkley, spoke to complaints having been made as to the quality and the pressure of the gas; and he said he had heard of cases where it had been given up altogether. There was not a sufficient supply for culinary purposes.

Mr. J. Wilde, a stationer and picture dealer, said he had 12 burners in his shop and about the same number in his house. In consequence of the unsatisfactory state of the gas, he tried to improve his light by adopting larger burners; but this did no good, and only damaged his goods. He had two gas-stoves for heating purposes. As soon as the lamps were lit in the streets, the pressure of gas in the stoves was very much reduced; and when, in addition, the churches and chapels were lighted up, it was worse. He had complained of the sulphurous smell of the gas. He considered that the inhabitants were inconvenienced by the Company breaking up the roads at unsuitable times.

Mr. J. T. Richmond, Mr. E. Ibberson, and Mr. H. Ellis gave similar evidence.

Mr. E. Walmsley, accountancy clerk to Messrs. Berry, Robinson, and Scott, Solicitors for the Bill, examined by Mr. BALFOUR BROWNE, said he received instructions to get a general knowledge of the accounts of the Gas Company, with the view of the Local Board acquiring their undertaking. With respect to the dividends paid by the Company, they were shown in his summary, and were as follows: In 1856, no dividend; in 1857, 4 per cent.; in 1858 and 1859, no dividend; in 1860, 3 per cent.; in 1861, 3½ per cent.; in 1862, 4½ per cent.; in 1863, 5 per cent.; in 1864, 5½ per cent.; in 1865, 7 per cent.; in 1866, 8 per cent.; in 1867, 8 per cent.; in 1868, 8 per cent. In 1869 there was a division of £2 per share, amounting to £420, besides which the shareholders received 10 per cent. dividend; making 30 per cent. for the year. With regard to the reserve fund, at the time the 1879 Act was passed, the surplus profits shown in the accounts amounted to £3239. This should have been, if the Company were right, only one-tenth on their paid-up capital of £12,100—viz., £1210. They had, therefore, in excess of this, a sum of £2029. In 1881 they added surplus profits of £542; and in 1882, £301. Therefore, the amount in excess of section 16 of the Act of 1879 was, according to his figures, £2873. The old Acts of 1869 and 1871 did not mention a reserve fund at all. The £2029 was brought forward with the reserve fund under the Act of 1879; and the whole of it was treated really as a reserve fund. In the years 1881 and 1882, when the sums of £542 and £301 were added to the reserve fund, the Company had no right to add anything. So that there were illegal additions to the reserve fund of £843. As to the insurance fund, by section 14 of the Act of 1879, out of the excess of profit on any one year the Company could set aside 1 per cent. on the paid-up capital. This meant £151; and they could accumulate it until the reserve fund equalled 1-20th of the paid-up capital. The first £151 was placed to the insurance fund in the year 1880. They had put money into this fund when there was no excess of profits properly to go into it. In 1881 they placed £151 there; and the same amount in 1882. In 1884 a sum of £151 was placed to the fund. In that year they had to take £636 out of their surplus to pay dividends; and yet the Company put £151 to the reserve fund when Parliament said they should not do so.

The Committee then adjourned till Thursday.

Thursday, June 2.

On the proceedings being resumed to-day,

Mr. Walmsley, further examined, said he had found that the undivided profits of the Company up to the passing of the Act of 1879 now formed part of the reserve. In 1879 the revenue balances commenced with £606; and at the end of 1890 they had accumulated to £3163. The undivided profits consisted of three items, making a total up to the end of 1891 of £9509; and then there was the interest of £61 on the investments of 1891. The ultimate total was therefore £9570. In 1884 there was a sum of £2000 charged to revenue which should have been charged to capital. In 1888 nothing was put down to capital; and there were doubtful items of about £400 which admittedly should have been charged to this account.

In cross-examination by Mr. PEMBROKE STEPHENS, witness said he

considered he had a roving commission to go back to the starting of the Company. He wanted to get at the formation of the capital account. In all cases the yearly accounts had been made out in the form required by the Act of Parliament. One of his employers, who were getting up the Bill, suggested he should go more deeply into section 16 of the Act of 1879.

Witness's report having been put in.

Mr. PEMBROKE STEPHENS remarked that the figures were widely different from those in the summary. The report was made in September, and it appeared that Mr. Walmsley was quite satisfied until somebody suggested he had not properly read one section in the Act of Parliament; and since then he (Counsel) supposed another set of figures had been made out.

Witness: Indeed they have not—not a single figure.

Re-examined by Mr. FREEMAN, witness said that, in order to verify his six years' account, he went back as far as was necessary to get the actual facts from the Company's accounts, and nothing more.

Mr. W. Woodhead, examined by Mr. WAUGH, gave particulars of the gas supply of several places adjacent to Ilkley; and said the charge in this town—3s. 4d. per 1000 cubic feet, with no discount—was 20 per cent. above the averages of its three nearest neighbours.

Mr. T. Newbigging, M.Inst.C.E., examined by Mr. FREEMAN, said that, in his opinion, the purchase of the gas undertaking by the Local Board would be for the general advantage of Ilkley. Of course, its full value should be paid to the Company. He had known hundreds of cases where the private roads had been lighted by the company; but in this instance they had not. He did not think they had shown a liberal spirit with regard to public lighting; and he considered the control of the lamplighters should be in the hands of the Local Board, as it would be for the public benefit. What was wanted was gas of good steady illuminating power, not too high—say, 17½ candles. A good many things in the accounts were reprehensible, and showed that an extreme profit had been made out of the consumers. For 1890 the expenditure on capital account was exceeded by no less than £5171, representing 25 per cent. of the total capital. The balance of the reserve fund and the insurance fund was £8637. There was a half-year's dividend due on the balance of revenue; and if this was deducted, it would come to £3163. He believed that a considerable amount had been taken out of the pockets of the consumers for the purpose of enlarging and extending the works. The Company had sold 410 shares by auction; and it happened to be suspiciously near the time of giving the notice for the Bill. These shares represented a sum realized in the open market of £6726; and this appeared in the Company's accounts for 1891 as if it were expended for recent works. The reserve fund—£4689—which appeared in the accounts of 1890, was an entirely distinct fund from the floating revenue. In the year 1879 this fund stood in the books at £3239; and it was clearly in excess of the sum which the Company were entitled by law to have put away as a reserve. In 1881 they illegally carried no less than £542 to the reserve fund out of the excess profits of the year; and in 1882 they pursued the same policy. In 1879 the Company illegally carried to the reserve fund £2029; in 1881, £542; and in 1882, £302—in all, £2873, or 61 per cent. of the total amount of the fund. The sum required to pay an increased dividend of 1 per cent. on the capital was £151; and to allow the Company to pay this, the price of gas would have to be reduced 4d. per 1000 cubic feet, which, on a consumption of 35 millions, came to £587—making together, £738. That was to say, the Company had to spend £738 by increasing the dividend 1 per cent. They would appropriate £151 themselves, and would give the consumers £587. The Board were anxious to give the full value for the property; and if the Company were paid a fair price, there would be no hardship whatever.

In cross-examination, witness cited the case of Stafford, in 1878, where the compulsory purchase of the gas-works was sanctioned by Parliament, as an instance of a proposal such as that of the promoters. He admitted that there the Company did not oppose.

Mr. C. Gott, M.Inst.C.E., of Bradford, gave corroborative evidence.

This closed the promoters' case; and witnesses were then called for the opponents.

Mr. W. F. Potter, M.Inst.C.E., in examination by Mr. FORBES LANKESTER, said he had lived at Ilkley for ten years, and had paid a considerable sum annually for gas. He had never had occasion to make any complaint as to its quality; and, personally, he was quite satisfied with it. He had had some experience of the gas supplied at Leeds by the Corporation; and he thought the Ilkley gas compared very favourably with it. He had no knowledge of any feeling in favour of the compulsory purchase of the gas-works at Ilkley; and had not heard any strong expressions of anxiety that they should be bought—indeed, he did not remember having heard the question discussed at all. He should say that the public interest in the thing was very slight; and he thought it was undesirable that the Board should acquire such an undertaking. He knew Mr. Wedgwood, the Company's Manager, and had never had reason to complain of want of courtesy on his part; but quite the contrary. On many occasions when he had seen him in connection with the gas supply of his house, he had always been treated with the greatest consideration.

Cross-examined by Mr. WAUGH, witness said his opinion was that the proposed purchase would be a mistake. The Local Board had too much in hand already. Probably the electric light would come into use at Ilkley; and therefore it would be financially detrimental to the ratepayers if the Board acquired the works. On account of its water supply, the town was peculiarly suited for having the electric light.

Mr. W. Crowe confirmed the statement of the preceding witness as to there being no strong feeling at Ilkley in favour of the purchase of the gas-works by the Local Board. He believed the real desire of the inhabitants was that they should be left in the Company's hands, as the Board had sufficient to do at the present time. As to the quality of the gas, witness said he had never had any cause of complaint.

Mr. W. Johnson, a restaurant keeper and confectioner in the main street of Ilkley, said he had lived in the town for 28 years. He had gas-ovens, gas-stoves, and fires in constant use, and paid a considerable sum annually to the Company—from £19 to £22. He had never had any cause to complain of the pressure or the quality of the gas. He had known Mr. Wedgwood for a long time, and had always found him courteous and pleasant. His opinion was that the people of

Ilkley were rather in favour of the Company carrying on the gas-works; there being a feeling that the Local Board had quite enough to attend to.

Friday, June 3.

Mr. W. Wedgwood was called to-day, and stated that he had been Manager of the Ilkley Gas Company for many years. As far as he knew, the Company had always endeavoured to fulfil their duty to the public. No written complaints from the Local Board as to the quality of the gas had ever been received; nor had they had any substantial verbal complaint. There was a difficulty in furnishing a uniform supply of gas in Ilkley, owing to its hilly nature; but this could be remedied by the consumers putting in governors. The witness dealt in detail with the evidence given by the promoters' witnesses as to the complaints made against the Company; saying that as to some of them he had only heard them in the Committee-room, and that generally the defective supply was owing to the size of the service-pipes. Although the illuminating power of the gas was fixed at only 14 candles, the Company actually supplied it of 17.43-candle power.

Mr. C. Beevers, Secretary and Accountant to the Company, said that there had never been a whisper on the part of the Local Board of objection to the manner in which the accounts were kept until the Bill was brought forward. He denied generally that there was anything wrong in the way in which the reserve and insurance funds had been accumulated. As to the floating balances, he could not see, under the Act, how they could have dealt with them in any other way than they did. He believed, too, their way of dealing with them was the most economical for the consumers.

In cross-examination, witness admitted that at the time of the passing of the Act of 1879 the reserve fund was £2029 more than the Company were entitled to under the Gas-Works Clauses Act; but Parliament, in the Ilkley Gas Act of 1879, authorized them to carry forward any reserve they might have.

The CHAIRMAN asked whether there was any doubt that, to a certain extent, large or small, there had been some departure from the statutory requirements.

Mr. PEMBROKE STEPHENS said that before 1879 there was a sum of £2000 more in the reserve fund than the General Act authorized; but he did not go any further than that.

The further consideration of the gas portion of the Bill was then postponed.

Tuesday, June 14.

To-day further evidence was given on behalf of the opponents.

Mr. J. E. Kirby, examined by Mr. PEMBROKE STEPHENS, said he was Manager of the Ben Rhydding Hydropathic Establishment. They were amongst the largest consumers of gas in the district, and paid about £120 a year for their supply. They certainly had no reason to complain either as to quantity or quality. The Manager of the Gas Company had always, in his opinion, been anxious to oblige consumers. The proposal of the Local Board to take over the gas-works against the wishes of the Company, was one to which he (witness) was strongly opposed.

Mr. BALFOUR BROWNE: Why are you strongly opposed to the proposition?

Witness: Because I think it would be wrong for the Board to acquire the gas undertaking when we have a prospect of electric lighting.

Witness was cross-examined in great detail as to local complaints of defective supply which had been brought forward in evidence; but he maintained that, so far as his experience went, the quantity of gas was adequate.

Mr. Greaves, a plumber and gas-fitter, and Mr. Parkinson, a consumer, supported the statements as to the sufficiency of the supply, and expressed their disapproval of the Local Board's project to acquire the gas-works.

Mr. Charles Hawksley was called, and examined by Mr. PEMBROKE STEPHENS. He said he had made himself acquainted with the proposal in the Bill to enable the Local Board to acquire, by compulsory purchase, the undertaking of the Gas Company. He believed there was no precedent whatever for such a transfer being sanctioned by Parliament—that was to say, no precedent for the acquisition of a company's works against the wishes of that company, where there had been no special circumstances to justify its interference.

Mr. PEMBROKE STEPHENS: In your opinion, are there any special circumstances to justify the compulsory transfer of this undertaking?

Witness: None whatever. The works are unusually good for such a place; and the concern has been regulated and controlled in such a manner as to reflect the utmost credit upon the management. I see no possible improvement that can follow from the transfer of the works from the Company to the Local Board. In fact, I do not think the Local Board could manage them better, or even so well, as they are being conducted at present. I think also that the Local Board might be much better employed in seeing that the Company do their duty, rather than in trying to do the work themselves.

In further examination, witness said he attached no importance to the argument advanced in justification of the Bill, that it would prevent the breaking up of the streets. That would continue as heretofore. He had examined the affairs of the Company; and, comparing them with those of similar undertakings, he thought they had been economically managed, and that the works had been properly maintained.

Mr. BALFOUR BROWNE said the witness had no knowledge of a case in which the compulsory acquisition of such an undertaking as that of the opponents had been sanctioned by Parliament. They had such knowledge, and therefore he did not propose to pursue the question.

Witness: I have no knowledge of a case where it has been sanctioned without the consent of the company.

Mr. BALFOUR BROWNE: Your opinion is that, if the works pass from the hands of the Company into those of the Local Board, they will not be so well managed?

Witness: Yes, that is my opinion.

The CHAIRMAN: Are you about to contend, Mr. Browne, on the part of the Local Board, that Parliament has been in the habit of giving such compulsory powers as those sought for here?

Mr. BALFOUR BROWNE: Most certainly, Sir.

Cross-examined as to the adequacy of the supply, witness expressed the opinion that there was no cause for complaint.

Mr. PHILLIPS asked whether the "juggling" with the Company's accounts in the creation of a reserve fund, to which reference had several times been made, would be sufficient justification for Parliament sanctioning the compulsory transfer of the undertaking.

Witness replied that he did not think it would. If there had been a "juggling" with the accounts, there was a remedy in the Courts of Law; and it was unnecessary to introduce a Bill into Parliament to obtain it. He admitted that, if the undertaking were being grossly mismanaged, and it could be shown that the Company were unwilling to improve, there might be some justification for its compulsory acquisition.

Mr. PEMBROKE STEPHENS said this closed the evidence on the part of the opponents.

The room was then cleared. On the public being re-admitted.

The CHAIRMAN said the Committee had been considering the proposals of the Bill with the view of saving time. With regard to the minor points—as to the question of the non-lighting of roads, and the turning out of lights too soon—they did not attach any importance to them; and their decision would not be affected by them. The matter they wished to hear Counsel upon was as to the allegations with reference to the Company's reserve fund and the floating balance.

Mr. PEMBROKE STEPHENS then addressed the Committee on behalf of the opponents. At the outset, he denied that any advantage would accrue to the consumers from the proposed purchase of the gas-works. He contended that there was nothing illegal in the transfer to a reserve fund of the balance existing at the time of the passing of the Act of 1879; indeed, to his mind, there was no other mode of dealing with it. He hoped he had satisfied the Committee that the circumstances of 1879, and those of the passing of the Gas-Works Clauses Act of 1847 were entirely different. He contended that this was, from the beginning to the end, a Local Board Bill, and not a consumers' Bill. Nearly all the witnesses called in support of it, with a few exceptions, were members and servants of the Local Board. Mr. Walmsley's accounts were, he urged, genuine and honest figures from first to last, given with the view of purchase by agreement; and in the report made in September, it never crossed his mind that anything was wrong in them. It was a noticeable fact that it was not proposed in the Bill to pledge the rates of the town at all to raise the money for the purchase of the concern. The Board were to raise it by mortgage of the undertaking. Such a purchase as that was, he asserted, absolutely unheard of. This was a Bill in which, by false pretences, they had got hold of the Company's books; and those books, he submitted, had thoroughly stood the scrutiny to which they had been submitted. The promoters had brought forward a scheme of purchase which, on the face of it, was one that did not cost them a penny. They proposed to make over the gas property to themselves, with the one object of giving themselves the profits; and he said that, looking at the case as a whole, both in law and in fact, and at the way in which the information had been obtained and used, it was an underhand, a mean, and a dishonest Bill, and therefore he hoped the Committee would reject it.

Mr. BALFOUR BROWNE, in summing up the case for the promoters, contended that their case as to complaints of deficient quality and pressure of gas, and "juggling" or manipulation of the accounts, had been fully proved. He submitted that, as to the "juggling," there had been no answer attempted to what he had said in his opening. He said, without hesitation, that there were dozens of cases in which compulsion had been put upon companies in Parliament to sell. The Company had not done their duty to the consumers; and he maintained the time had come when they should part with their property.

The room was then cleared. On the re-admission of the parties,

The CHAIRMAN said: I am desired by the Committee to say that we deem it expedient to empower the Local Board to acquire the undertaking and powers of the Gas Company to supply gas within the present limits of the supply of the Company; but any question as to the extension to Denton must be reserved.

The opposed portion of the Bill having been disposed of, the Committee adjourned till the following day, when the clauses were considered. Those relating to the purchase of the gas-works were passed; the one reserved, sanctioning the extension of the limits of supply to Denton, being agreed to. On the financial portion of the Bill, the Committee gave the necessary power to raise money for the purchase of the works and such further sum for working capital, &c., as the Local Government Board shall approve; the whole amount to be repaid in 30 years.

Water-Works for Standish.—The Local Government Board have approved of the borrowing of £12,000 by the Standish Local Board, for the purpose of constructing water-works for the district.

A Gravitation Water Scheme for Carlisle.—Mr. J. Hepworth, the Engineer of the gas and water works of the Carlisle Corporation, has recently presented to his Committee a report in which he deals with the present system of water supply and with the Cairn, Caldew, and Overwater as sources of supply by gravitation. He states that from 1866 to 1891 the total amount expended on the present water-works was £68,264; and the total amount now owing is £20,120. The revenue from the sale of water has increased from £2808 in 1866, to £7170 in 1891. It is now necessary to provide a new storage reservoir at Newlands, near Carleton, which will cost, with pumping engine, machinery, and mains, £25,000 to £30,000. Of the three sources for a gravitation supply, there can be no doubt as to the superiority of the Caldew. The quantity of the water is abundant and much in excess of the requirements of the city and immediate neighbourhood. The quality of the water is also excellent, as indicated by analyses made by Mr. W. Foster, M.A. The Gas and Water Committee have reported to the Council that they are of opinion (1) that the time has come when it is necessary to take steps to extend and improve the water supply of the city; (2) that such extensions and improvements would be most satisfactorily met by a gravitation scheme; (3) that the Council should authorize them to call in a consulting engineer to advise and report. The reports will be discussed by the Council at their next meeting.

MISCELLANEOUS NEWS.

THE INSPECTION OF GAS-LIQUOR WORKS UNDER THE ALKALI ACT.

The Sub-Inspectors' Reports.

In a recent number of the JOURNAL (p. 1075), we noticed the report of the Chief Inspector under the Alkali, &c., Works Regulation Act, 1881 (Mr. A. E. Fletcher), for the past year. We now give a few extracts from the reports made to him by the Inspectors of the various districts into which the area under his supervision is divided. These are: (1) Ireland, Mr. W. S. Curphey, F.I.C., F.C.S.; (2) North of England, Mr. B. E. Smith, F.I.C., F.C.S.; (3) Cheshire, North Wales, and part of Lancashire, Mr. E. G. Ballard, with whom is associated Mr. J. Affleck, M.A., D.Sc., as an additional Inspector for the Widnes sub-district, comprising Widnes and Runcorn; (4) East Lancashire and Yorkshire, Mr. R. Forbes Carpenter, F.I.C.; (5) South Midland, Mr. E. Jackson, F.I.C., F.C.S.; (6) South-West of England and South Wales, Mr. A. C. Fryer, Ph.D., M.A.; (7) South of England, Mr. Brereton Todd, assisted by Mr. F. N. Sutton, F.I.C., F.C.S. Scotland—divided between Dr. Blatherwick and Mr. W. S. Curphey—is, as usual, the subject of a separate report.

In Ireland there are 20 sulphate of ammonia works, which last year produced 2645 tons of sulphate. The general conditions under which these works are carried on has not changed since the previous report; the noxious gases given off during manufacture continuing, in some of the smaller works, to be destroyed by fire.

In the North of England, there are 34 works employed in the manufacture of sulphate of ammonia; the quantity produced being 4273 tons. In two cases, the liquor results from the condensation of gases from coke-ovens; 575 tons being derived therefrom. Tar, benzol, and naphthalene are also obtained in considerable quantities from the same source. There is one gas-liquor works in the district; but the only operation carried on is the concentration of the liquor. A small amount of liquid ammonia is also made by distillation from sulphate. The Chance-Claus sulphur-recovery process still gives rise to complaint, although the District Inspector acknowledges with pleasure the measures adopted to remedy the defects causing the nuisance. The sulphuretted hydrogen in the residual gases is now burnt in specially constructed furnaces; the final escape taking place by means of a high chimney. Some idea of the enormous volume of gases to be dealt with may be realized from the fact that, in one of the works in the district, 5,040,000 cubic feet of mixed air and sulphuretted hydrogen are disposed of every 24 hours, and the weekly output amounts to 200 tons of sulphur. There are in the district two Claus sulphur-recovery plants, both attached to plant for the manufacture of sulphate of ammonia. The output of sulphur is small; and the exit gases are successfully treated by a lime tower and an oxide purifier.

In the portion of district No. 3 which is under the supervision of Mr. Ballard, two new works for the manufacture of sulphate of ammonia have been added since the previous report. At one of the older works, the continuous system of distillation has been substituted for the intermittent process. With one exception (and in this case a prosecution was instituted), he always found the works in good order when he visited them. Of the works manufacturing sulphate of ammonia (some of which are registered as manure works) there are 12 working on the continuous, and 14 on the intermittent system of distillation; 17 absorb the sulphuretted hydrogen by an oxide purifier; 8 burn it; and in one case it is converted into sulphur in a Claus kiln. The total quantity of sulphate of ammonia made in the district (excluding the Widnes and Runcorn sub-district) last year was 2878 tons. A large portion of Mr. Affleck's report is devoted to the Chance-Claus process for the recovery of sulphur from alkali waste. By it there were recovered last year 21,041 tons of sulphur, and 10,400 tons of sulphuric acid; but the latter is no longer made—the production of sulphur being found much more profitable. The few works in which salts of ammonia are produced in the district remain as before. No changes were effected in the plant; and there were no complaints of nuisance. The production of sulphate and muriate of ammonia amounted to a quantity equal to 909 tons of sulphate.

The number of gas-liquor works registered in Mr. Forbes Carpenter's district decreased by one last year; and one fresh works was started. The total quantity of ammonia manufactured into sulphate, muriate, and liquor ammonia (crude and refined) was equivalent to 24,700 tons of sulphate of ammonia. Of the methods used for dealing with the waste gases, absorption by oxide of iron in open purifiers is adopted in the large majority of works; but combustion to sulphur dioxide as a source of supply to the vitriol chambers, where these exist, still continues a favourite method, and obtains with 36 per cent. of the sulphate of ammonia made—oxide being used with 46.5 per cent. The Claus process is in use in four works, where it is well liked and successfully worked. It can only be employed to advantage in large works having continuous plant in full operation during the week. Plant of the continuous type is steadily replacing that of the intermittent kind. Only 7 per cent. of the total sulphate made is manufactured by plant of the latter description. In the continuous plants, the evolution of foul gases, being more steady and uniform, enables these to be dealt with more advantageously, especially where they pass to the vitriol chambers, in which process regularity of supply is absolutely essential.

Mr. Jackson reports that, in the South Midland district, the manufacture of either sulphate or muriate of ammonia was carried on last year in 69 works; being a net increase of seven, as compared with 1890. In eight works, the resulting sulphuretted hydrogen is burnt for the production of oil of vitriol—an operation which, he says, is attended with obvious advantages. In four works, the Claus process is used, with a final limestone scrubber and an open oxide purifier. In these works the purifying arrangements have been found ample for effectually preventing the escape of noxious gases, although the proportions of sulphuretted hydrogen and sulphur dioxide leaving the chambers have been found exceedingly variable. Referring to the cost of working the various processes now in use for dealing with the

former gas, Mr. Jackson says it is interesting to know that at least at one sulphate of ammonia works in his district using the Claus apparatus, where the figures have been very carefully gone into, the entire expense of purifying the noxious gases has been covered by the sale of the recovered sulphur—leaving a balance on the right side. This cannot, he fears, be said of oxide purification, as, with a large make of sulphate of ammonia, the cost of labour, &c., in emptying the purifiers, becomes an important factor. In two works the noxious gases are still passed into the hydraulic main; in two others, lime is used in the purifiers; and in the remainder, the usual method adopted is the open oxide purifier. Three works have added coke scrubbers to the condensing plant, for more effectually drying the gases passing to the purifying apparatus. There are 14 works in which this form of condenser is now used. The gradual extension of the continuous method of distilling gas liquor in place of the intermittent plan, has again to be noted. The disposal of the spent liquor and the highly offensive water from the condensers gave much trouble last year in several places. In many works, this water has hitherto been mixed with the limed spent liquor, which, after settling and cooling, has been allowed to pass into the watercourses or sewers. Its elimination must now be looked upon, however, as a very advisable precaution; and after this has been done, in most cases the spent limed liquor settled and cooled is deemed sufficiently purified. At several works, where the soil has been suitable, a large reservoir has been made, into which the liquors are run and allowed to filter away, and are thus supposed to be gradually purified; but, Mr. Jackson says, the special circumstances and surroundings have to be well considered before such a plan can be recommended. In one case, where this method of disposal was adopted, it had to be abandoned. Such are the special difficulties experienced at two works, that all the spent liquors are evaporated. In all cases it is safer and better to treat the water separately. There are two plans frequently used in the district. In many sulphate of ammonia works attached to gas-works, it is conveyed to the ash-pits under the retort-beds, and so evaporated; the offensive steam passing through the heated flues, where the noxious gases are burnt. Another plan employed at several of the large works is to return the water to the still; the sulphuretted hydrogen contained in it thus passing on to the purifying apparatus. This method is a most satisfactory one from the point of view of diminishing nuisance, as it effectually disposes of all the sulphuretted hydrogen generated during the distillation; but the necessary increase in fuel rather makes against its general adoption. The most notable improvement in this class of works during the year was in one where the special difficulties of the case, consequent on the varying composition of the gases with admixture of air, required most careful investigation and consideration. Year by year advance has been made, and many methods have been tried; and now Mr. Jackson is pleased to report that a plan has been devised, and plant erected at considerable cost, whereby the noxious gases are satisfactorily dealt with. Six new sulphate of ammonia works were erected last year, particulars of which are furnished.

Coming to the district embracing the South-West of England and South Wales, we find Dr. Fryer reports that there are 65 registered works where the manufacture of muriate and sulphate of ammonia is carried on, and these produced last year 6900 tons of ammonia salts. A new plant was erected at one works; and the man in charge being not sufficiently acquainted with the details of its working, a serious escape of sulphuretted hydrogen took place. The town authorities, and also the owners of the works, at once communicated with the Inspector, whose suggestions were carefully attended to; and no further nuisance has been complained of. At another works the man employed at the saturator suffered from inflamed eyes, and was unable to attend to his duties for several days. The saturator was in good condition; and Dr. Fryer thinks the illness of the attendant may have been caused by the action of sulphuretted hydrogen and steam upon his eyes. A similar case was noticed in the previous report in the Manchester district; and Mr. Carpenter, after giving some details, added: "It would appear that when the saturator, from the open side of which the salt is fished, is working under much back-pressure (4 to 5 inches of water), and at the same time the acid used is not free from nitrous compounds, the sulphuretted hydrogen will discharge itself, as will also nitrous gases when present in quantity, from the open surface of the liquor. Neither cause seems sufficient in itself, unless aided by the other, to produce this reaction." Various modifications of the simple form of oxide of iron purifier which Mr. J. J. Jervis first made use of at the New Swindon Gas-Works* are now in operation. This simple heap of oxide of iron was found to work effectively at several of the smaller works; and now the Bath Gas Company have given it a trial for twelve months, with the result that the Manager (Mr. C. Stafford Ellery) is so well satisfied that he has removed the ordinary enclosed form of purifier.

In the Southern district, the portion supervised by Mr. Brereton Todd contains 37 works for the manufacture of sulphate of ammonia. In every case the sulphuretted hydrogen evolved in the distillation process is dealt with in an efficient manner. Two of the largest works use the Claus sulphur-recovery process; and the waste gases from the depositing chambers are finally absorbed in limestone towers and oxide purifiers. In one works the sulphuretted hydrogen evolved is burnt, and the resulting sulphurous acid is passed into the vitriol chambers, where it is utilized for making acid. Only one other works burns the foul gases; and this is done efficiently in a special furnace—the sulphurous acid being allowed to pass up the chimney. All the remaining works, after thoroughly cooling and condensing the watery vapour in the foul saturator gases, absorb the sulphuretted hydrogen in oxide of iron purifiers. Many of the close saturators are being replaced by open curtained saturators, from which the salt is fished direct. This does away with the unpleasant smell of the steam produced during evaporation, and is at the same time a more economical method. The total quantity of sulphate of ammonia turned out during the year was just over 5000 tons. In Mr. Sutton's portion of the district, the 39 works produced 33,535 tons of sulphate. There were two additional works; and the production was 1227 tons in excess

of that of the previous year. The Inspector deals rather fully with this branch of his labours. In the course of his remarks, he says: The proportion of sulphate made by gas-works shows a large augmentation; while there is a falling off in that produced by private distillers. This is accounted for by the fact that most of the gas-works show an increased quantity of coal carbonized, and also that one large London works and two small provincial works, which have hitherto sold their liquor, have now erected and started sulphate plants of their own. Of the total quantity of sulphuretted hydrogen evolved in the process of the distillation of gas liquor for sulphate making, the very large proportion of 76.5 per cent. is burnt into sulphurous acid and utilized for the manufacture of sulphuric acid; 12.8 per cent. is burnt and allowed to escape into the air as sulphurous acid; 5.5 per cent. is absorbed in oxide of iron; and 5 per cent. is treated by the Claus sulphur-recovery process. The utilization of the sulphuretted hydrogen for sulphuric acid making has again been carried out most successfully; but the quantity burnt and allowed to escape into the air without recovery is far too large. The comparatively small quantity absorbed in oxide of iron—5.55 per cent. of the total production—represents that evolved from no less than 24 of the 39 works producing sulphate of ammonia; so that it is obvious that the majority of the small works resort to this method of dealing with the foul gases. It is undoubtedly the best and safest one to employ. In most of these works, the cooling and purifying space in use is sufficient; and, speaking generally, I have been well satisfied with the condition in which the purifiers have been found. Instances have occurred where they were found to be showing signs of exhaustion; but I have had no case where more than a word of caution has been required. The Claus sulphur-recovery process has been in operation at three works. Tests of the gases leaving the chambers have been made in all cases from time to time; and very variable results have again been shown. It seems an exceedingly difficult matter to adjust the air supply to the theoretical quantity required. At times the waste gases are almost harmless; but frequently comparatively large quantities of either sulphuretted hydrogen or sulphurous acid, or both together, are found escaping. In each case they are effectually absorbed in limestone towers and oxide purifiers. The most recently erected plant has been under very careful and constant supervision during the 20 months it has been working; and the results have been much more satisfactory than in the other two cases. At one works the use of lime for decomposing the fixed ammonia salts has been given up in favour of caustic soda. The cost of the latter, when considered in relation to the amount of work it is capable of doing, is less than that of lime; and its use has the further advantage of being more cleanly, with less probability of blockage in the liming vessel and overflow pipes, and the entire removal of the necessity of settling-pits for ridding the spent liquor of lime sludge. There can be little doubt that the substitution of caustic soda for lime would in many other cases lead to economy in time, trouble, and cost. The plant at many of the works has undergone renewals and improvements; and the two new sulphate works which have been registered are both provided with continuous stills and oxide of iron purifiers. The quantity of sulphate of ammonia made by the continuous method of distillation increases year by year; and it has now reached 97.2 per cent. of the total amount produced in the district.

As already mentioned, the statistics relating to Scotland are given in a separate section of the report. The number of works registered last year was 137, of which 16 were alkali works, and 121 were other works coming under the classes named in the Alkali Act. In those in which sulphate of ammonia is made, the production last year was as follows: Gas-liquor works, 11,306 tons; shale-works, 26,600 tons; iron-works, 5790 tons—total, 43,696 tons. The total for 1890 was 39,689 tons, made up as follows: Gas-liquor works, 10,395 tons; shale-works, 24,730 tons; iron-works, 4564 tons.

MOSSLEY CORPORATION GAS SUPPLY.

The Attack on the Chairman of the Gas Committee and the Gas Manager.

In the course of the brief notice of the proceedings at the meeting of the Mossley Town Council which appeared in the JOURNAL for the 24th ult. (at which meeting the annual accounts of the Gas Committee were submitted), mention was made of some insulting remarks which had been uttered by one of the members of the Council (Mr. Jones) concerning the Chairman of the Gas Committee (Alderman R. S. Buckley) and the Gas Manager (Mr. R. Merrell). Alderman Buckley and Mr. Mitchell on that occasion accused Mr. Jones of having used, and they were both ready to prove that he had used, the words "damned frauds" in reference to the Gas Manager and the Chairman, and also with having made use of an expression in relation to the gas-works and management as a "Hunter and Lever business." The matter came before the Gas Committee on the 6th inst., when they passed the following resolution: "That the members of the Gas Committee hereby express their entire disapproval of the scurrilous and unprovoked attack made by Councillor Jones on the character of Mr. Richard Merrell, the Gas Manager; this attack they believe to be perfectly groundless and uncalled for. They desire further to place on record their complete confidence in the honesty and integrity of their Manager." This vote of censure was included in the minutes, which were submitted by the Committee at the meeting of the Town Council last Thursday week. Referring to the matter, in moving the confirmation of the minutes, Alderman Buckley said that, if the remarks which had been made had concerned himself alone, the members would not have heard another word on the subject; but, coupled with the observations and attacks made, there was the name of their Gas Manager, who naturally felt very uncomfortable under the accusations. He (the Chairman) believed him to be a faithful, honest, and worthy public servant, and his character had been attacked not in the newspapers but by individuals in that neighbourhood—individuals in that Council. That being the case, he thought that, when those attacks were made, they had a right, and it was their duty to protect their servants, and at any rate to pass a resolution expressing their confidence in him. Mr. Merrell was very anxious, his family was anxious, and his brother gas managers all over the country were anxious about the

* The sulphate plant devised by Mr. Jervis was described and illustrated in the JOURNAL for March 27, 1888 (p. 553).

matter; and as the report had been carried the length and breadth of the land, they naturally expected some justification about the reports which had been made. There was no better justification than to pass the minutes of the Committee. There had been no attempt to withdraw anything on Mr. Jones's part, and no attempt to apologise after being asked to do so; had he done so, no doubt the matter would have ended. Mr. Jones requested Alderman Buckley to state what constituted the scurrilous and unprovoked attack. Alderman Buckley replied that the first words he had used were that the Chairman and Manager were "damned frauds." Mr. Jones denied that he had used that expression; but Alderman Buckley told him there was ample proof that he did employ it. Then at a recent meeting in the Corporation offices, he had made use of the words: "There is no Hunter and Lever business about me." He would leave the Council to judge what was the occasion for the use of these words. An amendment was moved by Mr. Clementson to the effect that the resolution referring to Mr. Jones should be deleted, and the following resolution, which he had himself proposed at the meeting of the Gas Committee, but which was not then agreed to, should be inserted in its place: "That this meeting pass a vote of confidence in the Gas Manager for his honesty, straightforwardness, and good qualities as Gas Manager, and that the Committee have every confidence in him, notwithstanding the adverse statements made in some of the papers." The Town Clerk intimated that they could not substitute one motion for another, without referring it back to the Committee; and Mr. Clementson then altered his amendment to read: "That the minutes pass with the exception of the motion made by Alderman R. S. Buckley." Mr. Jones said, now it was defined as to whom his observations were said to apply, he desired to state to the Council that, when he made those statements at the general meeting on May 9, they did not refer to the Manager of the gas-works; and, therefore, he did not, nor had he any desire to, cast any aspersion on the conduct or character of Mr. Merrell. Mr. Mitchell strongly urged the Council to protect the Gas Manager, and to pass the resolution. Alderman Buckley having replied, the amendment was put to the vote and lost, and the motion was carried by a large majority. Since this meeting Mr. Jones has addressed a letter to a local newspaper, in which he compares the working of the Mossley and the Stalybridge gas undertakings; but, whatever the results may be, they cannot justify the language used by him as recorded above.

BINGLEY IMPROVEMENT COMMISSIONERS' GAS SUPPLY.

Annual Statement—Reduction in Price.

In moving the adoption of the minutes of the Gas Committee at the meeting of the Bingley Improvement Commissioners yesterday week, Mr. Gatecliff, the Chairman, made a statement giving a comparison of the results of the operations of the gas-works during the past two years, and also of the condition of the works in 1875 and at the present time. The gas produced in 1891 was 57,452,500 cubic feet, and in 1892 57,084,300 feet; while the amount sold was 53,264,200 and 53,968,200 feet respectively. The receipts from gas in 1891 were £8755; and in 1892, £9342. The profit in the first-named year amounted to £491; and last year to £726. The Committee proposed a reduction of 2d. per 1000 cubic feet; but they did not think it advisable that it should apply to the outside districts. These districts consumed 30 per cent. of the total amount of gas made; and if charged according to the average cost of mains and consumption of gas, they would proportionately pay 5s. 1d. per 1000 feet, against 3s. 4d. by the consumers within the Commissioners' district. The estimated profit for the present year was about £490, which would be sufficiently large to allow of the reduction. Turning to the condition of the gas-works in 1875, Mr. Gatecliff said that the value of the gas plant was then £18,000; the capital sunk, £49,507; the length of mains, 10 miles; the gas made, 32,318,200 cubic feet; the average price, 4s. 9d., with 5 per cent. discount; the amount of interest paid, £1763; the amount of sinking fund, £904; the gross profit, £564, or a loss of £340. In 1892 the gas plant was valued at £36,510; the capital employed was £26,131; the length of mains, 23 miles; the amount of gas made, 57,084,300 cubic feet; the price, 3s. 4d. per 1000 feet, with 15, 17, and 20 per cent. discount (gas for cooking and heating purposes being sold at 2s. 4d. per 1000 feet net); the interest paid, £1076; the amount of sinking fund, £1166; and the net profits, £726. Since 1875, besides paying interest on the capital, the gas-works had raised toward the rates and in reduction of capital a sum of £32,222. He thought if the undertaking continued to prosper as much during the next twelve or thirteen years, they would have plant valued at £40,000, the whole of the capital would be paid off, and they would be able to reduce the price of gas 1s. per 1000 cubic feet, and allow 15 per cent. discount. The minutes were duly adopted.

Sale of Shares.—Mr. H. Warren lately offered for sale by auction at Winchester £2500 of additional nominal capital in the *Winchester Gas and Water Company*, divided into 100 shares of £25 each, the dividend on which will not exceed 7 per cent. The amount realized was £3947 10s.; the average price per share being £39 9s. 6d.

Newcastle (Staffs.) Corporation Gas Supply.—At the last monthly meeting of the Newcastle (Staffs.) Town Council, the Management Committee recommended that £1350 be paid out of the profits of the department to the Urban Sanitary Authority. The Mayor (Mr. W. O. Briggs), in moving the confirmation of the minutes of the Committee, said there had been a moderate but steady increase in the business. The augmentation in the quantity of gas supplied had not been so large as in the previous year; but they had not had such a severe winter. There had also been a steady advance in the price of residuals. The expenditure for coal and purifying materials had been heavier, and labour had cost more. With regard to the last point, his Worship mentioned that two years ago the Council decided to increase the scale of pay; and the effect had been to raise the amount paid during the past year by nearly £200. After providing for payment of the interest on the bonds and income-tax, and also discharging their annual payment to the sinking fund, there was available for distribution £1518, as against £1448 in the preceding year. The minutes were confirmed.

LONDON COUNTY COUNCIL.

Electric Lighting of the Embankment—London Water Supply.

At the Meeting of the London County Council last Tuesday, the Highways Committee presented a report on the proposal to substitute electricity for gas in the illumination of the Thames Embankment. They recommended that it be referred to the Highways Committee to carry out, at a cost not exceeding £10,000, an electric installation, with the necessary plant for the lighting of the carriage roads, footways, and parapet wall of the Victoria Embankment. The consideration of the matter was adjourned for a week. On the same occasion, the Special Water Committee reported that, the Royal Commission on the Metropolitan Water Supply having expressed a wish to be furnished with some indication of the views of the Council on the subject of the inquiry, a memorandum had been prepared by the Deputy-Chairman of the Council and carefully considered by the Committee in conference with him. It was based on resolutions passed by them after due consideration of tables prepared by the Engineer (Mr. A. R. Binnie, M.Inst.C.E.) with reference (a) to the number of years upon which estimates, having regard to the future water supply of London, should be based; (b) the population for which provision should be made; and (c) the quantity of water which should be supplied per head per day. The views which they entertained on these points would, no doubt have greater weight with the Commission if the matter were considered by the Council. They therefore recommended the Council to confirm and adopt the following opinions and conclusions expressed therein: "(1) That, in making any estimates having reference to the future water supply of London, such estimates should be based on a period of 50 years from the present time; (2) that, in dealing with the question of a source or sources of water which shall meet the requirements of London and its neighbourhood for 50 years, provision should be made for supplying a population of at least 12,500,000; (3) that, in calculating the quantity of water required per head per day, the amount at present supplied by the Companies should be increased by at least 10 per cent., and in no case should it be less than 35 gallons." The recommendation was agreed to.

THE ELECTRIC LIGHTING QUESTION AT WORCESTER.

The Worcester City Council, at their last meeting, had a further debate on the question of electric lighting; but it appears that they are still undecided as to the extent of the proposed installation. Alderman Hill moved a resolution in favour of accepting the tender of the Brush Electrical Engineering Company, subject to obtaining the sanction of the Local Government Board; but delaying the actual settlement of the contract pending the receipt of a report from the Watch Committee as to the proportions which should be accepted, and especially as to (1) whether provision should be made for steam power only, or steam power and water power combined; and (2) the provision to be made for street lighting. In the course of his remarks in support of the motion, Alderman Hill stated that, if street lighting were undertaken, the extreme cost of the Brush system would be £22,630; and they would get a production of 450,000 volts. In the case of the Electrical Storage Power Company, the cost would be £23,699; and the production, 396,000 volts. The motion was seconded; and then Mr. Millington questioned the impartiality of their electrical adviser (Mr. Preece), who, he alleged, had been exceedingly careful to state everything he possibly could in favour of the Brush Company; but had been just as careful to omit to state things in favour of the Electrical Power Storage Company. During their visit to Bath, the members of the Council did not see an electric light. They only saw a dirty, greasy station; and there they found five or six engines doing nothing. At Bournemouth the members certainly saw a pretty little station; but he believed the engineer in charge left there about two months ago, really because he was tired of complaints, and was continually worried. He pointed out that the Committee had not applied to corporations for information with regard to the light, but to private companies. They obtained some particulars from Bournemouth, but that was practically the Brush Company, who were also interested in the works at Bath; and it was not at all likely that they would stultify themselves in the information they gave. Mr. Corbett, Alderman Airey, and Mr. Chaplin opposed the motion; the last named gentleman remarking that they ought to accept the tender of the Electrical Power Company, as their system was safe, and could be worked in an economical manner, Alderman Day expressed the opinion that the lighting at Bournemouth was extremely good; and as to the installation at Bath, the members visited the station at midday, when it was not necessary for the machinery to be at work. Mr. Wood said he should vote against the motion, on the ground that it appeared to him to be probable that the scheme, instead of being a source of revenue, would cause considerable loss for many years to come. On the motion being put to the vote, 28 members declared in favour of it and 10 against it. A meeting of the Watch Committee has since been held, at which it was referred to a Sub-Committee to consider and report as to which portions of the work should be proceeded with.

The Purchase of the Ipswich Water-Works.—A special meeting of the Ipswich Town Council was held last Tuesday, to receive a report notifying that the Bill promoted by the Corporation for the purpose of empowering them to acquire the water-works had received the Royal Assent. Arrangements, it was stated, had been made with Messrs. Gurneys, Alexander, and Co. to issue the stock at a price within the limit mentioned in the last report of the Committee (see *ante*, p. 1133), subject to the passing of formal resolutions by the Council. These sanctioned the creating of stock, in two sums of £213,700 and £1350; the minimum price to be 95 per cent., the dividend to be at the rate of 3 per cent. per annum, and the first dividend to be paid on Dec. 23. The sum of £213,700 will be redeemable in 1952, and the £1350 in 1907. The resolutions were agreed to; and a Water-Works Management Committee was appointed.

THE METROPOLITAN WATER SUPPLY COMMISSION.

Monday, June 20.

(Lord BALFOUR OF BURLEIGH, Chairman; Sir G. B. BRUCE, Sir A. GEIKIE, F.R.S., Professor DEWAR, F.R.S., Mr. G. H. HILL, M.Inst.C.E., Mr. J. MANSENGH, M.Inst.C.E., and Dr. W. OGLE, Commissioners.)

On the re-assembling of the Commission to-day, further evidence was given as to the River Thames.

Mr. G. J. Symons, F.R.S., was the first witness called. He said he had devoted a great deal of time and research to studying the rainfall over the watershed of the Thames; and not merely the Thames, but of the country generally. He put in a statement upon the rainfall over the Thames and Lea; mentioning that the very large area of the watershed of the former river and the immense number of rainfall records which had been kept within it rendered it necessary to find some mode of giving the results in a compact form. After much consideration, he had adopted a method in which the values quoted rested upon 10 consecutive years' observations, and in which nearly all were not merely the average of 10 years, but of a 10 years of which the average represented very closely that of 40 years—that was to say, the ten years chosen were neither a dry nor a wet period. In the first table in the statement was given the mean rainfall during the consecutive years from 1850 to 1889 at ten widely-spread stations; and in subsequent columns, the averages of their ratios to the 40 years' means for the same stations for three different groups of years. The period from 1860 to 1865 was quoted, because it was the first for which anything like a trustworthy average could be given for the whole country; and it was to be seen that, excepting Sussex, the ratios were low. The average of all was 97; therefore this period had 3 per cent. less than the average of the 40 years already mentioned. To put it in another form, during the six-year period there was annually about an inch less rain over the Thames watershed than during the average of the 40 years. Witness supplemented the explanations in his statement of the three tables—viz., Table I., which represented the relation of the rainfall in various periods to the mean of the 40 years from 1850 to 1889; Table II., which gave the mean rainfall at 145 stations in and adjacent to the watershed of the Thames and its affluents above the Nore; and Table III., which stated the fluctuation of rainfall in the Thames watershed.

In reply to Sir A. GEIKIE, witness stated that the heavy rainfalls were, as a rule, very local, and that the greatest rainfalls came down during thunderstorms. In such cases, over a small area—perhaps 1 mile square—they might have up to 3 inches in a couple of hours; if the fall came over the whole basin of the Thames, it was not often they had more than 1 inch in 24 hours. But he had not looked specially into this for the purposes of the inquiry.

Dr. A. Ashby, Medical Officer of Health for the borough of Reading, next gave evidence. His investigations for the purposes of the inquiry were, he explained, confined to the Thames and its tributaries between Hampton and Oxford; and, referring particularly to Oxford, Uxbridge, and Watford, he stated that he found much pollution. At Uxbridge, the effluent, even when diluted with river water, was very offensive. The sewage was delivered under water. He took a sample of it mixed with the river water, and sent it to a chemist; but he had not yet received the analysis. At Oxford, he found the effluent very foul; and the bed of the stream into which it went very bad indeed. At Watford the effluent went off into the river, likewise in a very foul condition; and there was a large deposit of offensive sludge in the bed of the river. Questioned as to the tests he applied, witness remarked that what he saw and smelt was quite sufficient, as far as he was concerned, to make known the character of the effluent. It was excessively foul, and gave forth a very offensive odour. These pollutions, he allowed, might be less on some occasions than on others; but he was fully persuaded that they were of a permanent kind, and that what he saw was a fair average of what was continually to be seen. Where the foul deposits in the streams remained for some time, there was great danger to the community. Further, he considered that no amount of supervision, without permanent works to remedy this state of affairs, would get rid of the danger.

The CHAIRMAN requested the witness to explain what pollutions he regarded as absolutely dangerous to health, and which might be classified as not dangerous—only nasty.

Witness said there was no doubt that, where human excreta were discharged into the sewers, there was most danger. From slop pollutions there was, as a rule, less; though he could not consider there was no danger from this. Being requested to say whether laundries, tanneries, fellmongers' yards, breweries, and paper-mills were inimical to health, witness added that he thought the tanneries and the fellmongers' yards were the most dangerous; and he likewise observed that the effect of the flow of a river on pollutions could not be relied upon to get rid of the danger from them.

The CHAIRMAN remarked that the witness, in his statement sent in, did not give the Commissioners any details about the effluent from the Reading sewage farm.

Witness said, as a rule, it was very fair. Of course, at times there were more or less impure emissions from it.

You have an opportunity of seeing that constantly. What is the worst you can say of it?—I think I may say of it the same as might be said of any sewage farm—that there may be times when there is not the purest effluent, when more or less impure matter goes out.

Is the result of your experience this—that no sewage farm is so perfect as to make it right for populations to use, as drinking water, a stream into which the effluent of the farm goes?—I think there is danger in the effluents from all sewage farms.

Is your opinion this, if you think it fair to express one, that the populations on the upper reaches of a river should be prevented from putting anything into it to pollute it, or that the lower populations should cease to use it as a water supply?—I think the right use for a river is, besides being a waterway for pleasure boats and for barges, to receive the sewage from places on it after the sewage is treated as perfectly as possible.

Then it is rather that Reading should pollute the river than that London should drink out of it?—That Reading should do the best not to foul the river, but should have the right to send its purified sewage into it.

The same would apply to the streams above the intake of the Reading Water-Works?—Yes.

Do you think Reading should continue to use Thames water?—I have expressed an opinion about that; but it has not been taken.

Questioned regarding the number of house-boats on the Thames, and as to a discrepancy between his written statement and that of the Thames Conservancy on the subject, witness said his source of information was very reliable, though private; and he put the number of the house-boats down as 240, and the number of steam-launches as 646. The Conservancy stated that the former numbered 167; and the latter, 393. Generally, he added, there were now no water-closets on the house-boats—they had earth-closets; but he could not believe that the contents of these were always deposited on shore. The temptation to get rid of refuse in the easiest and readiest way was, with the majority of people, too great for that.

In reply to Sir G. B. BRUCE, witness gave it as his opinion that works of sewage purification might be carried out so as to make the effluent perfectly fit to go into a river; but so much depended upon continual care, that he could not help thinking there must, even then, be times when the effluent was of a character to make it undesirable to take a water supply from the stream into which it went. Moreover, he looked upon the character of a water supply as upon that of a chain. The strength of a chain depended upon its weakest link; so a water supply should be judged at its worst, or in the circumstances of its greatest danger.

You are Medical Officer of Health for Reading. Have you any tangible evidence of injury to the inhabitants of the borough owing to their drinking the water with which they are supplied?—No; I have not.

Comparing, at the instance of Sir G. B. BRUCE, the effluent at Oxford with that at Reading, and referring to the treatment of the sewage at both places, witness pointed out that in that treatment a great deal depended upon the nature of the land where it was carried on. One piece of land might, he said, produce a purer effluent than another.

Sir G. B. BRUCE: But you consider that the water of no river which receives the drainage of towns or on which people live ought to be used for drinking?

Witness: I think it is undesirable, and what I should call unsafe.

The unsafeness of which you speak is not based upon your experience, is it, but is a theory?—There are instances where the use of river water for drinking has spread disease.

In reply to Mr. HILL, witness stated that he had no information as to the death-rate of the various places mentioned in his statement sent in, as he was not charged with inquiring into the sanitary condition of the places themselves. Of course, the sewage farms might be very excellent things for the towns that had them; and no doubt Oxford, and Reading too, had immensely benefited by their sewerage systems. Yet there was room for still greater improvement at these, as well as the other places he had visited.

Interrogated by Dr. OGLE, witness admitted that some of the pollutions to which he had referred in the statement he had sent in were excessively slight; but he explained that his statement gave the minimum amount of pollution of the Thames, because, from the nature of the investigations he had made, it must have happened that some sources of pollution had been overlooked by him. There was danger to health from taking a water supply from a stream that was polluted by cattle. At the same time, he had no evidence, nor had he read any, of fever or disease being propagated through the drinking of water polluted in this way. But the possibility of it was a matter which ought to be borne in mind when they were dealing with questions of water supply. Further, it was difficult, if not impossible, to say that streams on the borders of which populations resided were polluted only by cattle. There was always a chance of human excreta reaching them.

In answer to Sir A. GEIKIE, witness mentioned that he undertook the examination, the results of which he had given to the Commission, at the instance of the London County Council.

The CHAIRMAN asked if he was to take it as the opinion of the witness that it was impossible so to purify the Thames as to make it a safe source of water supply for the populations on its banks.

Witness replied that there were so many chances of pollutions of rivers that, with the best precautions and control, he could not think they were very safe sources of water supply.

Dr. G. H. Fosbrooke, Medical Officer of Health for the County of Worcester, gave the results of an examination by him of the Thames above Oxford. They went to show that, in the upper basin of the river, the substratum was very porous, and allowed of much of the sewage soaking through; but that some of the places where the sewage was disposed of were near the Thames, and so were conjectural sources of pollution.

At the close of this witness's evidence,

The CHAIRMAN remarked that what had been stated would have the most careful consideration by the Commissioners, and that perhaps local investigation at their instance would follow.

The Commissioners then adjourned till the next day.

Tuesday, June 21.

Dr. E. Frankland, F.R.S., was the first witness called to-day. In answer to the CHAIRMAN, he said that, although he appeared to give evidence at the request of the London County Council, the views he desired to express were entirely his own private opinions, and the Council were not at all responsible for them. Last year, when the Council were promoting a Bill in Parliament to enable them to treat with the London Water Companies in order to deal with the question of the water supply, they requested him to undertake a series of analyses on the Rivers Thames and Lea above the Companies' intakes, and also of the waters as delivered in London. The investigation he made was more complete, and more frequently repeated, than the one he conducted for the Local Government Board; his observations and analyses extending over a period of six weeks in the spring of last year. He had been requested at that time to draw up a proof, to be

placed before the Parliamentary Committee; but as the Committee declined to go into any question of quality, he was not examined on the point. The opinions he was prepared to give to the Commission would be based upon the information gained at that time, in addition to particulars to be gathered from a series of analyses made by Mr. Dibdin, the Chemist of the London County Council.

Professor DEWAR: With regard to the drainage of manured land and the effluents from sewage works, and even raw sewage itself, have you recently had any occasion to observe the character of the sewage effluents passing into the Thames?

Witness: I have had no opportunity of examining, as far as I remember, any sewage effluent passing into the Thames, of late years.

So that you are not conversant with the sewage treatment of the different areas, and whether it has been effective or ineffective?—No. There is found in water a great deal of animal matter which is generally innocuous, but is, I think, sentimentally objectionable. The drinking of liquid which has formed part of sewage, although it might be altered chemically to a considerable extent, might be occasionally dangerous, from the presence of zymotic disease amongst the persons contributing to the sewage.

Questioned as to whether he had considered the probability of pathogenetic germs being in the water delivered in London, witness said that at the present time he was engaged in a series of observations which would, he hoped, throw more light upon the subject. It was a point which still required a considerable amount of investigation. Of course, if they had any process of filtration which would remove every germ from the water, this would be almost an absolute safeguard; and there would then only be the sentimental objection. He had recently experimented on the water as it issued from the filters of the various London Water Companies drawing from the Thames and Lea; and he confessed that he had been somewhat astonished at the result. Instead of getting hundreds of microbe germs per cubic centimetre, he found in some cases only 4, and the maximum was only 24. These observations had only been made once; and it remained to be seen whether further investigations would confirm this result. It was obvious that the safeguard of filtration depended upon the number of microbes passing the filter-beds. At the same time, a single germ which passed through might multiply enormously, and affect the water flowing in the mains of London. There was no doubt that the germs did multiply in this way. If, however, many thousands, or tens of thousands, of microbes or their germs were removed from water, leaving only one, or even four, it was extremely unlikely that amongst those four there would be a pathogenetic germ.

Professor DEWAR: The amount of purification with regard to these microbe organisms reaches 88 or 89 per cent., does it not?

Witness: Yes; about that.

Assume that it reaches (say) 98 per cent., have you considered, as a mere question of probability, providing these two were specific organisms of an objectionable kind, what would be the chances of their escaping?—I should think, apart altogether from the possibility of after-development, the chances of their getting through the filter would be very small.

Have you yourself made any attempt to distinguish between the pathogenetic germs and the harmless germs in London water?—No; I have been rather deterred from doing so from the fact that an exhaustive examination has failed to distinguish between them. At the time of the Rivers Pollution Commission, it was considered that only suspended impurities would be removed by filtration, and from 20 to 30 per cent. of the organic matter in solution. It has only in recent years been discovered that sand filtration removes from 70 to 80 per cent. of the organisms present.

If the Royal Commission in 1874 had had the knowledge with regard to the filtration of water and the general characteristics of those microbe organisms, would their report have been quite so severe as it was?—No; I do not think it would. The recent discoveries in connection with filtration have very considerably modified my own opinion, and I have no doubt that of others also, with reference to the value of filtration, and its security. There have been a number of very remarkable outbreaks of disease which have been traced to impure water, especially at Zurich, in Switzerland. At Lausanne a case occurred where water was supplied to the community from a spring after making its way through the moraine of a glacier, and passing a mile or two of fine sand. After some very careful experiments, it was found that the water in a neighbouring valley, where typhoid fever had occurred, re-appeared at the spring in Lausanne. This was proved by dissolving several hundredweight of common salt in the water in the valley, which rendered the water in the Lausanne spring salt. The experiment was then tried with flour carefully mixed with water; but not a trace of the flour re-appeared, as the very fine starch granules had been filtered out of the water. The starch granules which the filtration there was sufficiently good to remove were, of course, larger than microbes, but they were very small indeed.

Can you give us any instance of river water (water that has been stored and subsequently filtered artificially) doing anything equivalent in the way of communicating disease?—No; neither do I believe that there is an instance to be found, because I have carefully searched for it. I can give an instance of what, in all probability, was the propagation of cholera from one town to another upon a river, when the river water was not stored. I presume it was filtered, although I am not sure about it. The case was that of Sheffield and Doncaster, on the River Don. The cholera outbreak in Sheffield preceded that in Doncaster. The sewers—six or seven of them—discharged into the Don, and the people drank the water. The cholera occurred at Doncaster when it might have been expected, assuming the poisoning to have been communicated by the agency of the river.

Mr. MANSERGH: Do you happen to know if there was an outbreak of cholera in Rotherham three or four miles from Sheffield?—I think there was.

Professor DEWAR: Is not a very small change in the environment absolutely destructive of a large proportion of these minute microbe organisms?

Witness: Yes. In a flowing river, where the environment is never constant, the conditions would be very fatal to the life of the organisms. Experiments have been made with pathogenetic organisms; and it has

been found that they would live in river and other waters, some as long as 114 or 116 days. These would probably be the spores. The amount of knowledge on the subject is very contradictory, and very incomplete; and people are only just beginning to know something definite about these organisms.

In answer to further questions, witness said no experiments had been tried upon a flowing river, except with regard to the inferential proof that the organisms have been carried a long distance, as it was, of course, difficult in a laboratory to imitate a flowing river. Several important trials had been made to ascertain whether the presence of other organisms was fatal, or not at all healthful, to the life of a small proportion—say, 2 per cent.—of the dangerous microbes; and from them it was found that such dangerous organisms frequently fall a prey to the harmless ones. There was always present in water a very large number of harmless organisms. The continuous change in environment in a river, together with the exposure to light, the variations in suspended matter, and precipitations going on, all tended to be fatal to the life of one or two specific organisms; and when to this was superadded filtration, the probabilities perhaps would be against these organisms occurring, though it by no means excluded the possibility. Asked if he recommended that increased storage should be compulsory on the Water Companies, witness said this was a very difficult question. Sometimes the storage was really an evil. A very much greater quantity was required than any Company possessed. The flood water must be taken into the reservoirs, and then sent on to London and distributed among the consumers; and he believed it could not be got rid of. Consequently, it frequently happened that a Company which had a great extent of storage had not such good water as others who had less, because immediately after a flood the water became very good; and this the smaller companies, having less water to deal with, were able to take in. It was a very difficult matter, therefore, to say that it was a good thing to have a large storage or a small quantity of storage; but he thought a fair amount—say, for 10 or 15 days—was desirable. If he could advise, without any reference to practicability, he should say that each Water Company should have sufficient storage to tide over the longest flood. This, however, he did not think was practicable, as the flood waters came down the Thames for a period extending to 30 or 35 days. As a general rule, although there might be some exceptions to it, those Companies who had the best storage delivered the best water.

Sir A. GEIKIE: Have you given any attention to the effect of storing water upon the propagation of the microbe organisms?

Witness: Only in the laboratory. I find that water which contained a large number of microbe organisms when it came out of the river would be almost sterile in the course of a week or ten days.

In answer to further questions, witness said there was no doubt at present that there was very great difficulty in supplying the Water Companies with gravel. The population was very sparsely distributed at that portion of the banks of the Thames from which the water came; but it was, he presumed, gradually extending. Between 1868 and 1873, and also in 1891, London water had deteriorated in respect of the organic matter held in solution. This, he thought, could only be explained by an increased population, and the passage into the Thames of sewage effluents from chemical and irrigation processes more quickly and in larger quantities than formerly.

Professor DEWAR: In spite of the large amount of work that has been done by the Thames Conservancy in inducing these populations to construct sewage works, which did not exist in 1868 or 1873, the river had deteriorated in 1891?

Witness said the presence of a greater quantity of dissolved organic matter had made it worse. It could not, he thought, have deteriorated in regard to other objectionable products in suspension. There could be no doubt that the river had been greatly improved in this respect by the Thames Conservancy.

Further questioned by Professor DEWAR, witness said he had analyzed a number of samples of water for the Commission, and these he had compared with the series he made last year. These samples were taken at different times of the year, when the river was in a fairly good condition, there being no flood. There was a very considerable variation—organic carbon rising to 0.403 per cent.; and water containing this amount of organic carbon he regarded as unfit for a domestic supply. He would not go so far as to say that such water was not capable of being satisfactorily treated by filtration, and subsequently distributed for domestic use; but it would require a long subsidence and very careful treatment, and the water would probably then be coloured.

Professor DEWAR: Can a river like the Thames, which receives treated sewage, be made into a perfectly safe water supply?

Witness: I should not like to say that there is sufficient safety in the operations to which it is subjected before delivery to make it a perfectly safe water for drinking purposes. London has already suffered very severely from illness owing to the propagation—in some cases by water—of animal disease.

Where would you go to get a supply that would be satisfactory?—To the springs in the Thames basin, and to deep wells in the chalk and the oolite, in which, I believe, there is not a single organism, though this remains to be proved.

In further examination, witness said he thought, as to the river itself, no improvement could be effected by going to any source higher than Hampton. At Staines the organic carbon and organic nitrogen were less than at Windsor. The river between Lechlade and Hampton differed very little in composition. He could not say that the tributaries of the Thames had deteriorated. It was a mere matter of chance what the condition of these rivers would be on any two occasions when samples were taken. Probably the state of the tributaries was very much the same as that of the Thames itself. The Colne was much better now than it had been. Taking all the figures together, he drew the conclusion that there had been very little change in the Thames, so far as analyses went, between 1868 and 1891; but the water as delivered for consumption was greatly improved. Asked if he had any suggestions to make as to the improvement of the present supply, he said that he would recommend the pumping of a larger quantity of water from the gravel, instead of taking it from the river, and also the sinking of deep wells

and bore-holes, which had been successful, in some cases, in bringing to the surface water of a very excellent quality. Taking the raw material as it came to the Company's intakes, and considering the way in which it was then treated by filtration, he did not think it could be done better than it was at present. The artificial softening of the water by Clark's method would be an improvement. He had, however, serious doubts as to whether it could be done on the enormous scale that would be necessary for London. It was carried out at one or two places, such as Bushey, but on a very much smaller scale than would be necessary with the Thames. With regard to the increased organic matter present in the water in 1891, there was no doubt it was connected in some way with the excessive fogs prevalent at that time; but how the impurities contrived to pass the filter-beds and to affect the water in the way they did, was very difficult to say. The River Lea had never been so much polluted as the Thames; and in 1891 the increase was proportionately less. He thought that for the next hundred years there would be no need to go outside the Thames basin for a good supply, as there was no place so rich in excellent water as this. It would become a question, if water was at any time taken from the chalk, as to whether it would cost more to do this than to bring it from a single source—Wales or Cumberland, for instance.

Questioned by Sir A. GEIKIE, witness said the chalk was a sort of sponge, which absorbed a large quantity of water, and heaped it up, as it were, in the chalk downs at a very considerable elevation above the river levels. The water was thus kept for a long time until the chalk was surcharged with water, when it very rapidly passed into the streams and was lost among the flood water. If, by sinking deep wells in the chalk, or by other means, the water was depleted, the rain water as it fell and was absorbed would be available. In that way, he imagined, a good deal more water could be obtained from the chalk stratum than by merely utilizing the springs as they now issued from the chalk. Oolite did not act as a sponge; but he believed there were a great number of fissures and cavities in it in which a large quantity of water was stored. Taking the springs in the Thames basin which he had himself investigated, he estimated their normal flow at between 70,000,000 and 80,000,000 gallons daily. He had contemplated, when saying that there was an ample supply of water in the Thames basin for a hundred years, the driving of a series of galleries into the chalk and the oolite. There would, however, be the objection to the scheme, that all the water would have to be pumped twice over—first out of the wells, and then into the mains.

By Mr. HILL: His own scheme was for the construction of storage reservoirs in the Thames basin; and the water thus collected from the springs would be brought down from the Companies' respective works. The direct consumption of this water would, no doubt, have an effect upon the streams; and in some cases the stream might be dried up. He did not think, however, that the surface of the ground would be affected for agricultural purposes.

Mr. MANSERGH asked witness if there had been any epidemic produced by London water since 1854.

Witness replied that in 1866 there was one which was attributed by Dr. Parr and others to an infected supply of the East London Water Company at the time. With regard to the microbes, a temperature of 75° C. would very soon destroy them; but the spores, which were the half-developed microbes, would sometimes stand boiling for five hours without being destroyed. This was the reason why, in their investigations, they required three days to sterilize any substance. If a true view of the composition of the average Thames water, as used for consumption, was required, he thought daily samples ought to be taken for at least a month, and even longer than that. Considering the rapid progress that was being made in researches, he was of opinion that, in another twelve months, they would be in possession of further useful information.

Dr. OGLE: It is uncertain how far the numerous cases of zymotic disease occurring in the Metropolis are traceable to the water?

Witness: Yes. There is no evidence that diseases like measles, scarlet fever, and whooping-cough are propagated in this way. The zymotic diseases to which I have referred are cholera and typhoid fever. I think these are the only two diseases which have been known to be communicated through water. It is very likely that water containing cholera microbes would lose them after passing for some distance down the river.

Might we not suppose that the danger of London being infected by cholera owing to there being cholera higher up in the Thames or Lea valleys, would be very small?—I think that probably the evidence tends in that direction; but I believe it would be very unwise to drink water from those rivers at such a time.

I have a list, taken from the Registrar-General's report, of the deaths occurring from typhoid fever during six years in the Lea Valley; and the average is 22·6 in a year—the maximum number in one year being 27. Taking the amount of water that flows down the Lea Valley, and adding to it the quantity delivered by the New River Company, and supposing that the water was polluted in all those cases, I find that to each instance of pollution there would be used a body of water three miles long, two miles wide, and six feet deep. Does not that diminish the risk of infection so much that it may be practically dismissed? I am taking into account the fact that 98 per cent. of the bacteria would be removed by filtration.—I certainly think that the filtration would reduce the danger, and make it exceedingly improbable that any considerable number of people, at all events, would be affected; but if a single individual imbibed a single germ, I suppose it might be as bad for him as if he had imbibed a hundred.

Is it your belief that, if a person swallowed a single bacillus, he would necessarily suffer from the disease? Would not a certain number be required, and would not one be very liable to be destroyed?—I suppose one may be; but then the one might first have multiplied to a thousand.

If, however, you put the two chances together—the chance of swallowing the bacillus and the chance of harm being incurred thereby—there is not much danger, is there?—I should not like to go so far as that. I think it very unlikely that the disease could be propagated, if the water were sufficiently filtered. Of course, the number of microbes varies very much indeed in rivers. I do not think that the fact that thousands of people who drink the water from these

sources suffer very little from typhoid fever is conclusive evidence that the water is wholesome.

In answer to further questions, witness said there was no direct evidence that typhoid fever had in some cases been communicated by water. If the Lea were exceptionally polluted by typhoid sewage, there ought to be a difference in the number of cases of typhoid fever occurring; but he was not aware of anything of the kind having been traced. The lowering of the death-rate for typhoid fever and the improvement of the water supply had been coincident. Of course, the water might pass through a second filter; and this might reduce the number of microbes.

The Commission then adjourned.

METROPOLIS WATER SUPPLY.

The Quality of the Water in May.

The returns furnished to the Registrar-General by the London Water Companies as to the water supply of the Metropolis during the past month, show that the average daily supply was 188,458,526 gallons, as compared with 179,908,849 gallons in the corresponding month of 1891; being at the rate of 240 gallons to each service. Of the entire bulk of water sent out, 95,280,334 gallons were drawn from the Thames, and 93,178,192 gallons from the Lea and other sources. Reporting upon the quality of the supply, Dr. E. Frankland said: "Taking the average amount of organic impurity contained in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies and by the Tottenham Local Board of Health was: Kent, 0·6; New River and Colne Valley, 1·1; Tottenham and East London (deep-well), 1·3; East London (river supply), 1·9; Chelsea, 2·1; West Middlesex and Grand Junction, 2·2; Lambeth, 2·3; and Southwark, 2·5. The untreated river waters gave the following numbers: New River cut, 1·5; River Lea at the East London Company's intake, 2·9; and Thames at Hampton, 3·4. The water abstracted from the Thames by the Chelsea, West Middlesex, Southwark, Grand Junction, and Lambeth Companies was again, for river water, of a high degree of organic purity, being even superior, in this respect, to the samples drawn in April. It consisted, in fact, principally of spring water discharged from the chalk and oolite. It was efficiently filtered before delivery. The water taken chiefly from the Lea by the New River Company again ranked with the deep-well waters in respect of organic purity; while that supplied from the same source, but lower down the stream, by the East London Company, was superior to the best of the Thames waters. Both supplies were efficiently filtered. The deep-well waters of the Kent, Colne Valley, and East London Companies, and of the Tottenham Local Board of Health, were of excellent quality for dietetic use; that of the Kent Company being especially distinguished for its very high degree of organic purity. The Colne Valley Company's water, having been softened before delivery, was rendered suitable for washing. All these waters were clear and bright without filtration. Seen through a stratum two feet deep, the Kent, Colne Valley, Tottenham, and East London (deep-well) waters were clear and colourless; the New River, clear and nearly colourless; while the remaining waters were clear and very pale yellow. The crude river waters presented the following appearances: New River cut, turbid and very pale yellow; the Lea at the East London Company's intake and the Thames at Hampton, turbid and pale yellow. The bacteriological examination of the waters as they left the filters of the various Companies by Dr. Koch's process of gelatine plate culture, gave the following results: One cubic centimetre of each water collected on May 20 and 21 developed the following numbers of colonies of microbes: West Middlesex and Lambeth, 4; Southwark, 8; New River and East London, 10; Chelsea, 12; and Grand Junction, 24. Of the untreated river waters, one cubic centimetre of the water from the New River cut developed 158, the Thames at Hampton 631, and the Lea at the intake of the East London Company 4526 colonies of microbes.

Messrs. Crookes and Odling, in the course of their report to the Official Water Examiner for the Metropolis (General A. de Courcy Scott) on the quality of the water supplied by the London Water Companies in the past month, as shown by samples taken daily for analysis, say: Of the 182 samples examined, three were found to be very slightly turbid; the remainder being clear, bright, and well filtered. The character of the water supply to the Metropolis during the month of May was not found to differ appreciably from that manifested during the two or three months preceding. The proportion of organic matter present in the water—noticeably low throughout—was found to be just a little higher in the March supply than in that of February, but lower again in that of April, and still lower in that of the past month; this statement being applicable both to the Thames-derived and the Lea-derived supplies. The following table shows the smallness of the proportion of organic matter present in the Thames-derived supply taken for illustration, and the successive, but not important, decrease in its proportion during the past three months. With the coming on, however, of any considerable rainfall, a corresponding unimportant increase in the proportion may be anticipated. The maximum proportion of organic carbon met with in any one of the 536 samples examined during the past three months, or 0·188 part in 100,000 parts of the water, corresponds as nearly as may be to a little over 0·3 of a grain of organic matter per gallon:—

	Ratio of Brown to Blue Tint. Means.	Oxygen required for Oxidation. Means.	Organic Carbon per 100,000 Parts. Means.	Organic Carbon per 100,000 Parts. Maxima.
March	8·6 : 20	0·043	0·144	0·188
April	5·6 : 20	0·033	0·125	0·147
May	4·7 : 20	0·029	0·119	0·143

The Lighting of Johannesburg.—The Johannesburg Lighting Company have received cable advice that the lighting of some of the principal streets of the town by gas commenced on the 20th inst.

SEVILLE WATER-WORKS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Tuesday, at the London Offices, No. 86, Cannon Street, E.C.—Mr. D. EVANS in the chair.

The SECRETARY (Mr. C. Crew) having read the notice convening the meeting.

The CHAIRMAN, in moving the adoption of the report, said he believed the shareholders would find it a satisfactory one, in the sense that the increase in water receipts had been quite up to the expectation of the Directors, and even a little in excess. On the other hand, they had suffered severely by the loss on exchange; but the results of the year's working enabled them to recommend the payment of a dividend at the rate of 4 per cent. per annum, and to carry forward £2691 17s. 6d. Their Auditors (Messrs. Deloitte, Dever, Griffiths, and Co.) had made an examination of the accounts; and they found that during the past year the maintenance and repairs, including irrigation and fire service, had been at the rate of 6.32 per cent., as against 7.74 per cent. in 1891; pumping and engine charges, 7.63 per cent., as compared with 8.91 per cent.; and salaries and office expenses, 18.9 per cent., as against 17.08 per cent. The losses on exchange had so disturbed expectations that the anticipated 4 per cent. earnings had not been realized. The yearly working profit in sterling was £8062, or slightly above 3 per cent. on the share capital; but had the exchange remained as in the previous year, the profit would have been about 3½ per cent. Having reminded the shareholders of the desirability of investing the amortization fund as soon as circumstances permitted, he proceeded to remark that the Directors had made inquiries of their Solicitors, and found they were permitted to invest in their own debentures; and therefore they proposed, to some extent at all events, that the sinking fund should in future be so invested. The conversion of the 6 per cent. debentures was a little more difficult than was expected, because many of the debenture holders took their money for other investments. With the exception of about £20,000 of debentures, however, which fell due at the end of the month, all the bonds were now placed at 5 per cent. The shareholders would observe that, in order to pay 4 per cent. dividend, the Directors had had to draw rather heavily on the unappropriated balance; but they hoped, with an increase in the water-rentals, that on the next occasion they would be enabled to pay 4 per cent. out of the profits of the year.

Mr. CROWLEY LAMBERT, M.P., seconded the motion, which was unanimously carried.

The retiring Directors and the Auditors were re-elected; and votes of thanks to the Chairman and Directors and the Manager (Mr. C. A. Friend) brought the proceedings of the ordinary meeting to a close.

An Extraordinary Meeting was then held for the purpose of giving the Directors authority to raise the sum of £10,000, in addition to the £120,000 already raised.

The CHAIRMAN, in moving a resolution to this effect, explained that the reason the Directors had applied to the shareholders for permission to raise a further £10,000 was that they owed to their contractors a balance of £6000. As, by law, they were not permitted to issue any shares when their shares were under par, and they could not raise any more debentures, because they were limited to £120,000—that was, they could not raise any more to rank *pari passu* with the £120,000—they proposed to raise £10,000 of what might be called "B" debentures; and they would then have some security to offer if it became necessary to borrow money.

Mr. LAMBERT seconded the motion, which was agreed to.

The proceedings then terminated.

Acquisition of the St. Petersburg Water-Works by the Municipality.—The Directors of the City of St. Petersburg New Water-Works Company, Limited, have received a communication from the Water Committee of the Municipality of St. Petersburg, informing the Board that the Douma has decided to purchase the Company's undertaking. The Directors understand that it is the intention of the Douma to take over the works as from Jan. 1, 1893. The Municipality have referred it to the Water Committee to settle with the Company the exact terms of the purchase. The calculations which have to be made will be governed mainly by the net revenue during the last year of working.

The Public Lighting Question at Exeter.—Last Wednesday an exhaustive report was presented to the Exeter City Council on the subject of street lighting. The Committee who had the matter in hand recommended that the offer of the Gas Company to reduce the price of gas for the public lamps to 2s. 9d. per 1000 cubic feet, to provide five large lamp-posts and lanterns, and to supply them with gas at 2s. 6d. upon a seven years' contract be accepted, provided the Company would agree to a clause being inserted in the agreement for its determination at the end of five years by either party on six months' previous notice. The Committee further recommended that one of the main streets be lighted by lamps consuming 12 feet of gas an hour, reducible to 6 feet after midnight. It was estimated that the additional cost of lighting High Street and Queen Street by electricity would be £392 per annum. In the discussion on the subject, Mr. Munro took exception to the Council binding themselves to any company for so long a period as five years. The Mayor expressed regret that it did not seem possible to light the main streets of the city with electricity at present; but the extra cost was so great that he did not think their finances would warrant them in going to the expense. He thought the Gas Company ought to make the contract terminable at three years, as well as at five, on six months' notice being given. From what he heard, he did not think the Company would be disposed to make the additional concession. They were indebted to the Electric Light Company in a sense for the improved terms they had obtained from the Directors of the Gas Company. Mr. Wreford moved that, unless the contract was made terminable at the end of three years as well as five years, it should not be signed. This was agreed to. It was also decided to give the Gas Company notice to terminate the present contract at Michaelmas next.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Although it is rather early to speak of it yet, there is a belief in Glasgow that the financial results of the Corporation Gas Department will not work out so well as the Gas Committee have been accustomed to find them. There is nothing very surprising in this; and, indeed, there is nothing unexpected. A year ago, when considering what the price of gas should be, it was a question whether it should not be raised; but it was resolved to go on for another year at 2s. 6d. per 1000 cubic feet. There was a net surplus on the year's working of £1150; but sundry payments fell to be made out of that sum, leaving only £694 to be carried forward, which compared very unfavourably with the £3245 carried forward in 1890. Last year more was paid for coal, and less was realized for residuals. The capital account of the department is also, apart from the acquisition of the Partick, Hillhead, and Maryhill Gas Company's undertaking, considerably higher; and taking everything into account, it is no matter for surprise that a deficit should be experienced in the year's working. The only course open to the Corporation is to increase the price of gas; and a proposal to that effect is likely to be made when the accounts come up for consideration in August. One cannot but feel regret that the first balance-sheet of the extended working should show a result on the wrong side. But the inevitable cannot be avoided; and the Gas and Electric Lighting Committee will have sufficient reason to show for what must be a greater disappointment to them than to the community. It is satisfactory to know that the consumption of gas still goes on increasing.

The Dunfermline Gas Company have completed their first year under their reconstructed form; and in connection with it, it is satisfactory to observe that Mr. Mackenzie, who is a veteran in the industry, still finds affairs prospering in his hands. The Directors' report stated that, notwithstanding they had been charged increased rates for coal and had realized lower rates for residuals, they had not hitherto required to raise the price of gas. There had been an increased consumption; and the results of the business for the year were in every way satisfactory. The profit and loss account showed a balance of £2741, which admitted of the payment of the ordinary dividend of 10 per cent. During the year, important extensions had been made to the purifying plant, from which the Directors anticipated considerable economy in manufacture, as well as improvement in the quality of the gas. Other extensions, rendered necessary by the increased demand for gas, are being carried out. The Chairman stated that the Company was registered as a limited liability undertaking as from November last; and that the issue of additional capital was readily taken up by the shareholders—the shares applied for considerably exceeding the number issued. So far as the cost of coal was concerned, the price of gas might have been maintained at 3s. 7d. per 1000 cubic feet; but with the fall in the price of residuals, it was necessary to raise it to 3s. 9d. The proposals of the Directors were agreed to. In its reconstructed form, the capital of the Company has been increased from £29,750 to £60,000 nominal; and the actual subscribed capital, from £25,462 to £36,375.

It is pointed out, in a Dundee newspaper this week, that whereas in 1870 the consumption of gas was 200,605,200 cubic feet, last year it was 505,592,600 cubic feet; and that, while in the former year, with the price at 5s. per 1000 cubic feet, the revenue of the Gas Commissioners from gas was £43,406, last year, with the price at 3s. 8d., the revenue was £89,952. These are certainly very encouraging figures.

The Gas Committee of the Aberdeen Corporation, having had before them the report of Mr. A. Smith, their Engineer, on the quality of the coal which has been tendered to them, have resolved that the gas to be supplied is to be of 24-candle power; and they have agreed to purchase 36,500 tons of coal, at a cost of £35,475, or an average of 19s. 6d. per ton. The contract price for the coal at present being supplied is 23s. 1d. per ton. The difference in price should mean a considerable surplus.

The Dundee Gas Commissioners and their friends, to the number of about 60, held their annual excursion last Saturday. The party travelled to Loch Awe, where they spent the day in driving down the Pass of Brander and sailing on the Loch. In the afternoon, dinner was served in the Loch Awe Hotel, which is so much frequented by tourists. Both the Members of Parliament for the city—Mr. John Leng and Mr. Edmund Robertson—graced the table with their presence, and took part in the complimentary speeches which were given. The outing was altogether a most enjoyable one.

It is difficult to conceive a situation in which a man has a better opportunity for showing his capacity than in the management of a gas-works. The statistics which are often collected by owners with a view to ascertaining the cost of materials, output, &c., in a number of other works, are usually, even after being tabulated at great cost of time and labour, quite bewildering in their variations. The reason is that the personal equation of the managers of the different works cannot be reduced to a percentage and placed in a table. A very gratifying instance of the value of a man who is worth his salt is found in the experience of the Cambuslang Gas Company, since, three years ago, they appointed Mr. J. Donaldson to be Manager of their works. The town is one of the pleasant suburbs of Glasgow. It is a mineral district, and is riddled underground with a network of coal-workings, which give constant trouble to the Gas Manager by subsidences of the surface, and consequent breakages of mains. Three years ago, the unaccounted-for gas amounted to 15 per cent; it has now been reduced to 8 per cent. The other results are equally satisfactory. Coal has risen in price since 1889 between 50 and 60 per cent.; yet the price of gas has been reduced from 4s. 4½d. to 3s. 11½d., and, what is more wonderful, the dividend has been increased from 5 per cent. to 7½ per cent. This reads almost like a paradox; but it was all explained as hard fact at the annual meeting of the Company last week. Dealing with the past year, it is found that the Company had an output of 17 million cubic feet; and the personal equation of the Manager is at once apparent when it is learned that the capital upon which this was realized is only £13,350. The price of coal was 1s. 3d. per ton higher than in the preceding year, yet the profits were £140

more. There was sufficient surplus to pay a dividend at the rate of 10 per cent.; but the shareholders contented themselves with 7½ per cent., and placed about £400 to the reserve fund. The yield of gas was 150 cubic feet more per ton than in the previous year, and 1800 cubic feet more than it was three years ago. That is one explanation of the prosperity of the Company. There are probably others; but whatever they may be, they all have their centre in good management. This was the view of the Directors and the shareholders, for, after a neat and complimentary speech by the Chairman, they voted to Mr. Donaldson a sum of twelve guineas, and that, too, after having last year raised his salary by £20 per annum. The Company are resolved to deal handsomely by their customers as well as their officials; and they adopted a proposal by the Manager to sell gas for cooking and heating at 2s. 11d. per 1000 cubic feet, or 1s. 0½d. less than the ordinary price. This is certainly reciprocity all round; and the result of so generous a policy, and of so much encouragement of merit, will be worth watching for at the end of the current year.

Mr. W. Key, the late Manager of the Tradeston Gas-Works of the Glasgow Corporation, has issued his prospectus on commencing business on his own account as a heating and ventilating engineer. The document is a very prettily got up one. Mr. Key's head-quarters are in Hope Street, Glasgow; but he has opened branch offices in London and Aberdeen. Appended to the prospectus are a number of highly-complimentary testimonials to the efficiency of Mr. Key's method of ventilating by propulsion, as introduced by him in the Victoria Infirmary, Glasgow, the Palace Hotel, Aberdeen, and numerous public schools, libraries, &c., in Glasgow, Aberdeen, Rochdale, and other places.

In the midst of the existing depression in the Scotch oil trade, arising from severe competition with the oil wells of Russia and America, Sir James King, ex-Lord Provost of Glasgow and a Director of Young's Paraffin Light and Mineral Oil Company, perceives an outlet for oil-products which gives him hope for the future. In his capacity of Chairman at the annual meeting of the Oil Company the other day, he said "there were two good outlets which appeared to be opening up for their products. Year by year the railway companies, both in this country and on the Continent, were using oil more largely for making gas for the supply of carriage lamps. Also, the price of cannel coal had latterly been ruling so high that gas managers were turning their attention to oil so as to increase the illuminating power of the gas obtained from lower priced coal." Sir James King has experience of one branch of what he was speaking about. He is a director of the Caledonian Railway Company, which use oil gas very largely for the lighting of their carriages. The popular notion is that oil and gas are deadly rivals; but these observations place them in another light, and show oil to be the handmaid of gas. But it has to be remembered that the speaker was addressing a meeting of shareholders in an Oil Company which was paying a diminished dividend. At the same time, his remarks have a meaning which he probably did not intend them to have; and that is that, if the enriching of gas with oil should become general, the price of the latter would rise so much that the value of the process, from a financial view, would be to a large extent taken away.

The accounts of the Dundee Water Commission for the past year, which were lately submitted, showed that the income had been £47,201, and that there was a surplus of £1883. The actual income for the year was £44,312; but there fell to be added to it a surplus of £2889 from the previous year. The total debt of the Commissioners is £508,233.

At a meeting on Monday of the Greenock Water Trust, the balance-sheet for the year which ended on May 26 last was submitted. It showed a revenue of £25,435 and an expenditure which left a surplus of £2 16s. 1d. The revenue from the various sources was as follows: Domestic rate, £5546; public rate, £2136; general rate, £1980; shipping rate, £1068; water power, £4098; public works, £10,037; water-meters, £442; and properties, £125. The Chairman (Mr. W. Smith) reported that the preferable bonds of the Trust were now reduced to £11,110; and that, as the most extended period is Whitsunday, 1893, the whole will be extinguished by that time. The loans falling due for rearrangement at the past term have been well renewed. Of the sum of £68,384 falling due, only £9500 was called up.

Alleged Improper Use of Water.—In the Queen's Bench Division, a short time since, the case of *Evans v. Gornall* came before Justices Mathew and Wright, in the form of an appeal by way of special case from the decision of certain justices of Chorley, raising an important question as to whether the inhabitants were entitled to use their waste-water for water-closets or any other purpose. Mr. Moulton, Q.C., with whom was Mr. Forbes Lancaster, appeared in support of the appeal, and said that, although the sum involved in this particular case was small, the point raised was one of considerable importance. The contention of Mr. Gornall was that, having once used water for domestic purposes, he was entitled to employ it in any way he liked before allowing it to run into the sewers. He (the learned Counsel) submitted that the water was supplied expressly for domestic uses; and there was no right on the part of the customer to use it for any other purpose. If the use of the apparatus employed by Mr. Gornall became general, not only would the special charge for water for water-closets be avoided, but the water which was supplied without limit for domestic purposes would be so lavishly used that the difficulty of the supply would be much enhanced. Apart from mere waste, they objected to the action of Mr. Gornall on sanitary grounds. It was true that they were not the sanitary authority; but they objected to any connection between an apparatus of the kind used and their pipes. Their Lordships, without hearing Counsel for the respondent, dismissed the appeal with costs. Mr. Justice Mathew said, in his opinion, what was contemplated by the section was a misuse of the water. It could not, however, he said that the respondent had in any way misused the water. Mr. Justice Wright said he was of the same opinion. The sole object of the section was to prevent a person taking more water under the colour of domestic use than was reasonably wanted for that purpose. There was nothing of the sort in the present case.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, June 25.

Sulphate of Ammonia.—Some improvement is noticeable in the market; and Hull quotations are advanced to £9 17s. 6d. to £10, while the latter price has actually been paid f.o.b. Leith. In view of the very small quantity now on the market, and the possibility of a better demand, more particularly for the Colonies and America, during July, a hardening of prices seems inevitable, however much it may be opposed by such of the dealers who are committed to low summer prices. Considerable shipments are taking place at nearly all the ports, therefore arguments in favour of decline, because of the absence of demand, are futile and artificial in view of these facts. The supply of liquor from gas-works is falling alarmingly short; and there seems some difficulty in carrying out existing contracts. The large inquiry this week for forward contracts indicates that buyers show greater confidence in the future; but the low range of prices does not offer any inducement to producers to commit themselves ahead. Nitrate is getting dearer; 8s. 3d. being now quoted for good quality on spot.

LONDON, June 25.

Tar Products.—Producers of benzol have apparently ceased pressing sales. The low price of benzol is doubtless a good deal due to the demoralized feeling that took hold of the makers a few months' ago. They now see the folly of their action, as, notwithstanding the repeated statements of a large over-production, the fact remains that to-day there are practically no stocks anywhere. This product looks like seeing better days. The same, however, cannot be said of anthracene, carbolic acid, and creosote, all of which are weak and difficult to sell. Carbolic acid is moving off; but prices do not improve. Important tar contracts have been fixed at prices ranging between 8s. 6d. and 11s. Other business is reported at: Pitch, 28s. Benzol, 90's, 1s. 8d.; 50's, 1s. 4½d. Toluol, 1s. 2½d. Solvent naphtha, 1s. 3d. Crude benzol naphtha, 30 per cent., 8d. Creosote, 1d. Naphthalene salts, 20s.; pressed, 45s. Carbolic acid, crude, 60's, 1s. 1d.; 70's, 1s. 4d.; crystals, 5d. Cresol, 8d. Anthracene, 30 per cent., "A" quality, 10d.; "B" quality, 7d.

Sulphate of Ammonia.—A good feeling prevails in this market; and the price of sulphate is likely to improve. There are plenty of buyers at £9 12s. 6d. to £9 15s. 0d., less 3½ per cent.; while makers are asking 2s. 6d. to 5s. more. Gas liquor (10-oz.) is quoted at 5s. 6d. to 6s. 6d.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Business continues very slow so far as all descriptions of round coal are concerned; and although many of the collieries are not working more than four days per week—whilst five days is now practically full time under the restriction to be enforced by the miners—stocks are accumulating at most of the collieries. It is only in exceptional cases where these are of any great weight, the limited "get" necessarily preventing large accumulations; and as a rule, stocks are of less weight than they were at this time last year. The best qualities of round coal are in very restricted request for house-fire consumption. But prices have been well maintained, as concessions would scarcely lead to any materially increased rate of buying; and it is more than doubtful whether any really material modification of pit prices will be made during the present summer. At the pit mouth best Wigan Arley still averages 12s., Pemberton four feet and second qualities of Arley, 10s. to 10s. 6d., and common house-fire coals, 8s. 6d. to 9s. per ton. With regard to the lower descriptions of round coal, for steam and forge purposes, however, there is a decided weakness in the market. This description of fuel is becoming increasingly difficult to dispose of, owing to the depressed condition of the principal coal-using industries; and although nominally there is no material giving way upon list rates, surplus lots are pushed for sale upon the market at low figures, and buyers prepared to take anything like quantities are enabled to secure these at considerably below the nominal list rates. At the pit mouth 7s. 6d. to 8s. per ton would now represent the full average price obtainable for ordinary descriptions of steam and forge coal. For shipment, prices continue very irregular; and although 9s. 3d. to 9s. 6d. is still being got in some instances for good qualities of steam coal, delivered at the ports on the Mersey, 8s. 9d. to 9s. represent more nearly the average selling prices for ordinary descriptions. In gas coals, contracts are being freely settled; but it is difficult to ascertain the price at which consumers are securing their supplies. The Manchester Corporation contracts are stated to have been renewed at something about last year's rates, any variation from these being slightly in favour of the buyers. Generally, however, from what can be ascertained, buyers are not enabled to get down prices to any material extent; and whilst 3d. per ton represents the full average concession upon last year's prices that is being made in connection with contracts settled for the ensuing season's supplies, any giving way beyond this is only in very exceptional cases. For engine classes of fuel, there is a generally brisk demand, with supplies of the better qualities, if anything, rather scarce in some instances; and prices show a hardening tendency. At the pit mouth good qualities of burgy average 6s. 3d. to 6s. 9d.; best qualities of slack, 5s. to 5s. 6d.; good ordinary descriptions, 4s. 3d. to 4s. 9d.; and common sorts, about 3s. 6d. per ton.

Northern Coal Trade.—Though local holidays have interfered with the production of coal, yet there is now a full output; and in some classes the limited consumption has caused a reduction of prices. Best Northumbrian steam coal is now quiet at about 10s. 3d. per ton, f.o.b.; whilst for forward delivery a lower price is taken. There is a further reduction in the price of small steam coal, which may now be had at 4s. to 4s. 6d. per ton, the output being large and the consumption rather irregular. For gas coal, with a production that is nearer the normal volume, the demand is very steady; and as many of the collieries have very heavy contracts, the price—though varying a little

according to the position of the colliery and the time of the delivery that is stipulated for—is on the whole well maintained. For prompt delivery, as high as 9s., less discount, is asked for best Durham gas coal, f.o.b.; and the price varies from that down to about 7s. 9d., according to quality and time of delivery. It would seem that the production of gas coal is being better taken up than had been anticipated; and that in consequence, the amount of the free coal is rather limited. Household coal is very dull; and the price is drooping. A similar remark applies to bunker coal, which is being sold very low in price—7s. 7d. f.o.b. having been taken for unscreened coal. Possibly, lower prices have to be accepted to induce a renewal of orders that had been diverted. Manufacturing coal is quiet. Coke for blast furnace purposes, is firm at about 17s. per ton f.o.b., with a large demand. Gas coke is quiet; the demand and the production being both low just at present.

Scotch Coal Trade.—Trade keeps fairly busy; dealers being, for the most part, well supplied with orders for a month or two. Ell coal is a little more plentiful than last week; but the demand continues about equal to the supply. Some of the smaller collieries are pressing their production on the market. The larger concerns are, however, inclined to hold out—in view, probably, of the early advent of winter orders. The men in the west are working steadily as yet; but their holidays are approaching, and for the next two weeks, at all events, while the General Election lasts, it is likely that the output will go down. In Fifeshire, they have been holidaying already; and as the coal masters are about to meet to consider the question of wages, it is possible that there may be more idling, and that a good deal of the trade which came north may return to Durham. The situation is therefore not altogether satisfactory—in fact, is rather mixed. Everything, however, points to quieter prices being the rule in the coming winter. It is reported that in the west there has already been an easing of prices to the extent of 3d. per ton all round; but this would seem to be going too far. The prices given this week are: Main, 7s. 6d. to 7s. 9d.; ell, 8s. 6d.; splint, 8s. to 8s. 6d.; and steam, 10s. to 10s. 3d. per ton. Shipments still go up. Last week the total quantity exported was 167,718 tons—an increase over the corresponding week of last year of 43,704 tons, and of 6347 tons over the preceding six days. For the year to date, the total shipments have been 3,281,328 tons—an increase over last year of 519,169 tons.

Stockholm Water Supply.—The Stockholm Water-Works had, up to the end of last year, entailed an expenditure of about £350,000. The total length of water-pipe laid was 157,571 metres. The net profits amounted to £22,000, representing rather more than 6 per cent. on the cost. During the year, the consumption of water was about 1700 million gallons, of which quantity 1100 millions were used for domestic purposes.

Eastbourne Electric Lighting Company.—The report of the Directors of this Company, which was submitted at the meeting of shareholders yesterday week, is a very interesting one. It stated that for the past six years the installation had been under the management of Mr. Robert Hammond, who, with the aid of certain capitalists associated with him, had, under an agreement, found all the necessary plant for carrying on the undertaking. The result was that the plant had been renewed, and the lighting business had improved and extended, until the annual losses had entirely disappeared, and a considerable surplus beyond working expenses realized. Having satisfied themselves that the revenue had sufficiently improved, so as to provide a substantial surplus beyond working expenses, the Directors resumed direct charge of the undertaking at the beginning of the year. The late managers had agreed with the Directors that the debentures to them for the amount of their outlay and losses should stand for ten years, and that the interest should be reduced to 5 per cent. For the fifteen months to Dec. 31 last, the profit over working expenses was £1950; and the total amount of debenture issue, after completing arrangements with the managers, would be £21,550 at 5 per cent., and this with share capital issued of £10,550, would represent the total capital expenditure of the Company. The Directors also mentioned that they had decided to reduce the price of the current to the consumers from 10d. to 9d. per unit from the 30th inst., hoping that an increase of business would compensate the Company for the reduction. The report was adopted; and a sum of £250 was voted to the Directors as remuneration for the period from Dec. 30, 1890, to March 31 last.

Electric Lighting for Chester.—Dr. J. Hopkinson has prepared a report, for the Chester Town Council, on the supply of electricity for lighting purposes. He states that it is not probable the demand will be great in the borough in the near future; and he is of opinion that a low-tension system with a small battery of accumulators is much to be preferred to a high-tension system. As the distance of the site he suggests is not too great, he strongly advises the use of the low, direct-current three-wire system, with a small battery of accumulators. He understands that £15,000 has been sanctioned for the proposed works, exclusive of the land upon which they are to be erected; while his estimate for the plant required for a thoroughly satisfactory generating works is £16,224, exclusive of the cost of taking up the streets and making them good again. The length of mains provided for is nearly three miles. The plant will enable a supply at one and the same time of 3000 16-candle power lamps, and will certainly permit 4000 lamps to be connected to the circuits. The annual cost of working and maintaining the plant he estimates at £745, and maintenance at £1196. The average cost to consumers for the supply will be about 6d. per unit; and, taking light for light, this is equivalent to gas at 5s. per 1000 cubic feet. He understands that gas in Chester costs about two-thirds of this, and it will be a matter of very grave consideration for the Corporation whether they should endeavour to supply electricity at such a price that it will cost no more than gas. On the whole, although he does not regard Chester as a specially favourable town for the electric light, he can see no reason to doubt that an electric lighting central station would speedily pay its current expenditure, interest upon the capital employed, and something over for extinguishing by depreciation the cost of the plant. The report has been referred to the Watch Committee for consideration.

Braddock's Meters.—The Corporations of Oldham and Walsall have each accepted the tender of Messrs. J. and J. Braddock, of the first-named town, for the supply of wet gas-meters in cast-iron cases during the next twelve months.

Gas Exhibition at Keswick.—During the past week a very well-arranged display of Messrs. Richmond and Co.'s gas ranges and stoves was held under the auspices of the Keswick Gas Company. Cookery lectures were given by Miss Owen, of South Kensington. We may mention that Mr. Richmond has lately issued, in pamphlet form, incorporated with a catalogue of the firm's appliances, his popular lecture on "Gas as a Domestic Servant;" and it has been largely circulated in various parts of the country.

The Water Supply of Gildersome.—An action brought by the Attorney-General, at the relation of the Corporation of Bradford, against the Corporation of Morley and the Gildersome Local Board, came before Mr. Justice Chitty last Wednesday, in the Chancery Division of the High Court of Justice, on the motion for an injunction to restrain the Corporation of Morley from acting on an agreement to supply and sell water to the Gildersome Local Board. The Corporation of Bradford sought a declaration by the Court that an agreement entered into by the Corporation of Morley to supply water to the Gildersome Local Board was void because it had not had the sanction of the Local Government Board. The plaintiffs alleged also that since the commencement of the present year the Corporation of Morley had supplied the Gildersome Local Board beyond the limits defined in the agreement. As stated by Mr. Levett, Q.C., who appeared, with Mr. Eyre, for the Bradford Corporation, the case now was that since the action was brought, the Corporation of Morley had applied to the Local Government Board for the requisite sanction to the agreement; and the Board had determined to hold an inquiry, at which the Corporation of Bradford would be heard. Terms were come to between the parties by which proceedings were stayed pending the inquiry; and his Lordship granted a postponement.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 1235.)

Issue.	Share	When ex-Dividend.	Dividend or Div. Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.					£ s. d.
GAS COMPANIES.								
590,000	10	13 Apr.	10½	Alliance & Dublin 10 p. c.	10	16½-17½	..	6 0 0
100,000	10	"	7½	Do. 7 p. c.	10	11-12	..	6 5 0
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105-107	..	4 13 5
100,000	20	27 May	8	Bahia, Limited	20	10-12	..	13 6 8
200,000	5	12 May	7½	Bombay, Limited	5	6½-6¾	..	5 11 1
40,000	5	"	7½	Do. New	4	4½-5	..	6 0 0
380,000	Stock.	26 Feb.	12½	Brentford Consolidated . . .	100	212-217	..	5 12 11
150,000	"	"	9½	Do. New	100	164-168	..	5 10 1
220,000	20	11 Mar.	11½	Brighton & Hove Original . .	20	40-42	..	5 9 6
888,500	Stock.	11 Mar.	5	Bristol	100	95-100	..	5 0 0
320,000	20	13 Apr.	11½	British	20	41-43	-1	5 4 8
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	10	19-20	..	5 15 0
51,510	10	"	8½	Do. 7 p. c.	10	15-16	..	5 6 3
328,750	10	"	—	Buenos Ayres (New) Limited	10	6½-7½	..	—
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	94-97	..	6 3 0
150,000	20	26 Feb.	8	Cagliari, Limited	20	25-27	..	5 18 6
550,000	Stock.	13 Apr.	13	Commercial, Old Stock . . .	100	229-234	..	5 11 1
165,000	"	"	10	Do. New do.	100	185-195	..	5 8 1
130,000	"	15 June	4½	Do. 4½ p. c. Deb. do.	100	117-120*	..	3 15 0
800,000	Stock.	15 June	13	Continental Union, Limited .	100	218-223*	..	5 16 7
200,000	"	"	10	Do. 7 p. c. Pref.	100	185-195*	..	5 2 7
75,000	Stock.	30 Mar.	10	Crystal Palace District . . .	100	185-195	..	5 2 7
486,090	10	29 Jan.	10	European, Limited	10	19-20	..	5 0 0
354,060	10	"	10	Do. Partly paid	7½	14-15	..	5 0 0
5,470,820	Stock.	12 Feb.	12	Gaslight & Coke, A, Ordinary	100	207-212	..	5 13 2
100,000	"	"	4	Do. B, 4 p. c. max.	100	94-98	..	4 1 7
665,000	"	"	10	Do. C, D, & E, 10 p. c. Pf.	100	250-255	..	3 18 5
30,000	"	"	5	Do. F, 5 p. c. Prf.	100	118-123	..	4 1 3
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	169-174	..	4 6 2
1,300,000	"	"	7	Do. H, 7 p. c. max.	100	154-158	..	4 8 7
463,000	"	"	10	Do. J, 10 p. c. Prf.	100	247-252	..	3 19 5
476,000	"	"	—	Do. K, 6 p. c. Prf.	100	148-153	..	3 18 5
1,061,150	"	15 June	4	Do. 4 p. c. Deb. Stk.	100	114-116*	..	3 9 0
294,850	"	"	4½	Do. 4½ p. c. do.	100	118-121*	..	3 14 4
908,000	"	"	6	Do. 6 p. c. do.	100	163-166*	..	3 12 3
3,800,000	Stock.	12 May	12	Imperial Continental	100	210-214	..	5 12 1
75,000	5	15 June	6	Malta & Mediterranean, Ltd.	5	4-4½*	..	6 13 4
500,000	100	1 Apr.	5	Met. of Melbourne, 5 p. c. Deb.	100	108-110	..	4 10 11
541,920	20	15 June	5	Monte Video, Limited	20	14-15*	..	6 13 4
150,000	5	27 May	10	Oriental, Limited	5	7½-8½	..	6 1 2
60,000	5	30 Mar.	7	Ottoman, Limited	5	4-5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited	10	2-3	..	—
People's Gas of Chicago—								
420,000	100	3 May	6	1st Mtg. Bds.	100	106-110	..	5 9 1
500,000	100	1 June	6	2nd Do.	100	100-103	..	5 16 7
150,000	10	15 Oct.	10	San Paulo, Limited	10	8-9	..	—
500,000	Stock.	26 Feb.	15½	Sout Metropolitan, A Stock	100	265-270	..	5 14 10
1,350,000	"	"	12	Do. B do.	100	214-218	-1	5 10 1
200,000	"	"	13	Do. C do.	100	250-240	..	5 8 4
725,000	"	30 Dec.	5	Do. 5 p. c. Deb. Stk.	100	142-146	..	3 8 6
60,000	Stock.	11 Mar.	11½	Tottenham & Edm'ton, "A"	100	225-230	..	5 0 0
WATER COMPANIES.								
743,952	Stock.	30 Dec.	10	Chelsea, Ordinary	100	253-258	..	3 17 5
1,720,252	Stock.	13 Apr.	8	East London, Ordinary . . .	100	195-200	..	4 0 0
544,440	"	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	138-142	..	3 3 4
700,000	50	11 Dec.	8½	Grand Junction	50	101-105	+2	4 0 11
708,000	Stock.	12 Feb.	10½	Kent	100	260-265	..	3 19 3
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max.	100	227-232	+3½	4 1 10
406,200	100	"	7½	Do. 7½ p. c. max.	100	194-199	+4	3 15 5
279,700	Stock.	30 Mar.	4	Do. 4 p. c. Deb. Stk.	100	122-125	+1	3 4 0
500,000	100	12 Feb.	12½	New River, New Shares . . .	100	325-335	..	3 2 4
1,000,000	Stock.	29 Jan.	4	Do. 4 p. c. Deb. Stk.	100	127-130	..	3 1 6
902,300	Stock.	15 June	6½	S'tbwk & V'xhall, 10 p. c. max.	100	147-152*	..	4 5 6
126,500	100	"	6½	Do. D 7½ p. c. do.	100	134-138*	..	4 14 5
1,155,066	Stock.	15 June	10	West Middlesex	100	237-242*	..	4 2 8

* Next dividend will be at this rate.

